Duarte Silveira

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Por favor dar entrada.

De: Comissão 4ª - CAE XII [mailto:Comissao.4A-CAEXII@ar.parlamento.pt]
Enviada: sexta-feira, 5 de Setembro de 2014 16:08
Para: chefegabinete
Cc: Comissão 6ª - CEOP XII; Comissão 11ª - CAOTPL XII
Assunto: Iniciativa europeia selecionada COM(2014)520 | Solicitação de parecer à ALRAA

Exma. Senhora Presidente da Assembleia Legislativa da Região Autónoma dos Açores,

No âmbito do escrutínio de iniciativas europeias, a Comissão de Assuntos Europeus recebeu, em 24 de julho de 2014, a **COMUNICAÇÃO DA COMISSÃO AO PARLAMENTO EUROPEU E AO CONSELHO - Eficiência energética e a sua contribuição para a segurança energética e o quadro político para o clima e a energia para 2030** [COM(2014)520].

Tratando-se de iniciativa selecionada pela Assembleia Legislativa a que V. Exa. preside e que, consequentemente, consta da Resolução da Assembleia da República n.º 74/2014, junto envio a referida iniciativa europeia para análise e elaboração de relatório.

Nos termos da Lei n.º 43/2006, de 25 de agosto, alterada pela Lei n.º 21/2012, de 17 de maio, e de acordo com a *Metodologia de escrutínio das iniciativas europeias aprovada a 8 de janeiro de 2013*, as iniciativas selecionadas são objeto de Relatório, o qual "*deve, sobretudo, abordar as questões de substância da iniciativa e implicações que a mesma tenha para Portugal, bem como se o objeto da iniciativa recai no âmbito de matérias da competência legislativa reservada da Assembleia da República. O Relatório pode também analisar a base jurídica e a observância dos princípios da subsidiariedade e da proporcionalidade. As conclusões devem discriminar separadamente as questões suscitadas quanto à substância e quanto à observância dos princípios da subsidiariedade e da proporcionalidade.*"

Mais informo que a mesma iniciativa europeia foi distribuída às Comissões de Economia e Obras Públicas e do Ambiente, Ordenamento do Território e Poder Local da Assembleia da República.

O Gabinete de Apoio à Comissão de Assuntos Europeus encontra-se disponível para qualquer esclarecimento e toda a colaboração.

Com os meus melhores cumprimentos,

Paulo Mota Pinto

Presidente da Comissão de Assuntos Europeus

ASSEMBLEIA LEGISLATIVA
DA REGIÃO AUTÓNOMA DOS AÇORES
ARQUIVO
Entrada 2533 Proc. n.º 02.08
Data: 014/09/05 N.º 107/X

COMISSÃO
EUROPEIA

Bruxelas, 23.7.2014
COM(2014) 520 final

COMUNICAÇÃO DA COMISSÃO AO PARLAMENTO EUROPEU E AO CONSELHO

Eficiência energética e a sua contribuição para a segurança energética e o quadro político para o clima e a energia para 2030

{SWD(2014) 255 final}
{SWD(2014) 256 final}

1. INTRODUÇÃO

A Comissão apresentou recentemente um quadro político para o clima e a energia no período de 2020 a 2030[1]. Este quadro propõe objetivos ambiciosos de redução das emissões de gases com efeito de estufa (GEE) e de energias renováveis como parte integrante da transição da União para uma economia hipocarbónica competitiva. Promove também a redução da dependência energética e uma maior acessibilidade dos preços da energia para as empresas e os consumidores decorrente do bom funcionamento do mercado interno. O quadro para 2030 foi posteriormente complementado por uma análise mais circunstanciada da segurança energética da União, tendo em conta os recentes acontecimentos geopolíticos na fronteira oriental da UE, juntamente com uma estratégia que propõe ações concretas para reduzir a dependência energética, não só no futuro imediato como também a mais longo prazo[2].

Em consonância com o pedido do Conselho Europeu[3], a presente Comunicação explica e quantifica o contributo que a eficiência energética poderia dar para a redução das emissões de gases com efeito de estufa e para uma maior segurança energética da União, que são ambas facetas de um quadro integrado para as políticas em matéria de clima e de energia. Em consonância com a Diretiva Eficiência Energética, a Comunicação inclui também as perspetivas sobre o cumprimento do objetivo de 20% de eficiência energética em 2020.

A eficiência energética tem um papel fundamental a desempenhar na transição para um sistema energético mais competitivo, seguro e sustentável, com um mercado interno da energia no seu centro. Embora a energia alimente as nossas sociedades e economias, o crescimento futuro deve ser obtido com um menor consumo de energia e com menores custos. A UE pode tornar este novo paradigma numa realidade. Conforme apresentado na figura, a UE já tinha começado, muito antes do início da crise de 2008, a dissociar o crescimento económico do consumo de energia graças a uma maior eficiência energética. Tem-se procedido desde então a uma dissociação crescente entre o crescimento económico e o consumo de energia, incentivada por sinais de preços e por um vasto conjunto de políticas em matéria de eficiência energética (ver figura).

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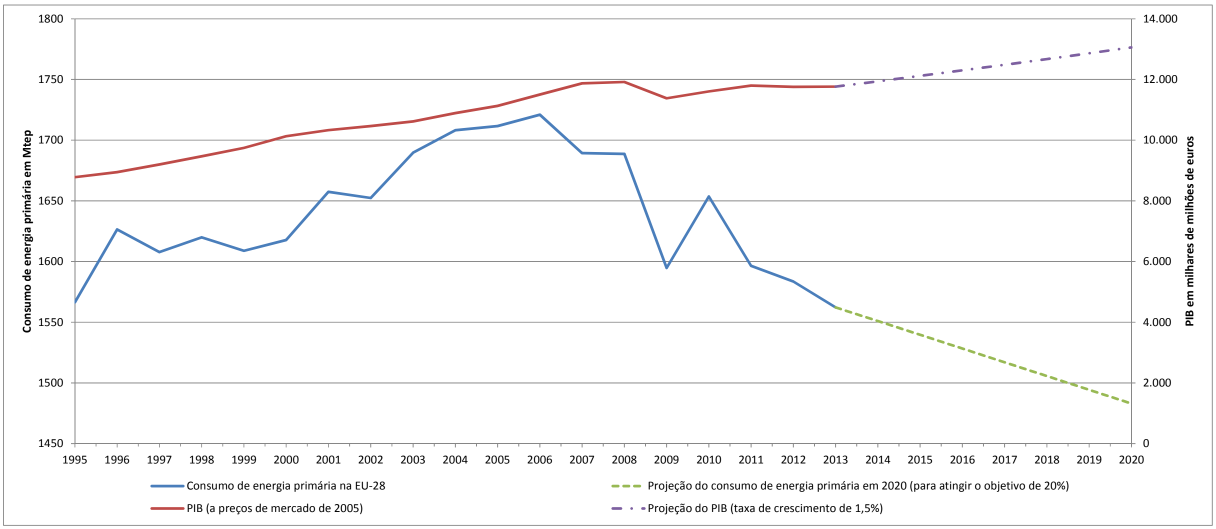
1 COM(2014) 15
2 COM(2014) 330
3 Conclusões da reunião do Conselho Europeu de 26 e 27 de junho de 2014, EUCO 79/14

Figura 1. Evolução do consumo de energia e do PIB na UE, 1995-2013



Fonte: Serviços da Comissão. com base em dados Eurostat

2. PERSPETIVAS DE CUMPRIMENTO DO OBJETIVO PARA 2020

O atual quadro em matéria de eficiência energética

Foi estabelecido um objetivo indicativo de 20% de poupanças de energia até 2020 como objetivo central de eficiência energética[4]. Os Estados-Membros fixaram objetivos nacionais não vinculativos de eficiência energética. As medidas de apoio aos referidos objetivos são:

- Diretiva Eficiência Energética (DEE)[5];
- Diretiva Desempenho Energético dos Edifícios (DDEE)[6];
- Regulamentação de produtos que estabelece normas mínimas de desempenho energético e a inclusão nos rótulos de informação sobre o desempenho energético[7];
- Normas de desempenho em matéria de emissões de CO_2 aplicáveis a automóveis e veículos comerciais ligeiros[8];
- Maior financiamento através dos Fundos Estruturais e de Investimento (FEIE) da UE, do Programa-Quadro Horizonte 2020 e de instrumentos específicos como o mecanismo ELENA[9] e o Fundo Europeu para a Eficiência Energética;
- Instalação de contadores inteligentes na sequência da Diretiva Mercado Interno da Eletricidade[10];

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4 Corresponde a 1483 milhões de toneladas de equivalente petróleo (Mtep) em consumo de energia primária em 2020

5 E suas predecessoras: Diretiva Cogeração (2004/8) e Diretiva Serviços Energéticos (2006/32)

6 Diretiva Desempenho Energético dos Edifícios (2010/31/UE)

7 Nomeadamente a Diretiva Conceção Ecológica (2009/125/CE) e respetivas medidas de execução; a Diretiva Rotulagem Energética (2010/31/UE) e respetivas medidas de execução.

8 Regulamento (UE) n.º 333/2014 e Regulamento (UE) n.º 443/2009.

9 Programa de Assistência Europeia à Energia Local gerido pelo Banco Europeu de Investimento; http://www.eib.org/products/elena/index

- Regime de Comércio de Licenças de Emissão da UE (RCLE)[11].

Na Caixa 1 é apresentada uma descrição da aplicação da legislação em vigor.

Caixa 1: Aplicação de legislação-chave em matéria de eficiência energética — ponto da situação

- O prazo de transposição para o direito nacional da Diretiva Eficiência Energética terminou recentemente. Os Planos de Ação de Eficiência Energética de 2014 dos Estados-Membros indicam o reforço das políticas nacionais neste domínio (ver síntese no anexo I).
- A DEE está a promover alterações no modelo empresarial das empresas de serviços energéticos. A diretiva estabelece que os Estados-Membros devem promover mecanismos de financiamento da eficiência energética. Na Alemanha, o banco estatal KfW concede empréstimos preferenciais para renovações que visem melhorar a eficiência energética dos edifícios existentes e para a construção de novos edifícios. Entre 2006 e 2013, foram renovados 2,8 milhões de habitações e foram construídas 540 000 novas habitações com elevado desempenho energético.
- Em França, o novo projeto de lei nacional prevê numerosas ações concretas, em especial relativas aos edifícios. Entre as medidas contam-se uma redução fiscal de até 30% do custo das renovações para fins de eficiência energética, a partir de setembro de 2014.
- Estão a ser diversificados os mecanismos de financiamento no âmbito dos Fundos Estruturais e de Investimento Europeus com uma maior utilização de instrumentos financeiros.
- Prevê-se um aumento de cinco para dezasseis do número de Estados-Membros que aplicam regimes de obrigações de eficiência energética a serviços de utilidade pública. Na Polónia, as disposições relevantes da DEE serão plenamente aplicadas através de um sistema desse tipo.
- A DEE promove programas de sensibilização dos agregados familiares sobre as vantagens das auditorias energéticas através de serviços de aconselhamento adequados. No Reino Unido, um serviço especializado contribui para a elaboração de políticas com base em estudos sobre formas de incentivar os consumidores a tomar decisões que tenham em conta a eficiência energética («economia comportamental»).
- Apesar destes progressos, até à data apenas cinco Estados-Membros notificaram a plena transposição da DEE. A Comissão enviou cartas de notificação para cumprir aos outros Estados-Membros.
- A aplicação da Diretiva Desempenho Energético dos Edifícios também está a sofrer de atrasos, apesar de o prazo de transposição para o direito nacional já ter terminado em julho de 2012. Neste momento, há nove Estados-Membros que ainda não concluíram o processo de transposição. A Comissão iniciou processos judiciais em quatro casos.

As políticas de eficiência energética estão a produzir resultados tangíveis

Na sequência das medidas de eficiência energética, os edifícios estão a consumir menos energia, os equipamentos ineficientes estão a ser eliminados do mercado e os rótulos dos aparelhos eletrodomésticos, como televisores e caldeiras, permitem aos consumidores fazer opções de compra com conhecimento de causa. As autoridades públicas, a indústria, as PME e as famílias estão cada vez mais conscientes das possibilidades de poupança de energia. Nos

[10] Diretiva 2009/72/CE que estabelece regras comuns para o mercado interno da eletricidade e que revoga a Diretiva 2003/54/CE.

[11] Diretiva 2003/87/CE, com a redação que lhe foi dada pela Diretiva 2009/29/CE e pela Decisão 1359/2013/UE.

transportes, os requisitos de desempenho em matéria de emissões de CO_2 permitirão uma redução de 40% das emissões médias da frota de automóveis novos de passageiros até 2021, em comparação com 2007.

A integração destes elementos num quadro comum da UE beneficiou da escala do mercado interno e permitiu aos decisores políticos nacionais aprender uns com os outros. Este quadro europeu complementa medidas nacionais, como acordos voluntários, obrigações de eficiência energética, regimes de financiamento e campanhas de informação. Os progressos dos Estados-Membros no domínio da eficiência energética são analisados anualmente no âmbito do Semestre Europeu.

Por conseguinte, a situação, tanto a nível nacional como da UE, revela uma dinâmica crescente gerada pelas políticas e medidas de eficiência energética.

É necessário envidar esforços suplementares com vista a atingir o objetivo de poupança de energia da UE até 2020

Com base numa análise das ações dos Estados-Membros e de previsões adicionais, a Comissão estima agora que a **UE conseguirá obter poupanças de energia de cerca de 18-19% em 2020**[12]. É de salientar que cerca de um terço dos progressos verificados no sentido da realização do objetivo de 2020 se deverão ao facto de a taxa de crescimento ter sido inferior ao previsto durante a crise financeira. É, por conseguinte, importante evitar qualquer complacência quanto ao cumprimento do objetivo de 20% e evitar subestimar os esforços que serão necessários para o cumprimento de qualquer novo objetivo que venha a ser fixado para o período após 2020.

Tendo em conta os grandes benefícios da eficiência energética e a acumulação de provas sobre a eficácia da política de eficiência energética, é essencial envidar esforços adicionais para garantir o cumprimento integral do objetivo. A implementação do quadro legislativo da UE continua ainda a sofrer de atrasos (ver os anexos II e III). **Se todos os Estados-Membros trabalharem agora arduamente na plena aplicação da legislação adotada, será possível atingir o objetivo de 20% sem necessidade de medidas adicionais.**

Os esforços devem incidir nos seguintes aspetos:

- Tranquilizar os consumidores sobre a qualidade dos seus edifícios mediante o reforço da verificação local e regional dos códigos de construção nacionais e uma informação correta dos consumidores sobre o desempenho energético dos edifícios para venda ou aluguer[13];

- Promover uma relação proativa entre os serviços de utilidade pública e os seus clientes que vise a obtenção de poupanças de energia[14];

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12 Tal significa que não será atingido o objetivo de 20% de poupanças por 20-40 Mtep.

13 A Comissão estima que, com estas ações, podem ser asseguradas poupanças adicionais de 15 Mtep até 2020. «*Study evaluating the National Policy Measures and Methodologies to implement Article 7 of the Energy Efficiency Directive*», CE Delft, projeto de estudo encomendado pelos serviços da Comissão Europeia.

13 http://ec.europa.eu/energy/efficiency/eed/guidance_notes_en.htm

14 A Comissão estima que, com estas ações, podem ser asseguradas poupanças adicionais de 20 Mtep até 2020; ver também http://ec.europa.eu/energy/efficiency/eed/guidance_notes_en.htm.

- Reforçar a fiscalização do mercado sobre a eficiência energética dos produtos, dotando-a dos recursos necessários em todos os Estados-Membros a fim de assegurar condições equitativas para a indústria e de proporcionar aos consumidores a informação de que necessitam para fazerem escolhas informadas[15].

3. EFICIÊNCIA ENERGÉTICA: AVALIAÇÃO DO POTENCIAL PARA 2030

Um objetivo-chave da futura política em matéria de clima e energia consiste em manter a energia a um preço acessível para as empresas, a indústria e os consumidores. Por conseguinte, o quadro para 2030 e os respetivos objetivos têm subjacente a necessidade de satisfazer os objetivos em matéria de clima e energia da forma mais eficaz em termos de custos. Esta abordagem exige que os Estados-Membros disponham da flexibilidade necessária sobre o modo de cumprimento dos seus compromissos, tendo em consideração o respetivo contexto nacional. Nesta base, a Comissão propôs a adoção de objetivos vinculativos de redução de 40% das emissões de gases com efeito de estufa em 2030 (em relação aos níveis de 1990) e de uma quota mínima de 27% de energias renováveis no consumo de energia em 2030. Estas são etapas no sentido da concretização, com uma boa relação custo-eficácia, de uma economia hipocarbónica competitiva em 2050.

No que diz respeito à eficiência energética, o quadro para 2030 revelou igualmente que para atingir, com uma boa relação-custo eficácia, o objetivo para 2030 de redução das emissões de gases com efeito de estufa seriam necessárias maiores poupanças de energia da ordem dos 25%[16]. O presente documento baseia-se nesta premissa e apresenta uma análise mais aprofundada do potencial de melhoria da eficiência energética com uma boa relação custo-eficácia, bem como de outros benefícios gerados por uma maior eficiência energética.

3.1. Competitividade da UE: Crescimento, emprego e indústria

A eficiência energética tem um papel importante a desempenhar na promoção do emprego[17] e do crescimento, especialmente incentivando o setor da construção, que é o mais capaz de reagir rapidamente para apoiar o relançamento da economia e que não está exposto à deslocalização.

Na indústria, a política de eficiência energética visa diminuir a quantidade de energia necessária para um mesmo processo ou produto — o que significa fazer o mesmo, ou mais, com menos, sem prejudicar as perspetivas de crescimento. As empresas europeias, em especial a indústria transformadora, já contribuíram muito para fazer da Europa uma das regiões com níveis mais elevados de eficiência energética em todo o mundo. Neste setor em particular, a melhoria da eficiência energética tem sido frequentemente uma resposta autónoma à evolução dos preços. Por exemplo, as indústrias da UE têm historicamente utilizado a energia de forma mais eficiente do que as suas congéneres norte-americanas — e

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15 Deveria permitir evitar a perda de, pelo menos, 4 Mtep de poupanças.
16 Pressupondo que é utilizado o atual método de medição dos progressos para a realização do objetivo para 2020 de aumento de 20% da eficiência energética.
17 Comunicação sobre Iniciativa Emprego Verde: Explorar o potencial de criação emprego da economia verde, COM(2014) 446 final.

melhoraram ainda mais a sua intensidade energética em quase 19% no período entre 2001 e 2011, em comparação com apenas 9% nos EUA[18]. No período de 1990 a 2009, verificou-se um aumento de 30% na intensidade energética da indústria da UE-27[19].

Está criado o quadro regulamentar de apoio a estas tendências, sendo o Regime de Comércio de Licenças de Emissão da UE o principal instrumento de promoção da eficiência energética (e da redução de GEE) na indústria, proporcionando a necessária previsibilidade regulamentar. Este quadro será melhorado com a reserva de estabilidade do mercado no âmbito do Regime RCLE, que tornará o sistema mais resistente a choques.

O quadro da UE em matéria de eficiência energética demonstrou ser um motor de inovação e crescimento económico para as empresas europeias. A eficiência energética tornou-se uma oportunidade comercial — sobretudo no setor da construção (um setor dominado pelas PME). A eficiência energética estimula a competitividade ao criar mercados para aparelhos eficientes e de elevado valor acrescentado e tecnologias de gestão descentralizada da energia. A crescente dependência das TIC em muitos dos domínios em causa constitui uma oportunidade para maiores ganhos de eficiência, desde que os sistemas e plataformas sejam dotados de interfaces normalizadas abertas que permitam uma fácil atualização e maior inovação. À medida que aumenta a procura a nível mundial de produtos com elevada eficiência energética, a política de eficiência energética gera também vantagens para os produtos europeus em mercados globais em crescimento e contribui para um desenvolvimento económico sustentável.

As novas tecnologias nos setores da construção, da indústria transformadora e dos transportes têm potencial para gerar um maior nível de eficiência energética se forem bem utilizadas em larga escala.

3.2. Edifícios — faturas de energia menos onerosas para os consumidores

A melhoria da eficiência energética nos edifícios pode poupar dinheiro aos consumidores. Na UE, os agregados familiares gastam, em média, 6,4% do seu rendimento disponível na utilização de energia relacionada com a casa, cerca de dois terços para aquecimento e um terço para outros fins[20]. Em 2012, quase 11% da população da UE não conseguiu manter as suas casas convenientemente aquecidas[21]. Tal deve-se ao aumento dos preços da energia - cujos efeitos têm contudo sido atenuados por uma maior concorrência no mercado interno da energia e por uma maior eficiência energética.

Na sequência da introdução de requisitos de eficiência nos códigos de construção, o consumo dos novos edifícios é hoje apenas cerca de metade do consumo dos edifícios típicos da década de 1980. No entanto, por exemplo, 64% dos aquecedores de ambiente continuam a ser pouco eficientes, pelo menos os modelos de baixa temperatura[22], e 44% das janelas ainda têm vidros

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[18] COM(2014) 21 *Preços e custos da energia na Europa*, p. 12; SWD (2014) 19, *Energy Economic Developments in Europe*, pp. 36 e 41.

[19] European Environment Agency 2012, http://www.eea.europa.eu/data-and-maps/indicators/energy-efficiency-and-energy-consumption.

[20] «*Energy prices and costs report*», Documento de Trabalho dos Serviços da Comissão, SWD(2014) 20 final/2.

[21] Idem

[22] Indústria de aquecimento europeia, dados de 2012, UE-28, excluindo Chipre, Luxemburgo e Malta.

simples[23]. As novas normas de eficiência e rotulagem aplicáveis a aquecedores de ambiente e de água irão em breve começar a ter um impacto no mercado. No que diz respeito à eletricidade, prevê-se que, até 2020, aparelhos mais eficientes venham a poupar anualmente aos consumidores 100 mil milhões de euros nas suas faturas de energia, o que equivale a 465 euros por agregado familiar.

O direito a uma faturação mais informativa, transparente e frequente e a participar em mercados de resposta à procura, dão aos consumidores poder para gerir o seu consumo de energia de uma forma ativa. A criação de um mercado de serviços energéticos inovadores, em que os investimentos em aparelhos eficientes e uma produção e consumo inteligentes compensem, deve ser o objetivo dos Estados-Membros ao preparar ou facilitar a implementação de sistemas de contadores inteligentes.

Tem-se verificado um aumento anual na eficiência energética dos edifícios de, pelo menos, 1,4%[24]. Este aumento é relativamente limitado em grande parte devido às baixas taxas de renovação. Os Estados-Membros que tiveram maior sucesso na redução do desperdício de energia combinaram requisitos rigorosos em matéria de eficiência para edifícios novos e renovados com programas destinados à renovação de edifícios existentes[25].

Para tirar todo o partido dos benefícios decorrentes da eficiência energética nos edifícios, o maior desafio é acelerar e financiar os necessários investimentos iniciais e acelerar a taxa de renovação do parque imobiliário existente, atualmente de uma média de 1,4% para taxas anuais superiores a 2%.

Uma parte do desafio consiste em implementar esta aceleração de uma forma socialmente aceitável. Terão de ser minimizados os efeitos secundários prejudiciais para as camadas mais frágeis da população e será necessário explorar formas que permitam a todas as camadas da população beneficiar dos investimentos em medidas de eficiência energética. Para tal é necessário criar instrumentos financeiros adequados que estejam acessíveis a todos os grupos de consumidores, independentemente da sua situação financeira.

Por sua vez, a redução da procura de combustíveis fósseis permitirá reduzir os preços da energia. Segundo uma estimativa, cada 1% adicional de poupança de energia permitirá obter em 2030 uma redução de cerca 0,4% nos preços do gás e de cerca de 0,1% nos preços do petróleo[26].

3.3. Transportes com boa eficiência energética

Verificou-se um aumento de 35% no consumo de energia nos transportes entre 1990 e 2007, mas desde então tem-se observado uma tendência descendente. Até à data, os melhores instrumentos neste domínio têm sido normas relativas ao CO_2 que permitiram reduzir as emissões de gases com efeito de estufa e tornar os automóveis e veículos comerciais ligeiros

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[23] Estudo preparatório no âmbito da Diretiva Conceção Ecológica, VHK, resultados preliminares

[24] «*Energy Efficiency Trends in the EU*»", Odysee-Mure, 2011

[25] Por exemplo, na Alemanha e na Eslováquia, verificou-se desde 1990 uma diminuição de 50% no consumo médio de energia por habitação.

[26] POLES, «*Quick analysis of the impact of energy efficiency policies on the international fuel prices*», Centro Comum de Investigação, 2014

mais eficientes do ponto de vista energético[27], embora outros fatores, como os elevados preços do petróleo e o ritmo mais lento de crescimento da mobilidade, tenham contribuído também para os 8% de redução do consumo de energia observados entre 2007 e 2012.

Há sinais de que o comportamento dos utentes dos transportes está a mudar. Em alguns Estados-Membros, o número de automóveis particulares está a atingir o ponto de saturação; à escala urbana, há uma série de histórias de sucesso de incentivo à mudança para formas mais eficientes de transporte — veículos elétricos, transportes públicos e deslocações em bicicleta e a pé. A diretiva relativa à criação de uma infraestrutura para combustíveis alternativos[28], recentemente aprovada, e o novo «pacote de mobilidade urbana»[29] continuarão a apoiar esta tendência.

Outras iniciativas adotadas pela Comissão, na sequência do Livro Branco sobre Transportes de 2011[30], visam incentivar a utilização de modos de transporte com melhor eficiência energética, graças a uma maior qualidade e escolha nos serviços ferroviários[31], a um maior investimento em investigação e inovação no setor dos transportes ferroviários[32] e a uma maior exploração das vias navegáveis interiores[33].

Para ser plenamente eficaz, é necessária uma transformação gradual de todo o sistema de transportes no sentido de uma maior integração entre modos de transporte, da inovação e da implantação de combustíveis alternativos, bem como de uma melhor gestão dos fluxos de tráfego graças a sistemas de transporte inteligentes. Esta transformação deve ser acompanhada por políticas urbanas e de utilização dos solos mais eficientes a nível da UE e dos Estados-Membros.

3.4. Bom equilíbrio entre custos e benefícios

O Conselho Europeu trabalha no sentido de serem acordados objetivos para 2030 em outubro, de modo a que a União possa desempenhar um papel ativo nas negociações internacionais em curso sobre alterações climáticas. Para que a contribuição da eficiência energética para o quadro para 2030 seja a mais adequada, é necessário que seja baseada numa análise exaustiva dos custos e benefícios adicionais de superação do objetivo de 25% de poupança de energia anteriormente indicado pela Comissão. No quadro 1 são apresentados alguns aspetos-chave das diferentes opções.

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27 Observou-se uma descida nas emissões dos automóveis novos vendidos em 2013 de uma média de 127 g/km, pelo que o objetivo de 130 g/km fixado para 2015 foi cumprido com dois anos de antecedência.

28 COM(2013) 18 final

29 COM(2013) 913 final

30 COM(2011) 144 final

31 Quarto Pacote Ferroviário, disponível em: http://ec.europa.eu/transport/modes/rail/packages/2013_en.htm

32 Shift2Rail, disponível em: http://ec.europa.eu/transport/modes/rail/news/shift-to-rail_en.htm

33 Pacote NAIADES II, disponível em: http://ec.europa.eu/transport/modes/inland/promotion/naiades2_en.htm

Quadro 1. Custos e benefícios de uma série de diferentes objetivos de eficiência energética[34]

	REF2013 Base de referência	GHG40 (40% GES, 27% FER, 25% EE)	Objetivo de eficiência energética mais ambicioso (%)					
			EE27	EE28	EE29	EE30	EE35	EE40
Poupanças de energia em 2030 (avaliadas em função das projeções de referência de 2007 relativas ao consumo de energia primária)	21,0%	25,1%	27,4%	28,3%	29,3%	30,7%	35,0%	39,8%
Consumo de energia primária em 2030 (Mtep) [Consumo interno bruto de energia, excluindo a utilização não energética]	1490	1413	1369	1352	1333	1307	1227	1135
Custos dos sistemas energéticos sem efeito de eficiência energética nos custos não financeiros[35] (média anual de 2011-2030 em milhares de milhões de euros de 2010)	2067	2069	2069	2074	2082	2089	2124	2181
Despesas de investimento (média anual em 2011-2030 em milhares de	816	854	851	868	886	905	992	1147

[34] O quadro 1 baseia-se na análise mais recente disponível.

[35] O conceito de custos do sistema energético inclui, em termos gerais, dois elementos: custos de capital e compras de energia. Os custos de capital podem ser divididos em três elementos principais: i) custos em numerário dos investimentos em eficiência energética; ii) custo da obtenção de financiamento para esse fim e iii) custos não financeiros atribuídos aos obstáculos que os consumidores enfrentam, tais como os esforços necessários para obter informações sobre edifícios ou produtos eficientes. As políticas de eficiência energética visam estes obstáculos, permitindo assim uma redução do custo.

milhões de euros de 2010)[36]								
Importações líquidas de gás em 2030 (milhares de milhões de metros cúbicos)[37]	320	276	267	256	248	237	204	184
Custos das importações de combustíveis fósseis (média anual em 2011-2030 em milhares de milhões de euros de 2010)	461	452	447	446	444	441	436	434
Emprego em 2030 (milhões de pessoas)	231,74	n.a[38]	n.a.	232,39	n.a.	232,53	233,16	235.21
Preço médio da eletricidade em 2030 (€/MWh)	176	179	180	179	178	178	177	182

[36]Apesar de a opção GHG40 ser 0,5 milhões de euros menos dispendiosa que a EE27 ao longo do período de 2011 a 2030 em termos de custos totais do sistema energético (2068,5 versus 2069 mil milhões de euros), implica despesas de investimento ligeiramente superiores. Tal deve-se principalmente à menor ambição da opção EE27 em termos de redução dos GEE (- 40,6% versus -40,1%) e à adoção de algumas políticas EE de baixo custo para a eliminação de obstáculos não relacionados com o mercado (que existem na opção GHG40) e explorando o potencial relevante de EE disponível na UE.

[37]Como o resultado PRIMES é expresso em Mtep, utilizou-se o fator de conversão de 0,90567 (ref: IEA).

[38] Em termos de emprego, procedeu-se à modelização de um menor número de cenários uma vez que a análise preliminar revelou que os resultados — por exemplo para as opções EE27 e EE28 — eram muito semelhantes. Por conseguinte, apenas se procedeu à modelização das opções EE28, EE30, EE35 e EE40.

Estima-se que um objetivo de 25% de poupança de energia resultará num aumento do custo anual médio do sistema energético de 2067 mil milhões de euros para 2069 mil milhões de euros (2011-2030), ou seja, aproximadamente 2 mil milhões de euros por ano ou 0,09%. Os custos substanciais a assumir pelos Estados-Membros no que diz respeito ao sistema energético fazem parte da renovação em curso de um sistema energético obsoleto[39]. Com 25% de poupança de energia, o quadro para 2030 permitiria já obter melhorias substanciais em termos da dependência energética da União, representando uma poupança de 9 mil milhões de euros por ano na importação de combustíveis fósseis (menos 2%) e uma redução de 13% das importações de gás (cerca de 44 mil milhões de metros cúbicos), em comparação com as atuais tendências e políticas.

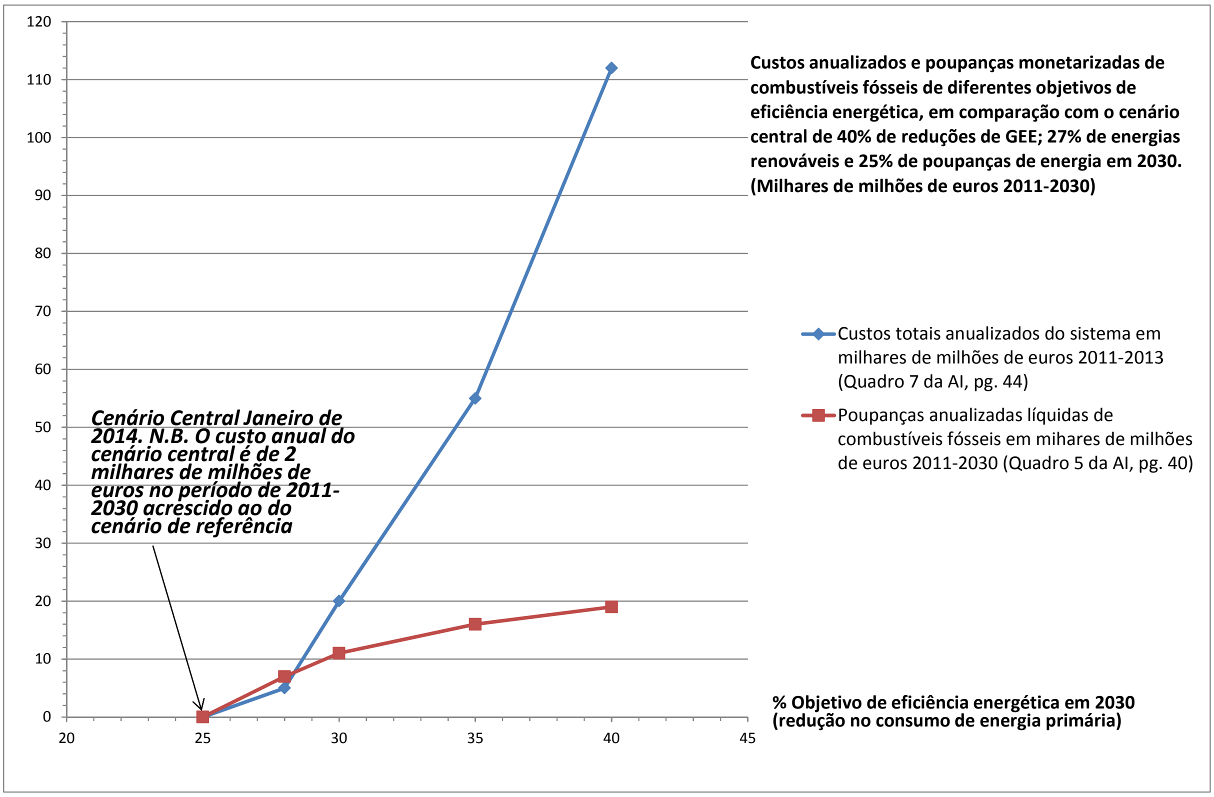
O objetivo de 40% de poupança de energia preconizado pelo Parlamento Europeu teria um impacto importante na dependência energética, permitindo especialmente uma redução das importações de gás. No entanto, estes benefícios ao nível da segurança energética seriam acompanhados por um forte aumento nos custos gerais do sistema energético de 2069 mil milhões de euros para 2181 mil milhões de euros por ano, ou seja, de cerca de 112 mil milhões de euros por ano no período de 2011 a 2030.

A Comissão avaliou uma variedade de níveis de ambição entre 25% e 40% de poupanças de energia. Esta análise revelou que os benefícios aumentam com um aumento mais ambicioso da eficiência energética e que se verificaria uma redução das importações de gás de 2,6% por cada 1% adicional de poupança de energia. Este processo tem um impacto direto no aumento da segurança do aprovisionamento da UE — embora com poupanças de energia superiores a 35% se verifique uma queda acentuada da taxa de redução de importações de gás decorrentes de poupanças adicionais de energia.

De forma mais geral, decorre claramente do quadro 1 e da figura 2 infra que um objetivo mais ambicioso de eficiência energética permite obter maiores benefícios, especialmente em termos de importações de combustíveis fósseis. Entre os benefícios adicionais contam-se os resultantes da redução das emissões de GEE, da redução da poluição da atmosfera, da água e dos solos e da poluição sonora e da redução na utilização de recursos para a produção, transformação, transporte e utilização de energia, juntamente com os benefícios associados para a saúde humana e o estado dos ecossistemas. Estes são complementados por benefícios em termos de níveis de emprego potencialmente mais elevados. No entanto, há também custos adicionais para além do que é necessário para atingir o objetivo de 40% de redução das emissões de gases com efeito de estufa. Por exemplo, o objetivo de 28% de eficiência energética resultaria num aumento dos custos totais do sistema energético de 2069 mil milhões de euros por ano com 25% de poupanças para uma ordem de grandeza de 2074 mil milhões de euros, ou seja, um aumento de cerca de 5 mil milhões de euros por ano, representando 0,24% por ano, durante o período de 2011 a 2030. A figura 2 mostra igualmente que os custos da eficiência energética aumentam mais rapidamente do que as poupanças nas importações de combustíveis fósseis.

[39] Estima-se que sejam necessários cerca de 1 bilião de euros nos próximos 10 anos para investimentos na produção e transporte e de 600 mil milhões de euros para a transmissão e distribuição.

Figura 2. Custos anuais adicionais médios do sistema energético e poupanças de combustíveis fósseis em comparação com o cenário central de 40% de gases com efeito de estufa e com os objetivos de 27% de energias renováveis e de 25% de poupança de energia.



Nota: O quadro 1 supra resume os principais custos e benefícios dos diferentes níveis de poupança de energia em 2030

A distribuição dos impactos é também uma consideração importante. As medidas adicionais de melhoria da eficiência energética teriam de visar sobretudo a eficiência energética dos edifícios e produtos e, por conseguinte, incidir em grande medida nos setores não abrangidos pelo RCLE. No que se refere ao setor da construção, que representa cerca de 10% do PIB da UE, a melhoria da eficiência energética dos edifícios é o fator determinante mais promissor para a retoma do crescimento após a recessão.

4. FINANCIAMENTO DA EFICIÊNCIA ENERGÉTICA E FAZER A PONTE PARA 2030

As oportunidades para a melhoria da eficiência energética identificadas na presente análise podem ser financiadas desde que seja criado um quadro eficaz de financiamento para cobrir os custos iniciais significativos.

Os fundos da União devem produzir um efeito de alavanca no financiamento privado

Estariam disponíveis fundos substanciais da União para a implementação de medidas de eficiência energética no período anterior a 2020 no âmbito do atual Quadro Financeiro Plurianual. A utilização destes fundos é já um ponto-chave de debate com os Estados-Membros em relação ao acordo geral sobre o quadro para 2030 e à garantia de uma distribuição justa e equitativa dos esforços.

Se aplicados de uma forma sensata, os investimentos realizados no período anterior a 2020 continuarão a gerar as poupanças de energia necessárias após 2020. A maior parte do potencial de poupanças de energia reside no setor da construção, que representa 40% do consumo de energia da UE proveniente de edifícios, e quase 90% da área útil de edifícios privados e mais de 40% dos edifícios residenciais construídos antes de 1960. Esta situação aponta para a necessidade de um considerável financiamento privado. É, por conseguinte, essencial a emergência de um mercado para melhoria da eficiência energética, bem como a intervenção dos fundos públicos para gerar um efeito de alavanca na mobilização de capital privado.

A título de exemplo, os investidores institucionais na UE (aderentes da iniciativa Princípios para o Investimento Responsável) gerem atualmente mais de 12 biliões de euros de fundos e o montante que investiram no setor imobiliário privado está estimado em mais de 1,5 biliões de euros em 2012. Estes são recursos disponíveis que é preciso libertar mediante uma utilização inteligente dos fundos públicos, acompanhada de um quadro regulamentar estável, transparente e a longo prazo. A avaliação de impacto indica que seria necessário um investimento adicional de 38 mil milhões de euros por ano para dar cumprimento ao quadro para 2030. Neste contexto, a Comissão considera que os Estados-Membros devem atribuir partes significativas do financiamento da Política de Coesão e/ou dos fundos nacionais ao apoio à transição para uma economia hipocarbónica, a fim de utilizar estes recursos para produzir um efeito de alavanca no capital privado. No orçamento da UE para 2014-2020, verificou-se um aumento significativo na atribuição de verbas para a melhoria da eficiência energética. Estará disponível uma dotação mínima de 38 mil milhões de euros para investimento na economia hipocarbónica ao abrigo dos Fundos Estruturais e de Investimento Europeus no período de 2014-2020 — e este montante será multiplicado pelo cofinanciamento nacional e regional e pela atração de capital privado.

Além disso, um maior apoio do Programa-Quadro Horizonte 2020 e dos Fundos Estruturais e de Investimento Europeus será investido em inovação no domínio da eficiência energética. No período de 2014-2020, está prevista a atribuição de cerca de 2000 milhões de euros, em particular no âmbito do Desafio Societal «Energia segura, não poluente e eficiente» do Programa-Quadro Horizonte 2020, bem como das Parcerias Público-Privadas sobre «Edifícios Eficientes em termos Energéticos», «Fábricas do Futuro» e «Indústria de Transformação Sustentável através da Eficiência Energética e dos Recursos (SPIRE)».

Nos últimos anos, a UE tem vindo a desenvolver projetos-piloto de instrumentos de financiamento inovadores, como o Fundo Europeu para a Eficiência Energética (FEEE), o Fundo Mundial para a Eficiência Energética e as Energias Renováveis (GEEREF) e o Financiamento Privado para a Eficiência Energética (PF4EE) no âmbito do programa LIFE, que podem ser utilizados diretamente ou como exemplos para replicação a nível dos Estados-Membros. Além disso, com base nas primeiras experiências bem sucedidas no período de 2007-2013, como é o caso do Instrumento JESSICA[40], é fortemente incentivada a utilização de instrumentos financeiros nos Fundos FEIE no período de 2014-2020, por

[40] Apoio Europeu Comum ao Investimento Sustentável em Áreas Urbanas (*Joint European Support for Sustainable Investment in City Areas* - JESSICA).

exemplo por meio dos «empréstimos para a renovação». Estes proporcionarão oportunidades acrescidas para os Estados-Membros garantirem um elevado efeito de alavanca dos FEIE Há aliás provas crescentes dos importantes benefícios decorrentes da utilização de fundos públicos para despoletar a participação de capitais privados: utilização mais eficaz em termos de custos dos escassos recursos públicos, importantes efeitos de alavanca em termos de investimentos do setor privado, melhor alinhamento do apoio público com o ciclo de investimento das empresas, envolvimento do setor financeiro, maior transparência e redução dos encargos administrativos.

É necessário incidir nos fatores que afetam a oferta e a procura de financiamento para investimento

Do lado da procura, é necessário que os consumidores de energia sejam mais bem informados sobre todos os benefícios da eficiência energética que ultrapassam o simples retorno do investimento ou os quilowatt-hora poupados, como sejam a melhoria da qualidade de vida ou o reforço da competitividade das suas empresas. Pode ser promovida uma procura adicional mediante uma implementação mais eficaz do quadro regulamentar em vigor e da assistência ao desenvolvimento e à demonstração de uma cadeia sólida e modulável de projetos de investimento, bem como da partilha de conhecimentos e experiências.

Pode ser reforçada a disponibilidade de meios financeiros utilizando fundos públicos para estruturar e replicar regimes de financiamento específicos existentes, oferecendo produtos de financiamento atrativos, de fácil acesso (próximos do mercado) e simples, como a concessão de empréstimos a baixos juros a diferentes tipos de consumidores.

Além disso, a fim de motivar os consumidores de energia a procurar financiamento para a melhoria da eficiência energética, é necessária investigação socioeconómica mais orientada para os aspetos financeiros com vista a permitir uma melhor compressão do comportamento dos consumidores — incluindo os inquilinos e agregados familiares de baixos rendimentos — ao decidir sobre medidas de eficiência energética. Deve ser dada especial atenção ao mercado emergente de serviços energéticos (incluindo contratos de desempenho energético e acordos de serviços energéticos). A prestação de novos serviços (por exemplo, poupança de energia) decorrentes de modelos empresariais relacionados com a resposta à procura influenciarão certamente a procura de investimento e de financiamento.

A fim de incentivar a oferta de investimentos em eficiência energética, é necessário trabalhar no sentido de demonstrar claramente a sua fundamentação comercial para os investidores e financiadores. É necessária transparência, escalabilidade e normalização para criar um mercado secundário de produtos financeiros de eficiência energética e libertar o potencial de refinanciamento dos investimentos em eficiência energética através de produtos e estruturas de mercado de capitais.

Por conseguinte, a mobilização da oferta e da procura para o financiamento de investimentos implica:

- A identificação, medição, contabilização e valorização de todos os benefícios dos investimentos em eficiência energética através de factos e dados sólidos que possam ser utilizados por decisores privados e empresariais, bem como pelo setor financeiro, designadamente mediante a utilização de certificados de desempenho energético no setor dos edifícios;

- O desenvolvimento de normas para cada elemento do processo de investimento em eficiência energética, incluindo contratos jurídicos, processos de subscrição, processos de concurso, adjudicação, medição, verificação, apresentação de relatórios, (contratos e certificados de) desempenho energético e seguros;

- A disponibilização das ferramentas e serviços aos consumidores necessários para o controlo do consumo de energia a fim de lhes permitir comparar os custos (de capital) dos investimentos em eficiência energética com os custos (operacionais) do consumo de energia;

- Uma utilização de forma orientada dos Fundos da UE (em especial dos FEIE) através de instrumentos financeiros público-privados com vista a aumentar exponencialmente o volume dos investimentos e contribuir para acelerar a participação do financiamento do setor privado mediante uma partilha de riscos modulável, podendo também as receitas do RCLE ser orientadas para investimentos em eficiência energética;

- Abandono pelos Estados-Membros dos regimes tradicionais de financiamento e estudo dos modelos de trabalho que melhor respondam às necessidades de investimento em renovação para fins de eficiência energética nos seus parques imobiliários (conforme estabelecido nas suas Estratégias Nacionais de Renovação dos Edifícios).

- Um maior diálogo entre os decisores dos setores financeiro e público e de outros profissionais afins, que lhes permita estruturar e demonstrar quais são os mecanismos financeiros e os regimes de investimento mais eficazes — adaptados tanto a nível local como a segmentos de mercado específicos — e replicá-los em toda a UE.

Papel da Comissão

A Comissão reforçará a cooperação com os Estados-Membros, os decisores do setor público, os investidores e as instituições financeiras, incluindo o Banco Europeu de Investimento («BEI»), com vista a aumentar o nível de conhecimentos sobre os mecanismos de financiamento existentes aplicáveis à eficiência energética, para além do financiamento de meras subvenções, e o seu desempenho e impacto, incluindo questões relacionadas com a análise de riscos, a avaliação e a normalização. A Comissão prosseguirá igualmente a sua cooperação com as instituições financeiras e os Estados-Membros para um maior desenvolvimento e implantação de iniciativas e instrumentos financeiros adequados, reforçando a disponibilidade de liquidez para medidas de eficiência energética.

Será dada especial atenção à cooperação com os Estados-Membros no que diz respeito à utilização dos Fundos Estruturais e de Investimento Europeus, a fim de refletir a diversidade de necessidades, obstáculos e oportunidades em toda a UE. A Comissão já publicou orientações abrangentes sobre o modo de financiamento da renovação de edifícios com financiamento da Política de Coesão, que visam ajudar as autoridades de gestão a planificar e implementar investimentos em edifícios no âmbito de Programas Operacionais. Estas orientações incluem uma lista de boas práticas e de estudos de casos. Além disso, exploram os diferentes mecanismos de financiamento que as autoridades podem utilizar com o objetivo de lançamento de investimentos em larga escala para a renovação energética de edifícios e a atração de maiores níveis de investimento do setor privado.

Adicionalmente, a Comissão continuará a trabalhar em estreita colaboração com os Estados-Membros, facultando orientações adicionais se necessário, com vista a complementar as orientações já existentes para fins de apoio à aplicação da Diretiva Eficiência Energética[41], e apoiando o intercâmbio de boas práticas. Além disso, a Comissão continuará a velar por que a legislação da UE seja corretamente transposta e aplicada, garantindo condições equitativas entre os Estados-Membros e a maximização das poupanças de energia.

5. PRÓXIMAS ETAPAS

Após um início hesitante, a política de eficiência energética da Europa está agora a produzir resultados. Enquadrada pelo objetivo para 2020 de poupança de 20%, verifica-se uma boa dinâmica a nível europeu e nacional. Com a plena aplicação e acompanhamento da legislação já aprovada, a UE pode colocar-se na boa via para atingir este objetivo, poupando 170 Mtep no consumo de energia entre 2010 e 2020.

Acontecimentos recentes, sobretudo a crise na Ucrânia, recordam de forma dramática a situação vulnerável da UE em matéria de segurança energética e de importações de gás em especial. A recente Estratégia Europeia de Segurança Energética salienta o papel da eficiência energética como meio para melhorar a segurança do aprovisionamento energético da União — cada 1% adicional de poupança de energia permite uma redução de 2,6% nas importações de gás.

Por conseguinte, a Comissão considera que é oportuno manter a atual dinâmica em matéria de poupança de energia e propor um objetivo ambicioso de eficiência energética de 30%. Tal conduzirá a substanciais benefícios adicionais e o custo adicional constitui um equilíbrio razoável, dada a proeminência crescente dos riscos de segurança energética, mantendo simultaneamente a um nível aceitável os custos da Estratégia para as Alterações Climáticas e a Energia 2030 da União.

O atual quadro, baseado num objetivo indicativo a nível da UE e numa combinação de medidas vinculativas a nível da UE e de ações nacionais, provou ser eficaz na indução de fortes progressos nos Estados-Membros. Por conseguinte, esta abordagem deve continuar a aplicar-se até 2030 e a eficiência energética deve tornar-se uma parte integrante do quadro de governação proposto na Comunicação para 2030, que permitiria simplificar os atuais requisitos de acompanhamento e comunicação de informações. Por conseguinte, a eficiência energética deveria ser uma componente-chave dos planos nacionais dos Estados-Membros em prol de uma energia competitiva, segura e sustentável que promoveria uma maior coerência das medidas e políticas em matéria de clima e energia a nível nacional e regional.

Com base nos planos nacionais recebidos e nas suas próprias análises em matéria de energia e de clima a nível pan-europeu, a Comissão procederá ao acompanhamento dos planos nacionais e avaliará as possibilidades de cumprimento dos objetivos nacionais/UE neste domínio (incluindo os relativos à eficiência energética), as perspetivas sobre a dependência energética da UE e o funcionamento eficaz do mercado interno da energia, com base em indicadores-chave adequados relativos à energia. Neste contexto, a Comissão explorará a possibilidade de utilização de indicadores adicionais, com vista a exprimir e acompanhar os

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[41] Comunicação «Aplicação da Diretiva Eficiência Energética — Orientações da Comissão» [COM(2013) 762].

progressos verificados no sentido da realização do objetivo de eficiência energética, tais como a intensidade energética, que tomem em melhor consideração as **variações subjacentes e as projeções relativas ao PIB e ao crescimento da população**. Além disso, a Comissão **procederá em 2017 à análise dos progressos em matéria de eficiência energética, tomando em consideração estes elementos**. Em última análise, o processo de governação proporcionará o quadro no âmbito do qual será avaliada a eficácia das políticas nacionais e da UE relacionadas com os objetivos para 2030 em matéria de clima e de energia.

A Comissão prosseguirá igualmente os seus esforços no sentido de uma maior sofisticação da modelização económica e energética utilizada para avaliar os custos e benefícios das medidas de eficiência energética.

A Comissão continuará a apoiar os Estados-Membros nos seus esforços nacionais através de medidas políticas a nível europeu, como um contributo para a concretização das poupanças propostas. Neste contexto, serão utilizados os seguintes elementos:

- A próxima avaliação e revisão da Diretiva Rotulagem Energética e de determinados aspetos da Diretiva Conceção Ecológica, previstas para o final de 2014, constituirão uma oportunidade para atualizar o quadro da política em matéria de produtos;

- Maior desenvolvimento de instrumentos financeiros e de assistência ao desenvolvimento de projetos com vista a produzir um efeito de alavanca no investimento do setor privado em equipamentos e tecnologias com boa eficiência energética.

- A avaliação e revisão em 2017 da Diretiva Eficiência Energética e da Diretiva Desempenho Energético dos Edifícios, do artigo 7.º da DEE e os próximos Planos de Ação Nacionais de Eficiência Energética (PANEE) proporcionarão uma oportunidade para estudar quais são os elementos políticos necessários para promover investimentos sustentados em eficiência energética, especialmente tendo em conta a prevista eliminação progressiva de alguns elementos-chave da DEE em 2020.

- A Comunicação da Comissão sobre o mercado retalhista, a publicar em breve, incidirá na criação de um mercado em que serviços inovadores baseados numa fixação dinâmica dos preços garantam a oferta pelo mercado de produtos que promovam a utilização eficiente de energia, com base no diálogo com os Estados-Membros e os reguladores e no âmbito da DEE e da legislação relativa ao Mercado Interno da Energia.

- Aplicação da reserva de estabilização do mercado no âmbito do Regime de Comércio de Licenças de Emissão que promoverá melhorias da eficiência energética no setor industrial e assegurará que sejam colhidos os frutos das sinergias entre as políticas em matéria de clima e de eficiência energética.

- Aplicação progressiva do programa apresentado no Livro Branco sobre Transportes de 2011[42];

- Utilização do Programa-Quadro de Investigação e Inovação Horizonte 2020 e estreita cooperação com os Estados-Membros a fim de produzir um efeito de alavanca na

[42] COM(2011) 144 final

disponibilização de produtos economicamente acessíveis, inovadores e energeticamente eficientes, bem como dos novos modelos empresariais subjacentes.

6. Conclusões

Neste momento, as previsões indicam que há boas probabilidades de atingir o objetivo de eficiência energética de 2020. A Comissão não tem intenção de propor novas medidas, mas convida os Estados-Membros a intensificarem os seus atuais esforços com vista a assegurar a realização coletiva do objetivo de 2020. A Comissão complementará estes esforços com orientações adequadas e a divulgação das melhores práticas a fim de assegurar o pleno aproveitamento dos fundos disponíveis da União.

A Comunicação da Comissão sobre um quadro político para o clima e a energia para 2030 considerou que um nível de poupanças de energia de 25% faz parte de uma estratégia para atingir o objetivo de redução de 40% das emissões de gases com efeito de estufa com a melhor eficácia em termos de custos. No entanto, dada a importância crescente do reforço da segurança energética da UE e da redução da dependência da União face às importações, a Comissão considera adequado propor um objetivo mais elevado de 30%. Tal resultaria num aumento de 20 mil milhões de euros nos custos anuais do quadro para 2030, mas continuaria mesmo assim a gerar benefícios tangíveis em termos económicos e de segurança energética.

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PART 1/3

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

Communication from the Commission to the European Parliament and the Council

Energy Efficiency and its contribution to energy security and the 2030 Framework for climate and energy policy

{COM(2014) 520 final}
{SWD(2014) 256 final}

Contents

1. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

1.1. Organization and timing

The preparation of the Impact Assessment (IA) for the Energy Efficiency Review started in 2012 following the adoption of the Energy Efficiency Directive (Directive 2012/27/EC, 'EED') which requires it. Its scope was broadened by the Communication “A policy framework for climate and energy in the period from 2020 to 2030” (2030 Communication), and the IA builds on the preparatory work and impact assessment done for that Communication[1].

Interservice meetings at Director level were held on 22 March and 9 April 2014. The energy efficiency interservice group (ISG) discussed the IA 4 times, on 13 March, 28 March, 30 April and 13 May 2014. The lead DG is Energy. The services invited to the ISG were Agriculture and Rural Development; Budget; Communications Networks, Content and Technology; Climate Action; Competition; Economic and Financial Affairs; Employment, Social Affairs and Inclusion; Enterprise and Industry; Environment; Eurostat; Health and Consumers; Infrastructure and Logistics in Brussels; Internal Market and Services; Joint Research Centre; Mobility and Transport; Regional and Urban Policy; Research and Innovation; Secretariat-General; Taxation and Customs Union; Legal Service; and the Executive Agency for Small and Medium-sized Enterprises.

1.2. Consultation and expertise

1.2.1. Consultation

Public consultation was conducted between 3 February and 28 April 2014. Stakeholder views were sought on (i) the right approach for addressing the shortfall in progress towards the 2020 target; (ii) the design of a possible future energy efficiency target; (iii) possible additional measures to address the economic saving potentials in different sectors. 733 responses were submitted representing a broad spectrum of stakeholders.[2] The Commission's minimum consultation standards were met. The report of the public consultation is in Annex I.

The review was discussed with Member States in the Energy Efficiency Directive Committee on 14 March 2014. A high-level stakeholder conference was held on 22 May 2014. It provided useful first-hand accounts on the major issues addressed by the consultation and complemented the formal public consultation.

Those Member States that took part in the public consultation (8 Member States), have stated diverging views with two calling for a binding target and 5 being against energy

[1] http://ec.europa.eu/energy/2030_en.htm

[2] 720 replies were submitted through the IPM tool, which were taken into account statistically. Out of 720 - 37% respondents were citizens, 34% organisations, 25% companies, 3% public authorities – including 8 Member States - and 2% others.

efficiency targets, some of them suggested waiting for clearer results of the impact of the existing measures, and/or pleading for the reinforced implementation of the existing measures.
In addition to the views received to the public consultation, five additional Member states called for a binding energy efficiency target in an open letter to the Commission in view of the EED Review (dated 17 June 2014).

Box 1: Main findings of the public consultation

Many respondents argued that energy efficiency is a sound response to the prevailing energy security issue in Europe and also an effective tool for climate mitigation. It triggers innovation and creates new jobs. A number of replies indicated in particular that there is still untapped potential in manufacturing industry and that more needs to be done in buildings.

Most respondents considered that the shortfall in achieving the EU energy efficiency objective for 2020 should be addressed through targets or new policy measures. 108 respondents suggested other means of tightening the gap.

Among 312 respondents favouring targets for 2020 and/or 2030, 43% considered that these should be expressed in terms of absolute energy savings; 20% in terms of energy intensity; and 30% as a combination of the two. Respondents favouring targets argued for them at EU (218), national (205) or sectoral (110) level. 221 respondents (70%) favoured legally binding targets while 70 (22%) would prefer indicative targets.

534 respondents saw the need for additional financing instruments and mechanisms at EU level. For many, this should go hand in hand with reducing the market and non-economic barriers and raising awareness of the underlying benefits of energy efficiency.

One group of stakeholders stressed the need for the development and uptake of new technologies, while a second emphasised that the necessary solutions are already available and should be promoted through demand side policies and exchange of best practice, awareness raising and information campaigns.

1.2.2. External expertise

The IA is supported by:

- Analysis of **security of supply** through energy system modelling using the PRIMES partial equilibrium model, developed and used by the National Technical University of Athens (NTUA). The model provided projections of energy consumption and import dependency. A number of energy efficiency scenarios were modelled to analyse their impacts on import dependency;

- Analysis of **European competitiveness** on the basis of the Communication and assessment of energy prices and costs in Europe[3] and accompanying ECFIN report[4]; macroeconomic modelling using GEM-E3, a general equilibrium model, maintained and used by NTUA; and macroeconomic modelling using E3MG, a macro-econometric model run by Cambridge Econometrics. GEM-E3 and E3MG were used to assess GDP, employment and related impacts of the energy efficiency scenarios;
- Analysis of **sustainability** aspects through the PRIMES model;
- Analysis of impact on energy prices through the POLES model;
- Analysis of **potentials and progress** through:
    - Bottom-up analysis of the impact of current EU and Member State energy efficiency measures; decomposition analysis of factors contributing to changes in energy consumption in the EU; and bottom-up analysis of sectoral energy-saving potentials by Fraunhofer ISI;
    - Analysis of Member States' energy efficiency obligation schemes and alternatives under the Energy Efficiency Directive (EED)[5] by CE Delft.

1.3. Opinion of the Impact Assessment Board

The draft IA was submitted to the Impact Assessment Board (IAB) on 14 May and was discussed at the IAB hearing on 4 June 2014, following which the IAB asked for a revised submission. The board asked for clarifying the context of the initiative and the logic behind the impact assessment. This was done by including a clearer description of the link and complementarity of the Energy Efficiency Review with the relevant initiatives, notably the “2030” Communication (section 2.1).

Regarding the analysis of progress towards the 2020 target the board requested more evidence on the basis of which certain assertions are made, in particular the expected size of the gap to the target. The revised impact assessment includes up-to-date and more extensive information .

The board also requested to include an analysis, based on experience with the current framework, of the interactions between different sets of targets (EE, RES, GHG) and, more broadly, pricing/market-based instruments and other types of policies. A dedicated section has been added in section 2.

In line with the request from the board section 2 has been restructured to provide clear information on the baseline should be clarified.

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[3] COM(2014) 21 /2 and SWD(2014) 20 final/2.

[4] Energy Economic Developments in Europe, European Economy, 1/2014.

[5] Art. 7 of the EED requires Member States to establish an energy efficiency obligation scheme or alternative to achieve new savings every year from 2014–2020 of up to 1.5% of the annual final energy consumption averaged over the years 2010-2012.

The analysis of options for bridging the gap to 2020 (section 5.2) includes more details on the underlying assumptions and expected impacts.

Regarding the analysis of options for the optimal level of energy efficiency policy for 2030 the board asked to justify the logic behind modelling different levels of ambition rather than different options for achieving 25% savings by 2030, mentioned in the 2030 Communication. This is addressed in section 4 (4.2) and 5 (5.1).

Section 3 (objectives) has been restructured to make clearer links with section 2 (problem definition) and 4 (policy options) and correspond to the IA guidelines.

The board also indicated that the impact analysis of the different levels of ambition for 2030 needs to be strengthened, in particular regarding possible interactions with the EU Emission Trading Scheme (ETS). Additional information in this respect was added in section 2.2.4, 3.1 and Annex V.

Finally the board asked to explain how the option of a binding target would be translated into concrete actions and legislative acts (e.g. for the building sector, CO_2 reduction targets for cars, and on eco-design), and assess the related according costs and benefits. The scope of the review was clarified in section 4.2.

2. PROBLEM DEFINITION

2.1. Policy context

In 2007 the European Council set the target of saving 20% primary energy by 2020 (compared to 2007 projections). The Energy Efficiency Directive (EED) establishes a common framework of measures for the promotion of energy efficiency to ensure the achievement of the target. It requires the Commission to assess by June 2014 whether the EU is likely to reach the target and to propose further measures if necessary[6].

Amid concerns over current events in the Ukraine on the one hand, and growing energy costs for EU consumers and businesses on the other, the European Council of 21 March 2014 invited the Commission to consider the role energy efficiency should play in:

- increasing the security of energy supply to the EU market; and
- hedging against energy price increases.

The Council highlighted the timely review of the EED and the development of an energy efficiency framework as elements to reach an early agreement on a new policy framework for energy and climate in the period 2020 to 2030.

The recent European Energy Security Strategy (EESS)[7] highlights moderating energy demand as *"one of the most effective tools to reduce the EU's external energy*

[6] EED Arts. 3(2), 3(3), 24(7).

[7] COM(2014) 330

dependency and exposure to price hikes". The strategy primary focus is on short-term measures that can increase the EU energy security and so it does not analyse in a detailed and quantified way the long-term relationship between increased energy efficiency and greater security of supply.

The "2030" communication lays down the broad modalities of the EU climate and energy framework for the period between 2020 and 2030, including proposals for binding targets of 40% greenhouse gas reduction and 27% share of renewable energy in final energy demand by 2030[8]. While the communication states that *"A greenhouse gas emissions reduction target of 40% would require an increased level of energy savings of approximately 25% in 2030"* it indicates that the exact ambition of future energy savings policy and measures necessary to deliver it are to be established in the review of the EED building on the analysis underpinning the 2030 framework and the targets and objectives for greenhouse gas reductions and renewable energy. It also requires the review to consider whether "*energy intensity improvements of the economy and economic sectors, or absolute energy savings or a hybrid of the two represents a better benchmark upon which to frame a 2030 objective*". The logic behind this is two-fold:

- A decision on the modalities of the energy efficiency framework beyond 2020 needs to build on the lessons learned from the current framework, including which policies had worked and what were the drivers of energy efficiency developments in recent years. The review under the EED can provide such an ex-post analysis, notably because it benefits from up-to-date information submitted by the Member States as part of reporting obligations under that directive.
- While the impact assessment accompanying the "2030" communication established that a 40% decrease of greenhouse gas emissions matched by 27% renewables and 25% energy savings represent the lowest energy system costs for achieving the 40% GHG reduction, it also indicated that savings going beyond that threshold result, for relatively limited cost (up to a point), in substantial benefits in terms of increased security of supply, health, employment and, under relevant assumptions, economic growth, while remaining consistent with the other targets. The decision on the optimal level of policy ambition in 2030 needs to find the right balance between these elements and would benefit from an analysis of a broader set of scenarios focusing on energy efficiency in the context of this broad set of impacts and taking into account current EU policy priorities..

2.2. Progress achieved and lessons learned

[8] The underlying model is the "GHG40" model analysed in the 2030 Impact Assessment. This model has total system costs (average annual 2011-2030) of 2069 bn €'10, the investment expenditures (average annual 2011-2030) are 854 bn €'10 and 1188 bn €'10 (average annual 2031-2050).

2.2.1. *Trends in energy consumption and energy efficiency*

The European Union's energy efficiency target for 2020, adopted in 2007, equates to primary energy consumption of no more than 1483 Mtoe.

Having increased from 1618 Mtoe in 2000 to 1721 Mtoe in 2006, primary energy consumption has since decreased to 1584 Mtoe in 2012. As Figure 1 shows 2006 marked a turning in decoupling economic growth from energy consumption. This was a result of increased energy efficiency. Since then this decoupling has accelerated driven both through price signals and a comprehensive set of energy efficiency policies.

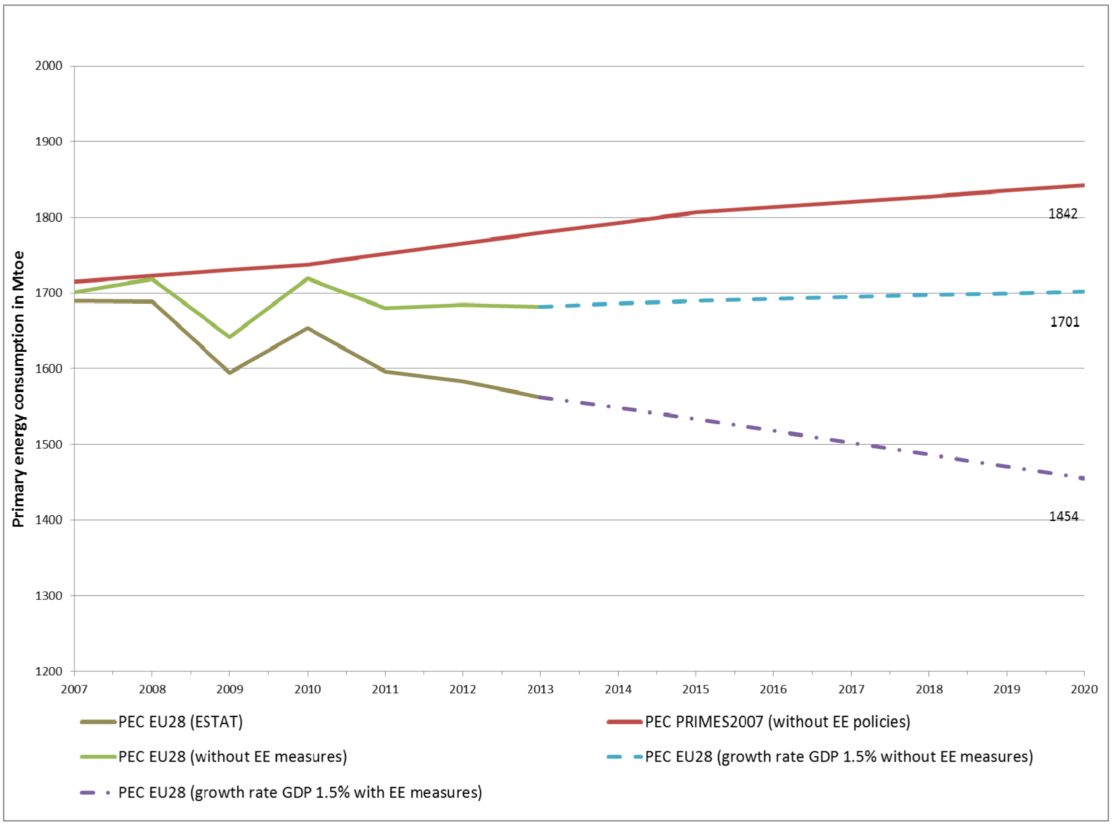
Figure 1. Evolution of energy consumption and GDP in the EU 1995-2013

Source: European Commission

While the economic crisis that began in 2008 had a significant impact on energy demand, the effect of efficiency gains (driven by prices and policies) was greater. This can be observed on Figure 2 which compares the developments in primary energy consumption under 2007 Reference projections on which the 2020 target is based (red line) with real developments projected so far, where the impact of energy efficiency (brown line) and economic drivers (green line) has been stripped out[9]. As the graph shows if current trends continue by 2020 roughly 1/3 of reduction in energy consumption compared to the 2007 Reference will stem from lower growth than anticipated, and about 2/3 from increasing energy efficiency improvements.

[9] Based on « Study evaluating the current energy efficiency policy framework in the EU and providing orientation on policy options for realising the cost-effective energy efficiency/saving potential until 2020 and beyond, Fraunhofer ISI, draft study commissioned by the Commission services

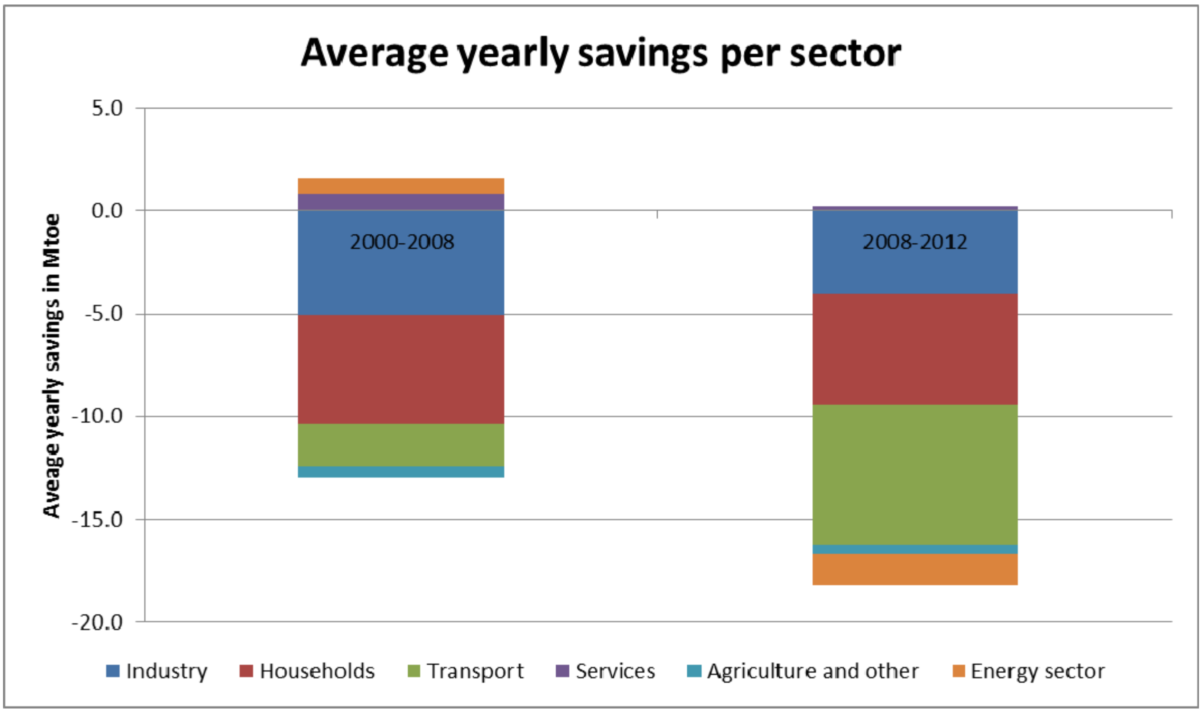
Figure 2. Comparison of primary energy evolution under 2007 Reference with registered and projected developments (including the impact of energy efficiency and economic/activity factors)



Source: European Commission, PRIMES 2014

At sectoral level as can be seen in Figure 3, the efficiency gains had the biggest impact on reducing energy demand in absolute terms in transport, followed by households and industry. The pace of energy efficiency improvements has also increased, especially in transport. Whereas the efficiency of the power and services sector deteriorated between 2000 and 2008, this trend was reversed in subsequent years.

Figure 3. Absolute reductions in primary energy consumption at sectoral level attributable to increased energy efficiency (2000-2008 and 2008-2012).



Source: European Commission, Fraunhofer (based on the decomposition analysis included in Annex III)

Progress in energy efficiency within the different sectors can be exemplified by the following elements[10]:

- Between 1995 and 2010 the average specific consumption of new cars in the EU was more than 2 litres less than in 1995 (reduction from 7.7 l/100 km to 5.6 l/100 km);
- New dwellings built today consume on average 40% less than dwellings built 20 years ago;
- The share of refrigerators meeting the highest energy efficiency labelling classes (A and above) increased from less than 5% in 1995 to more than 90% 15 years later;
- EU industry improved its energy intensity by almost 19% between 2001 and 2011, compared with 9% in the US[11].

Although it is in general difficult to single out the effect of policies from prices and other factors influencing energy efficiency, the figures and examples above allow concluding that policies work and there is a clear correlation between the roll-out of certain policies in the EU over the last years and energy efficiency trends. For example the increased savings in the transport sector as of 2008 can be to a large extent attributed to the effect of fuel-efficiency standards for passenger cars.

[10] Energy efficiency trends in the EU, Odyssee-Mure, 2013
[11] European Commission, « Energy Economic Developments in Europe », European Economy(1) 2014

At the same time without lower economic growth than expected the target would probably not be met. The 85 policy measures included in the 2006 Energy Efficiency Action Plan[12] when the target was proposed were expected to bring 14% savings by 2020. In 2011 the Commission estimated that the EU was on track to reach only 11% of savings and hence proposed the Energy Efficiency Directive which was supposed to bridge the gap to the 2020 target. The directive as adopted by the European Parliament and the Council was however weakened by about 25% compared to the original Commission proposal. Hence it can be concluded that the EU and Member States equipped themselves with the policy tools matching the 2020 target, but only with the lower economic growth taken into account.

2.2.2. Policy developments

The EU policy framework (including an indicative EU target and concrete measures in the fields of buildings, appliances, power generation, transport and industry) seems to have served as an effective framework to support this progress in energy efficiency, while needing to be accompanied by appropriate action in the fields of financing and of policy implementation.

The energy efficiency policy framework has been developed significantly in the last years. The EU target has been clearly defined, providing political momentum, guidance for investors and a benchmark to measure progress. In the areas of buildings and products, including cars, progressive rules have been established although their implementation and enforcement remains an issue in some cases. Despite the economic crisis investment in energy efficiency is growing although it remains below the thresholds necessary to realise the cost-effective efficiency potential of the EU economy (see section 2.2.5). Experience from funding energy efficiency indicates that what is needed is a robust framework enabling better understanding, knowledge, transparency, performance measurement and de-risking at the EU level, accompanied by tailored Financial Instruments at the appropriate level, which will often be closer to final beneficiaries.

At European level, the most effective policy so far have been product efficient standards including ecodesign and energy labelling of products and the cars and CO_2 legislation. The Energy Performance of Buildings Directive and the Energy Efficiency Directive of 2012 have the potential to drive energy efficiency in the EU provided they are properly implemented by Member States. The long-term potential of the EED is however limited as some of the key provisions stop applying in 2020.

Between 2008 and 2012, primary energy consumption fell in all Member States except Austria, Estonia, Latvia, Lithuania, Luxembourg and Poland. Changes in the level of economic activity played a big part in this, as did changes in the electricity generation mix and changes in industrial structure. In certain countries – especially in Bulgaria,

12 COM(2006)545.

Croatia, Latvia, Lithuania and Romania – the effect of these factors was countered by changes in the level of consumption (e.g. increasing average size of dwellings). When the effects of these factors and of climatic variation are stripped out, the Member States that made the greatest improvements in final energy consumption per unit of energy service were Bulgaria, Denmark, Greece, Hungary and Slovakia. Details are in Annex III.

At national level, Member States report success with different policy measures. Examples include taxation (e.g. Sweden), voluntary agreements with industry (e.g. Netherlands, Finland), credit for building owners (e.g. Estonia, Germany). Energy efficiency obligations for utilities have been an effective tool in the five Member States – UK, Denmark, Italy, France and Belgium - that have had them in place for some time. The up-to-date information submitted by Member States in their 2014 National Energy Efficiency Action Plans indicates further strengthening of national policies, including new measures to implement the Energy Efficiency Directive, in many Member States. Energy efficiency obligations for utilities to implement energy-saving measures among their customers, involving actors that have the most direct link to energy consumers and who previously had little or no incentive to limit energy demand, have changed the business model of energy providers and created a stable source of financing for energy efficiency. Following the adoption of the Energy Efficiency Directive the number of Member States applying such schemes is expected to go from five to sixteen. Other countries will strengthen existing schemes: for example in France savings required the ambition level of the current utility obligations scheme will be doubled from 2015. Several Member States' new national building renovation strategies indicate that they are linking a better knowledge of their building stocks with policies to stimulate cost-effective deep renovation of buildings and with suitable financial support[13]. The draft Operational Programmes beginning to be submitted under the European Structural and Investment Funds indicate an increase in sums allocated for the low–carbon economy (in some cases significantly above the minimum requirements for this objective). Financing mechanisms are being diversified, with less focus on grants and greater use of financial instruments (leveraging private capital), such as soft loans or guarantees.

While the overall trend both in terms of energy consumption and efficiency and in terms of the policy framework that aims to foster it is positive, implementation of EU rules is often incomplete and delayed (details are provided in section 2.4).

More details on EU and national policy developments are given in Annex II.

2.2.3. Projections of progress towards the 2020 target

The latest projections using PRIMES are for primary energy consumption of 1539 Mtoe in 2020 - savings of 16.8%. These projections serve as the baseline for this impact

[13] This includes support from the European Structural and Investment Funds 2014-2020, Horizon 2020, energy efficiency obligation schemes and funds coming from ETS revenues.

assessment. These projections are based on the PRIMES Reference Scenario 2013 "EU Energy, Transport and GHG Emissions – Trends to 2050"[14] ("Reference 2013"), which was also used in the Impact Assessment of the 2030 framework. A reference scenario follows the logic of including only policy measures which have been adopted until a certain cut-off date, without including new policies not yet officially adopted. In the Reference 2013 scenario, the cut-off date was spring 2012 (the EED was therefore included, with strongly conservative assumptions as to its implementation).

In order to have as accurate as possible a review of the effects of possible new energy efficiency measures and their overall level of ambition, it was necessary to update this Reference Scenario 2013 with regard to recently adopted and proposed policies especially with regard to legislation influencing energy consumption. The update of the Reference Scenario 2013 is called the Reference Plus Scenario ("Reference+") and features the policies that were adopted between spring 2012 and January 2014. A detailed description of both scenarios is included in Annex V. The Reference+ scenario projects energy savings in 2020 at 17.0%.

However, the energy consumption estimates referred to in the previous paragraphs are likely to be too high for two reasons:

1. Member States' latest reports on their national targets and planned measures under the EED suggest that these will deliver significantly more savings in 2020 than assumed in PRIMES[15]. While the national targets notified in 2013 summed up to 17% savings, the latest notifications (submitted at the end of April 2014 therefore already after the cut-off date of new measures included even in the updated baseline) give a more positive picture: 6 Member States are expecting that savings resulting from the measures included in the latest National Energy Efficiency Action Plans will lead to lower energy consumption than the respective national targets. In the case of 3 among them this difference exceeds 10%. If these elements are taken into account the latest notified national targets and accompanying national measures sum up to 18%. PRIMES also made certain conservative assumptions regarding the implementation of relevant legislative provisions. In PRIMES it is assumed that Article 7 obligations will not be fully achieved in any Member State to take into account uncertainties regarding the implementation of this article. In fact it is assumed that the whole EED will lead to a reduction in annual final energy consumption of 39 Mtoe in 2020. By contrast, the targets notified by Member States for the implementation of Article 7 of the Directive alone sum, if fully achieved, to savings of 59 Mtoe in 2020.

2. The EU economy has recently on aggregate performed less well than assumed in PRIMES Reference scenario – so that at the end of 2013, GDP was 3% lower

[14] http://ec.europa.eu/energy/observatory/trends_2030/doc/trends_to_2050_update_2013.pdf
[15] National Energy Efficiency Action Plans submitted in accordance with Article 24(2) of the EED (deadline 30 April 2014): http://ec.europa.eu/energy/efficiency/eed/neep_en.htm.

than assumed. Unless growth accelerates rapidly to make up this shortfall, this will translate into additional energy savings in 2020. Sensitivities accounting for high and low economic growth performed on the PRIMES Reference showed the following impacts:

Table 1. Sensitivies on GDP growth rate for the PRIMES 2013 Reference scenario and according impact on energy consumption.

Growth rate (av. annual 2010-2030)	Savings achieved in 2020 (compared with 2007 Reference)
1.2% (low)	18%
1.5% (normal)	17%
1.9% (high)	15.5%

Source: PRIMES

According to the latest economic forecasts[16], average GDP growth between 2010 and 2015 will be 1%. If the shortfall in economic growth up to 2014 is not made up later in the decade, energy consumption will probably be lowered by 0.5-1%.

It is therefore expected that on current trends, the EU will achieve primary energy savings in 2020 in the range of **18-19%**, corresponding to a gap of 20-40 Mtoe relative to the 20% target. This conclusion rests on the assumption that (a) current economic trends will not significantly change in the coming years; and, more importantly, that (b) the energy efficiency plans recently notified by Member States will be realised with reasonable effectiveness. It is important to note that taking into account these notifications does not imply an assumption of full implementation of the current policy framework as important delays and gaps in this implementation as described in Section 2.4 remain and, if not rectified, will lower the chance of meeting the 2020 energy efficiency target.

2.2.4. Interactions with other elements of the present energy and climate framework

In line with the Impact Assessment accompanying the "2030" communication the following interactions between policies aimed at increasing energy efficiency, fostering the development of renewables and abating GHG emissions can be identified:

- As indicated in the Impact Assessment accompanying the 2030 communication the 2020 energy efficiency target has been instrumental in ensuring progress in improving energy efficiency of the EU economy as well as in progressing towards meeting the GHG target. A quantified target has provided a political

[16] European Economic Forecast spring 2014 DG ECFIN, European Commission.

momentum and guidance for investors. The energy efficiency targets gave a clear mandate for the Commission to come up with specific efficiency measures, which are necessary to correct certain market failures. This was the case for example in 2011 when the Commission proposed the EED because the EU was not on track to meet the target.

- Specific measures promoting energy efficiency and renewables can in some cases lead to higher costs of GHG abatement than the marginal cost of abatement required to reach the cap in the ETS sector. At the same time such measures produce additional benefits, in terms of spurring innovation or synergies with resource efficiency. Energy efficiency measures are often complementary to the ETS since they address non-price barriers such as imperfect information. In addition, energy efficiency targets have most of their effect in the non-ETS sector, where Member States have national targets under the Effort Sharing Decision[17]. EU action to support energy efficiency targets brings down the cost of national action to achieve these targets – for example through harmonised product efficiency standards (ecodesign) and common approaches to the certification of buildings' efficiency.

- By reducing electricity consumption in buildings and products, EE targets have an indirect effect on the demand for electricity, which is part of the ETS sector. Because EE targets reduce the demand for electricity, the ETS has to do "less work". As a result, the price of allowances is lower than it would otherwise be. It should however be pointed out that so far Commission assessments, including the impact assessment of the “2030” communication, have not found evidence of this in the current framework as the decrease in the prices of allowances was primarily driven by lower economic activity and other factors. In the future this might change, although the proposed Market Stability Reserve, by reducing the surplus, would counteract this effect and stabilise the level of emission allowance prices.

- The current low price of allowances is primarily due to low economic activity, and not to spill-over effects of specific energy efficiency measures.

- Policies based on price signals, such as the ETS, are less effective in certain sectors, such as residential due to the fact that consumers are not very price sensitive[18] and the potential of energy efficiency is not realised to a large extent due to barriers that cannot be addressed by price signals alone, such as split incentives between landlords and tenants.

[17] Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emission to meet the Community’s greenhouse gas emission reduction commitments up to 2030.

[18] For energy consumption in the residential sector elasticities of -0.2 are typically reported (e.g. Lavin, F., L. Dale, et al. (2011)) which means that for every 10% increase in price consumers typically reduce their consumption by 2%.

- Energy savings help to ensure progress towards higher shares of renewables, as lower energy consumption means a lower denominator in the ratio between consumption of renewables and gross final energy consumption. Reversely, non-thermal renewable energy typically has much lower transformation losses than conventional energy sources, lowering the primary energy consumption for any given final energy consumption. Higher shares of renewable energy can therefore help to make progress towards the energy savings target, as the target relates to primary energy consumption.

2.2.5. Current energy efficiency trends compared to the identified cost-effective energy-saving potentials and the EU decarbonisation goals

Looking at long-term trends, analyses have shown that current improvements in energy efficiency in the EU are below the cost-effective energy-saving potential and are not sufficient to fully contribute to the EU decarbonisation goals. A study by Fraunhofer ISI[19] concluded that significant cost-effective potentials remain in all sectors at the EU level, notably in buildings. The findings of this study are broadly in line with the analysis of the IEA[20]. According to the IEA, efficiency gains compared to current trends could increase EU GDP by 1.1% in 2035; additional investments required in end-use efficiency are $2.2 trillion over 2012-2035 compared with reduced energy expenditures of $4.9 trillion during that period.

The Impact Assessment accompanying the "2030" communication established that under current trends (the Reference 2013 Scenario) only 21% savings compared to projections would be achieved; whereas 25% savings would be needed to meet the 2030 GHG reduction objectives, with improvements above 25% having positive impacts on employment and the security of supply. The Impact Assessment also made it clear that these savings could not be driven by the EU Emission Trading Scheme alone and more policies will be needed in the non-ETS sectors post 2020[21]. The Reference 2013 Scenario shows that under the current policy setting, the energy efficiency improvements will slow down after 2020.

2.3. What is the problem?

2.3.1. General problem

The general problem is that despite policies which foster energy efficiency being already in place, certain persistent barriers to energy savings still remain and the cost-effective energy-saving potential (both short- and long-term) is not fully realised.

[19] Draft study commissioned by DG ENER for supporting the Energy Efficiency Review.
[20] World Energy Outlook 2012.
[21] These were modelled in the Scenario GHG40 through 'carbon values'.

The scale of the problem is smaller within the 2020 perspective as it is now expected that the 2020 target, identified as the cost-effective saving potential, will be missed by 1-2 percentage points only. For 2030 the mismatch between the expected efficiency trends and the underpinning policies, on the one hand, and the efforts required to reach the climate objectives or realise the cost-effective potential mentioned in section 2.2.5 is greater.

Therefore, energy efficiency does not presently and, to a greater extent, is not expected in the future to sufficiently contribute to the EU's energy policy objectives. This has the following consequences:

- In terms of **security of supply**, high energy demand increases the dependence of the EU on energy imports, notably of gas. (In 2011, energy dependency was already 54% and gas imports were at 394[22] Mtoe.) While international trade, including in commodities, is one of the foundations of the global economy and relatively small indigenous fossil fuel resources in the EU are a geological fact, the overexposure of several Member States to fossil fuel imports from single providers and dependency on single import routes create several risks, including price volatility and sudden disruptions of supply. Reliance on single providers has also negatively affected the EU internal energy market by fragmenting it. The potential savings to be made on fuel import bills could instead be invested in other areas of the EU economy – leading to economic growth and job creation.

- In terms of **affordability (for households)** and **competitiveness (for the EU economy),** the unused energy efficiency potential hampers the economy in several ways: it limits productivity and economic output; it negatively affects the trade balance of the EU; it limits employment especially in the current economic environment with significant spare capacity; it creates uncertainty on markets given their exposure to the volatility of energy prices; and it leads to a loss of budget revenue.

- High energy demand for fossil fuels makes the transition to a **low-carbon economy** more difficult and costly. Insufficient energy efficiency means that the EU will not be on track to reach its long-term climate objectives (and will also be confronted with higher costs linked to health problems). Energy efficiency measures are among the cheapest options for GHG abatement.

2.3.2. Specific problems

This general problem is underpinned by the following specific problems:

[22] Source : Eurostat

1) Despite existing policies the EU energy savings target for 2020 will not be fully met

   Significant progress has been made since the analysis carried out in 2010 that showed that the EU was far from reaching its target and needed to double its efforts on energy efficiency. Now the gap is projected to be much smaller also thanks to new policies such as the Energy Efficiency Directive, but still remains at 1-2%. In addition, as shown in section 2.2.1 it is expected that about 1/3 of the progress by 2020 will be attributable to lower growth than expected at the time of setting the target. Consequently, some of the short-term energy efficiency potential of the EU economy remains untapped and will remain so under current trends.

2) The 2020 time horizon is not sufficient to create investment security

   In the absence of a clear objective post-2020 there is no signal orienting the market to the outcomes that public policy aims to achieve. This is a particular problem given the long timeframe of investments in some sectors, especially energy generation and buildings. The viability of such investments needs to be weighed against long-term projected energy demand which can be heavily affected by energy efficiency policies. The period up to 2020 is also insufficient for the establishment of business solutions and of markets for energy efficiency and services. A long-term and coherent policy framework is needed to reduce the perceived risk amongst investors and consumers alike.

   From a policy perspective in the absence of these long-term determinants, the choice of present policy instruments risks to be driven by short term analysis.

3) Ensuring coherence of different targets and policies

   Given the key role of energy efficiency for energy security, competitiveness and GHG reductions, as well as the interactions between GHG, renewables and energy efficiency targets and policies, the future energy efficiency framework needs to be defined in a coherent way with the general 2030 framework. Otherwise there is a risk that different policy instruments within the energy and climate framework will be set up and applied in an incoherent way driving down their effectiveness, undermining the internal market and increasing the overall cost.

2.4. What are the drivers for the problem?

There is a broad body of evidence and theoretical analysis of barriers preventing consumers and investors from adopting cost-effective energy efficiency measures.

These have been categorised into economic, behavioural and organisational barriers[23] or alternatively into market and non-market failures[24].

The current policy framework addresses market, regulatory and behavioural failures in several ways. There is however evidence that this framework does not address existing barriers sufficiently. The following elements with respect to this framework can be singled out:

- **Incomplete implementation**: the principal reason why the 2020 target is expected to be missed is insufficient Member State level implementation of the existing legislative framework. Regarding the EPBD the following main issues arise: (i) there is not enough national supervision and technical capacity for checking at local and/or regional level the compliance of energy performance requirements in building energy codes; (ii) the reliability of Energy Performance Certificates is undermined by a lack of transparency of how they are established for establishing them use underlying calculations which are often not sufficiently transparent for the outcomes to be directly comparable. Regarding Ecodesign the main problem driver is insufficient market surveillance. Only 5 Member States are estimated to have an active policy in that regard and the total amount spent on it is estimated to represent some 0.05% of the value of lost energy savings[25].

- **Short-term perspective**: some of the key policy tools were designed within a 2020 timeframe and therefore do not provide long-term incentives for investing in energy efficiency. Examples include the fact that Article 7 of the EED, ceases to apply after 2020 and there is no post-2020 overall target.

- **Inadequacy:** certain existing policy tools need to be revised to address existing barriers more effectively. As an example under the Energy label the A+, A++ and A+++ labelling scales that were introduced during the previous revision of the Directive have been shown to affect consumers' motivation to buy more energy efficient products less effectively than the previous scale. This change has weakened the market transformation impact of the label.

- **Incompleteness:** Regarding financing, important barriers that hamper further uptake of energy efficiency investments in buildings continue to be in place, including a lack of awareness and expertise regarding energy efficiency financing on the part of all actors; high initial costs, relatively long pay-back

[23] Energy efficiency policy and carbon pricing, International Energy Agency, August 2011 after O'Malley et al., 2003.
[24] Ibid after Jaffe and Stavins, 1994.
[25] Evaluation of the Energy Labelling Directive and specific aspects of the Ecodesign Directive, Ecofys, 2014.

periods and (perceived) credit risk associated with energy efficiency investments; and competing priorities for final beneficiaries[26].

An overview of the current status of implementation of the relevant EU provisions is included in Annex IX.

2.5. The Union's right to act, subsidiarity and proportionality

The EU's competence in the area of energy in general and energy efficiency in particular is enshrined in the Treaty on the Functioning of the European Union, Article 194(1). In acting, the EU needs to respect the principles of subsidiarity and proportionality. Member States are at the centre of the realization of energy efficiency policy and EU intervention should be well targeted and supportive to their actions. The EU's role is in:

- Establishing a common framework which creates the basis for coherent and mutually reinforcing mechanisms while leaving in being the responsibility of Member States to set, in a transparent and comparable way, the concrete means and modalities to achieve the agreed objectives;
- Creating a platform for exchanging best practice and stimulating capacity building;
- Setting minimum requirements in areas where there is a risk of internal market distortions if Member States take individual measures;
- Using EU instruments to promote energy efficiency, e.g. through financing, and to mainstream it in other policy areas.

3. SCOPE AND OBJECTIVES

3.1. Context and scope

EU leaders have set the objective of saving 20% of the EU's energy consumption compared to projections for 2020. This target is recognised as an integral element and essential part of the EU energy policy, with its triple objectives of competitiveness, sustainability and security of supply. In March 2014 EU leaders have reiterated that the 20% energy efficiency target has to be met. As established in section 2 of this Impact Assessment this will not happen under current trends. Specific short-term options for bridging the gap to the target need therefore to be identified and analysed.

[26] 2013 financial support for energy efficiency in buildings report (http://ec.europa.eu/energy/efficiency/buildings/doc/report_financing_ee_buildings_com_2013_225_en.pdf).

The “2030” communication has set the broad framework for the energy and climate policy after 2020. It indicated that the specific level of energy savings aimed at in 2030 needs to be established, while ensuring full coherence with the GHG and RES targets. The GHG target is (40% domestic reduction wrt. 1990 levels, of which the sectors covered by the EU Emissions Trading System (ETS) would have to deliver a reduction of 43% in GHG in 2030 compared to 2005, by means of a strengthening of the EU ETS cap and an ETS market stability reserve, for which a legal proposal has been made, which makes the system more robust. Ensured by binding national targets, the non-ETS sector is expected to deliver a reduction of 30% both compared to 2005) and renewable energy target (at least 27% share of renewables in the final energy consumption). Similarly as in the case of the impact assessment underpinning the “2030” communication the aim here within the mid and long-term perspective (i.e. beyond 2020) is to: (i) focus the analysis on the desired level of a possible energy efficiency target from the perspective of the general aims of the EU energy policy and of the interaction of this target with the other elements of the energy and climate policy framework; and (ii) to propose the general direction of policy development in the energy efficiency area, without entering into the details of specific policy options, which will be underpinned by appropriate impact assessments in the future.

3.2. Objectives

In this context the objectives of the initiative are:

3.2.1. General objective

To ensure that energy efficiency contributes to the development of a competitive, sustainable and secure EU energy system.

3.2.2. Specific objectives

- To agree on the measures necessary to achieve the 20% energy efficiency target providing thus the relevant actors with information on the actions that need to be undertaken in the short term;
- To agree on the level and general direction of energy efficiency policy in the long term providing thus Member States and investors with more predictability and certainty.

3.2.3. Operational objectives

Theses general and specific objectives are to be achieved by:

- Proposing actions to bridge the gap to the 2020 target;

- Setting a level of energy efficiency policy ambition for 2030 consistent with the goals of the EU energy policy and coherent with the other headline targets of this policy framework;
- Proposing a long-term energy efficiency policy architecture, including the formulation of a possible target.

3.3. Consistency with other policies

The above objectives are in line with other EU policies. They:

- Promote economic recovery and enhance the competitiveness of EU industries in line with the Europe 2020 Strategy, contributing to the Resource Efficiency flagship initiative and the sustainability layer of Europe 2020;
- Increase security of energy supply as called for in the European Energy Security Strategy create jobs and reduce energy poverty in support of the EU's social agenda.
- Enable further reductions of GHG emissions up to 2020 and thus contribute to reaching the EU's climate objectives.
- Facilitate further commitments on GHG emission reduction after 2020.

4. POLICY OPTIONS

4.1. Options for closing the gap towards the 2020 target

The following options are considered:

1. No action.
2. New primary legislation laying down binding national targets or additional binding measures.
3. Strengthened implementation of current policies.

Option 1 is discarded from further detailed analysis as the 2020 target would not be fully achieved and the benefits associated with meeting it would not be realised.

4.2. Analysis of the optimal level of savings for 2030

Building on the 2030 Communication and its accompanying IA, six scenarios with a stepwise increase in the ambition of energy efficiency efforts (in all sectors targeted by current policy measures) were modelled and the impacts that these efforts would have on security of supply, competitiveness and sustainability were assessed both in 2030 and in 2050 perspective.

The 2030 IA also itself investigated a range of scenarios with energy efficiency policies reaching higher levels of energy savings than the Reference scenario. While the Reference scenario achieves 21% energy savings (in comparison to 2007 PRIMES baseline for 2030[27]), the scenarios presented in the 2030 IA achieve between 23 and 34% savings. The 2030 Communication states that achieving the proposed 2030 GHG (40% reduction) and RES (at least 27% share) targets cost-effectively would require 25% energy savings (which corresponds to GHG40 scenario). At the same time, the 2030 IA indicated that a higher ambition in energy efficiency would have additional benefits in terms of energy security, growth and jobs and lowered imports bill as well as on health – while incurring higher costs within the energy system.

The scenarios included in the IA underpinning the 2030 Communication modelled EE with different approaches (with reference settings or in the context of enabling conditions, with carbon values (in GHG40 scenario) or with concrete (and ambitious) EE policies (in GHG40/EE and GHG40/EE/RES30 scenarios) and the very ambitious EE policies (in GHG40/EE/RES35) scenario).

In the GHG40 scenario, the 25% cost-efficient energy savings were reached without modelling additional energy efficiency policies compared to the References scenario 2013 by 2030. However, more stringent CO2 standards for passenger cars are assumed in the GHG40 scenario after 2030, going down from 95gCO2/km to 25gCO2/km in 2050 (and also for vans – see table below). The level of 25% energy savings in 2030 is achieved in the GHG40 scenario with a) the existing EE legislation in place plus tighter CO2 standards for passenger cars after 2030 and b) with a 40% GHG target triggering energy efficiency mainly through carbon values in the non-ETS sector[28] and c) in the context of the assumption of enabling settings[29]. The GHG40 scenario does not model specific EE policies beyond the ones indicated above. In contrast, this IA proposes scenarios which achieve higher levels of energy savings with concrete EE policies. It should be noted that *by construction*, the GHG40 scenario, working with carbon values in the non-ETS sector, depicts the lowest possible cost of achieving 40% GHG savings in 2030.

In this IA, a broader range for EE ambition is explored aiming for up to 40% energy savings in 2030 with the aim of analysing energy system cost impact and broader impact in terms of security of supply, job creation and economic growth.

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[27] Here and subsequently, energy savings in 2030 are calculated relative to the energy consumption projected, in PRIMES in 2007, for that year (1874 Mtoe).
[28] See Annex V.
[29] See Impact Assessment in energy and climate policy up to 2030, SWD(2014) 16, p. 43 and 160.

In the present IA, the analysis from 2030 IA is continued in a coherent way, taking into account not only the modelling results but also the progress that Member States are making towards their national targets under the EED and taking into account studies on energy-saving potentials and responses to the public consultation. . Six energy efficiency scenarios were modelled with primary energy reductions in 2030 relative to PRIMES 2007 projection of around 27 %, 28%, 29%, 30%, 35% and 40%. Chapter 5 analyses the energy system impacts of these scenarios, their macro-economic impacts and, in addition, Annex VII shows the results of specific EE policies in their specific fields (e.g. improvement in performance of appliances, rate of renovations, energy savings in industry etc.). The scenarios are based on common assumptions regarding GDP and population growth, imported fossil fuel prices and technology costs as all of them are built on and later on compared to the Reference Scenario 2013 ("Reference") – the same as used in the 2030 IA.

The mix of energy efficiency policies assumed for the scenarios follows the logic of the current set of EE legislation including the EED, EPBD, regulations adopted under ecodesign/energy labelling . Only the overall level of ambition is intensified. In this sense, the IA is conservative – it does not analyse measures or propose new mechanisms (e.g. in EED). For transport, the policy measures put forward in the 2011 White Paper on Transport are assumed to be implemented. For industry the Best Available Technology (BAT) uptake is modelled. At this stage, it is however clear that the main effort will be concentrated on buildings/products reflecting lower GHG abatement potential in the transport sector and the fact that EE in industry is chiefly driven by costs of energy and competitiveness aspects. Different policy mixes and specific policy instruments might be necessary or desired in the future but entering into such considerations goes beyond the scope of the Energy Efficiency Review and could pre-empt future policy choices. Future policy choices will translate - into specific policy or legal proposals which will be accompanied by dedicated IA assessing costs and benefits for specific sectors or economic actors.

In the context of all energy efficiency scenarios analysed here, it is assumed that the EE legislation continues after 2020 and further intensifies in terms of saving obligations. The following policies are assumed to intensify until 2030 and then intensify only moderately beyond 2030:

- EED with annual savings obligation beyond 2020 and intensifying;
- CO2 standards for cars and light commercial vehicles (LCVs) becoming more stringent beyond 2020 and other transport policies leading to energy efficiency savings;
- EPBD with stronger requirements leading to higher and deeper (in terms of EE) renovation rates;
- Eco-design requirements excluding less performing technologies currently still present on the market and stretching to new categories of products leading to a more accelerated uptake of efficient technologies in the demand sectors enabled by lowering perceived cost parameters;
- Measures promoting increased use of CHP and district heating and cooling;

- Measures aimed at higher uptake of BAT in the industry;
- Measures limiting grid losses.

Other transport policy measures, in addition to CO2 standards for light duty vehicles, are in line with the 2011 White Paper on transport and are assumed to be included in all scenarios but their intensity is not varied between scenarios (i.e. measures leading to 1.1% improvements per year in the fuel efficiency of heavy duty vehicles (HDVs), development of infrastructure for alternative power-trains, internalisation of external costs, introduction of a CO2-related element in vehicle taxation, wide deployment of intelligent transport systems and other soft measures like fuel labelling and eco-driving).

The energy efficiency assumptions imply reduced demand for energy by end-users and also reduced demand for electricity. For each scenario the model simulates a new equilibrium in the energy market. This means that the lowered energy demand in each scenario affects, to a different extent, the electricity prices, the fuel mix, the need for new generation capacities, electricity/gas networks or other energy system components. Also the ETS is affected by the reduced demand.

The table below shows the assumptions on energy efficiency measures in the scenarios that have been modelled and for comparability reasons the assumptions of the GHG40.

Table 2. Assumptions of the GHG40 scenario and the policy scenarios assessed in this impact assessment[30 31]

GHG 40	Primary energy savings: 25.1% GHG reduction in 2030 (wrt. to 1990): 40.6% RES share in 2030: 26.5% Energy efficiency policies: ⅄ Adopted energy efficiency regulations until spring 2012 as in the Reference Scenario 2013; ⅄ no strengthening of policies before or after 2020 (except for CO2 standards for cars and vans – see below); ⅄ Carbon values drive some additional energy efficiency in comparison to the Reference. Measures reducing energy consumption in transport and driving the electrification in the long-run: CO2 standards for passenger cars of 95 gCO2/km in 2030 (25 gCO2/km in 2050) and CO2 standards for LCVs of 147

[30] See Annex V for further details on assumptions.
[31] Other transport policy measures, in addition to CO2 standards for light duty vehicles, are included in all scenarios in line with the 2011 White Paper on Transport but their intensity does not change among scenarios.

	gCO2/km in 2030 (60 gCO2/km in 2050). The scenario is set in enabling conditions.
EE28	Primary energy savings: 28.3% GHG reduction in 2030 (wrt. to 1990): 40.2% RES share in 2030: 27.7% Energy efficiency policies: - Increasing energy efficiency of houses and buildings leading to renovation rates of 1.48% in 2015-2020, 1.84% in 2021-2030 and 1.15% in 2031-3050 which will bring average energy savings after renovation of 21.93% in 2015-2020, 44.55% in 2021-2030 and 45.79% in 2031-3050; - Elimination of market failures and imperfections reflected in the reduction of discount rates from 12% in 2020 progressively to 10.2% (by 2050) in the residential sector and from 10% to 9% (by 2050) in the tertiary sector; - Increased uptake of advanced technologies (Ecodesign); - Increased uptake of BAT in industry; - Higher penetration of district heating; assuming that 11% of households will be connected to district heating networks in 2030; - Measures limiting grid losses; - Measures reducing energy consumption in transport and driving the electrification in the long-run (e.g. CO2 standard of 75 gCO2/km in 2030 (26 gCO2/km in 2050) for passenger cars and 110 gCO2/km in 2030 (60 gCO2/km in 2050) for LCVs). The scenario is set in enabling conditions.
EE29	Primary energy savings: 29.3% GHG reduction in 2030 (wrt. to 1990): 40.1% RES share in 2030: 27.7% Energy efficiency policies: - Increasing energy efficiency of houses and buildings leading to renovation rates of 1.53% in 2015-2020, 2.11% in 2021-2030 and 1.22% in 2031-3050 which will bring average energy savings after renovation of 22.04% in 2015-2020, 45.04% in 2021-2030 and 47.55% in 2031-3050; - Elimination of market failures and imperfections reflected in the reduction of discount rates from 12% in 2020 progressively to 10.2% (by 2050) in the residential sector and from 10% to 9% (by 2050) in the tertiary sector; - Increased uptake of advanced technologies (Ecodesign);

	- Increased uptake of BAT in industry; - Higher penetration of district heating; assuming that 11% of households will be connected to district heating networks in 2030; - Measures limiting grid losses; - Measures reducing energy consumption in transport and driving the electrification in the long-run (e.g. CO2 standard of 74 gCO2/km in 2030 (26 gCO2/km in 2050) for passenger cars and 110 gCO2/km in 2030 (60 gCO2/km in 2050) for LCVs). The scenario is set in enabling conditions.
EE30	Primary energy savings: 30.7% GHG reduction in 2030 (wrt. to 1990): 40.1% RES share in 2030: 27.7% Energy efficiency policies: - Increasing energy efficiency of houses and buildings leading to renovation rates of 1.61% in 2015-2020, 2.21% in 2021-2030 and 1.26% in 2031-3050 which will bring average energy savings after renovation of 22.08% in 2015-2020, 45.82% in 2021-2030 and 48.48% in 2031-3050; - Elimination of market failures and imperfections reflected in the reduction of discount rates from 12% in 2020 progressively to 9% (by 2050) in the residential sector and from 10% to 8.5% (by 2050) in the tertiary sector; - Increased uptake of advanced technologies (Ecodesign); - Increased uptake of BAT in industry; - Higher penetration of district heating; assuming that 12% of households will be connected to district heating networks in 2030; - Measures limiting grid losses; - Measures reducing energy consumption in transport and driving the electrification in the long-run (e.g. CO2 standard of 72 gCO2/km in 2030 (25 gCO2/km in 2050) for passenger cars and 110 gCO2/km in 2030 (60 gCO2/km in 2050) for LCVs). The scenario is set in enabling conditions.
EE35	Primary energy savings: 35.0% GHG reduction in 2030 (wrt. to 1990): 41.1% RES share in 2030: 27.4% Energy efficiency policies: - Increasing energy efficiency of houses and buildings leading to renovation rates of 1.64% in 2015-2020, 2.39% in 2021-2030 and 1.32% in 2031-3050 which will bring average energy savings after renovation of 22.10% in 2015-2020, 46.19% in 2021-2030 and 48.84%

	in 2031-3050; - Elimination of market failures and imperfections reflected in the reduction of discount rates from 12% in 2020 progressively to 9% (by 2050) in the residential sector and from 10% to 8.5% (by 2050) in the tertiary sector; - Increased uptake of advanced technologies (Ecodesign); - Increased uptake of BAT in industry; - Higher penetration of district heating; assuming that 14% of households will be connected to district heating networks in 2030; - Measures limiting grid losses; - Measures reducing energy consumption in transport and driving the electrification in the long-run (e.g. CO2 standard of 70 gCO2/km in 2030 (17 gCO2/km in 2050) for passenger cars and 110 gCO2/km in 2030 (60 gCO2/km in 2050) for LCVs). The scenario is set in enabling conditions.
EE40	Primary energy savings: 39.8% GHG reduction in 2030 (wrt. to 1990): 43.9 % RES share in 2030: 27.4 % Energy efficiency policies: - Increasing energy efficiency of houses and buildings leading to renovation rates of 1.65% in 2015-2020, 2.42% in 2021-2030 and 1.33% in 2031-3050 which will bring average energy savings after renovation of 22.11% in 2015-2020, 46.18% in 2021-2030 and 48.85% in 2031-3050; - Elimination of market failures and imperfections reflected in the reduction of discount rates from 12% in 2020 progressively to 9% (by 2050) in the residential sector and from 10% to 8.5% (by 2050) in the tertiary sector; - Increased uptake of advanced technologies (Ecodesign); - Increased uptake of BAT in industry; - Higher penetration of district heating; assuming that 14% of households will be connected to district heating networks in 2030; - Measures limiting grid losses; - Measures reducing energy consumption in transport and driving the electrification in the long-run (e.g. CO2 standard of 70 gCO2/km in 2030 (17 gCO2/km in 2050) for passenger cars and 110 gCO2/km in 2030 (60 gCO2/km in 2050) for LCVs). The scenario is set in enabling conditions.

Source: European Commission, PRIMES2014

This IA does not aim at assessing in detail specific policy measures within a 2030 perspective. Neither does it compare the impact of typical policy alternatives (regulation, voluntary agreements, financing, training and awareness) as it is likely that they would all play a role within the long timeframe considered. Rather, the IA aims at identifying the optimum strategic direction, to be complemented by specific IAs in the future.

4.3. Options for the architecture of the energy efficiency framework post-2020

The current, **2020** framework is based on:

- an indicative EU target underpinned by indicative national targets;
- EU legislation for products traded in the internal market;
- EU legislation coupled with administrative support in other areas, such as buildings and combined heat and power, providing general overall provisions while leaving flexibility for the national and local level to implement them in an appropriate way;
- national and local provisions not linked to common EU rules
- financing through European, national and local sources.

This design provides a mutually-reinforcing set of instruments. At the same time it is the result of an 'organic' evolution of policies and has not so far been thoroughly compared with alternatives. This analysis with its long-term perspective allows such a comparison.

The following options for the architecture of the framework for **2030** are identified:

I. No action. This implies that post 2020, any EU target would be abandoned and efforts at European level would be based solely on specific instruments.

II. Indicative EU target, coupled with specific EU measures. This would be a continuation of the current framework.

III. Binding EU target, coupled with specific EU measures. This would replicate the approach proposed by the Commission in the 2030 Communication for RES.

IV. Binding MS targets, coupled with EU polices solely in areas linked to the internal market.

In addition, irrespective of the character and level of a possible target, it needs to be considered how it could be formulated. The following options for target formulation are identified:

- Consumption target
- Intensity target
- Hybrid approach

5. ANALYSIS OF IMPACTS

5.1. Methodology

This IA follows and is fully consistent with the 2030 Communication and its accompanying IA.

The 2030 Communication proposes two binding targets for 2030: 40% GHG emissions reductions and at least 27% share of renewable energy in final energy consumption. These targets were taken as constraints[32] in modelling of policy scenarios presented in this IA.

The policy scenarios of the 2030 Communication build upon the Reference scenario 2013 which takes into account climate and energy policies adopted up to June 2012. For comparability reasons, the policy scenarios of this IA build on the same Reference 2013.

Given the requirement for the EED review to assess whether or not the EU is on track for its 2020 energy saving objective, it was necessary to update the Reference scenario with recently adopted policies. This is why so–called "Reference+" scenario was also developed taking into account policies adopted (and some important polices proposed by the Commission) up to January 2014. The Reference+ scenario is described in Annex V and assessment of achievement of 2020 target is presented in chapter 2.2.3.It should be noted that this exercise has shown that the differences of the policy scenario including recently adopted policies are minimal to the one without these policies. This is due to the fact that the additional measures (e.g. eco-design measures which were adopted in the last 2 years) are part of the EE policy mix of the policy scenarios in any case which are intensified between the different scenarios to achieve a higher EE level.

The internal logic of scenarios and the key assumptions have not been changed from 2030 modelling exercise (see Table 3 below). The starting point of the present analysis is the GHG40 scenario, whose results are shown in all summary tables for more convenient reference. The policy scenarios presented in this IA are, however, not fully comparable with the GHG40 scenario as they use concrete energy efficiency policies rather than carbon values in the non-ETS sector. All policy scenarios analysed in this IA are in fact similar in structure to the GHG40/EE scenario in the 2030 IA, which featured

[32] In modelling it is difficult to achieve precisely a set constraint of GHG emissions and RES because of various complex constraints and interactions For example the GHG40 scenario used for the 2030 communication itself achieves GHG savings of 40.6%. The modelling exercise underpinning this IA clearly illustrated that greenhouse gas emissions fall as energy efficiency policy are intensified. This is why the EE40 scenario overshoots in 2030 the 40% GHG reduction target proposed by the Commission. As an EE target of 40% in 2030 was proposed by the European Parliament, this scenario is nonetheless presented in this IA even if the GHG constraint is not fulfilled to analyse the full range of EE levels proposed in the current political discussion.

concrete EE policies. Finally, while the overall energy savings in 2030 amounted to 25% (for GHG40) and 29% (for GHG40/EE), the range of ambition is broader in the policy options analysed here.

Six scenarios were thus quantified, assuming a stepwise increase in the intensity of energy efficiency efforts after 2020 in sectors targeted by current policy measures. The energy saving (calculated against the 2007 PRIMES baseline projections for 2030) achieved by the scenarios is the key metric, which, because of its importance, is used for labelling of scenarios. The scenarios achieve respectively energy savings in 2030 of around 27%, 28%, 29%, 30%, 35% and 40%. Later on they are referred to as EE27, EE28, EE29, EE30, EE35 and EE40 scenarios. As explained in chapter 4, the mix of energy efficiency policies is not altered among the scenarios (it always follows the logic of current legislation) and only the overall level of ambition intensifies. The specific policies are defined in a general manner and the precise assessment of their impacts would have to be done on case-by-case basis and will likely be done alongside specific legislative or other initiatives of the Commission that will follow this proposal.

Table 3: Methodological approach for modelling– consistency with 2030 communication

	2030 Communication	2014 EED review	Notes
Reference scenario	Climate and energy policies adopted up to June 2012	As "2030" For the purpose of assessment of achieving the 2020 target, Reference+ scenario was elaborated (as "2030", plus policies adopted up to January 2014)[33]	For the Reference+ modelling results suggest that the 13 ecodesign/ energy labelling regulations adopted since June 2012 have no impact.[34]
GDP growth	2010-20: 1.5% p.a. 2020-30: 1.6% p.a.	As "2030"	
Fossil fuel prices (€'10/boe, 2020/30)	Oil 89/93; gas 62/65; coal 23/24	As "2030"	
Energy technology progress	Decreasing costs and increasing performances for specific technologies	As "2030"	
Structure of EU28 economy	Increasing share of services in the gross value added of the economy	As "2030"	
Population growth	2010-20: 0.3% p.a; 2020-30: 0.2% p.a.	As "2030"	
Degree days	Kept constant at 2005 level	As "2030"	
Policy scenarios: GHG emissions	-40%	As "2030"	Most high-saving scenario: overshooting allowed
Policy scenarios: share	at least 27%	As "2030"	

[33] F-Gas regulation; new transport measures (alternative fuels infrastructure, better quality and more choice in railway services, improvements in fuel efficiency of lorries, speeding up the reform of Europe's air traffic control system); new ecodesign and energy labelling regulations; updated depiction of 2012 Energy Efficiency Directive, reflecting reporting by Member States.

[34] In PRIMES efficiency and technology improvements are driven not only from specific policies but also from economic drivers and market forces. Ecodesign and energy labelling policies were already modelled in the Reference 2013 scenario. This means that in the technology menu more advanced technologies which can be selected in a scenario were included. In this case, the uptake of efficient technologies - if economically justified - is occurring de facto, even in absence of a specific policy and even if not prescribed by specific policy such as eco-design. In this respect, the Reference 2013 scenario projected already significant changes in regard to energy efficiency, technology progress (in the menu of available technologies for choice) and in effective choice of technologies. Therefore, the inclusion of recently adopted ecodesign and labelling policies in the policy scenarios did not show any significant changes in energy consumption.

of renewable energy			
Representation of active public policy in energy efficiency and other sectors	"Carbon values"[35], and, post-2030, "enabling settings"[36]. In addition, tighter CO2 standards for cars after 2030. The 2030 IA also included some scenarios with modelling of additional energy efficiency measures[37].	As "2030"	Carbon values and enabling settings in the case of energy efficiency, replaced by energy efficiency measures[38] .
Discount rates used to depict decision-making by economic actors	8-17.5%; some energy efficiency measures can lower discount rates	As "2030"[39]	
System costs	Calculated using standard (un-lowered) private discount rates[40]	As "2030"	

[35] Mirroring ETS prices in the non-ETS sector – representing still undefined policies that will drive GHG reduction.

[36] Assumption of perfect market coordination and consumer confidence driven by firm commitment to decarbonisation, leading to lower system costs and faster uptake of EE, RES and emission reduction technologies.

[37] Savings obligations for utilities; energy management systems; ESCOs; energy labelling; CHP and district heating/cooling; efficiency in grids; ecodesign; take-up in industry of best available techniques; internalisation of local externalities in transport; CO_2-related element in vehicle registration and circulation taxes; revised Energy Taxation Directive; ITS for road and waterborne transport; ecodriving; tighter CO_2 standards for cars and vans; efficiency improvements for heavy duty vehicles.

[38] As described in the footnote above.

[39] In the 2030 impact assessment, the scenarios with ambitious energy efficiency policies made the assumption of a wide deployment of energy performance contracting and strong penetration of ESCOs, which is mirrored by a further reduction of discount rates for households from Reference scenario conditions – see assumptions on discount rates in Annex V.

[40] Households, private cars 17.5%; industry, tertiary, trucks, inland navigation 12%; power generation 9%; public transport 8%.

5.2. Policy options for 2020

On present trends, EU primary energy savings are likely to achieve 18-19% in 2020, a shortfall compared to the target of approximately **20-40 Mtoe** (Chapter 2). Chapter 4 identified two options to address the gap:

- New primary legislation laying down binding national targets or additional binding measures
- Strengthened implementation of existing legislation

Based on the precedents of the EED and the Energy Performance of Buildings Directive (EPBD), **new primary legislation –** whether binding measures or binding targets **–** would be unlikely, even on an optimistic timetable, to enter into force before 2018.[41] The EU would then need to reduce energy consumption, compared to what it would otherwise have been, by an additional 12 Mtoe in each of the next three years, nearly doubling the rate projected in the modelling. It is unlikely that this could be achieved at such short notice.

The PRIMES modelling in question assumes a level of **implementation** of the requirements of the EED, EPBD and regulations adopted under ecodesign/energy labelling that falls well short of full compliance.

Regarding the EED, PRIMES assumes that it will lead to a reduction in annual final energy consumption of 39 Mtoe in 2020. By contrast, the targets notified by Member States for the implementation of Article 7 of the EED alone sum, if fully achieved, to savings of 59 Mtoe in 2020, whereas the potential impact of the EED - if fully implemented - calculated at the time when it was adopted was estimated to be above 100 Mtoe. In this impact assessment under a conservative approach, it is concluded on the basis of these numbers that another 20 Mtoe could be saved through proper implementation.

Regarding the EPBD, the impact assessment[42] of that directive estimated its impact to be in the range of 60 Mtoe savings by 2030. A study by Fraunhofer ISI[43] concluded that this potential will not be fully realised, unless it is properly implemented, and that proper implementation which could bring an additional 15 Mtoe savings. The key elements that need to be strengthened are the reliability of energy performance certificates, the effectiveness of certification frameworks in all Member States, and better checks of the compliance of new and renovated buildings with the relevant provisions in building codes.

[41] Proposal by Commission: January 2015. Adoption by co-legislators: July 2016. Transposition: January 2018.
[42] SEC/2008/2865.
[43] Draft study commissioned by DG ENER for supporting the Energy Efficiency Review.

Regarding Ecodesign and Energy Labelling the combined impact of the 40 or so measures adopted so far, based on engineering-type calculations, is 80 Mtoe. When overlaps and rebound are taken into account it can be conservatively estimated that at least half of these savings will materialise in practice. It is estimated that approximately 10% of the savings could be lost due to poor compliance[44]. This corresponds to additional 4 Mtoe could be saved through stronger enforcement.

This analysis suggests that the approach with the best potential to close the remaining gap to 2020 is strengthened implementation of existing legislation. This conclusion is corroborated by the study by Fraunhofer ISI which collated the expected impact of more than 500 national energy efficiency measures: according to that study assuming that these measures will be implemented as planned and correcting for double-counting the 2020 target could be fully reached[45]. The list of the analysed national measures and their expected impact is included in Annex VIII.

Strengthened implementation could be achieved through:

- Full implementation of EU legislation at national level, with effective monitoring;
- Reinforced resourcing of market surveillance and better cooperation among national market surveillance authorities;
- Strengthening energy performance certificates under the EPBD through benchmarking of the effectiveness of certification frameworks in all Member States, assisting Member States in compliance checks and linking national schemes to reliable EN standards;
- Making wider use of innovative financing in the form of standardised investment products to support energy efficiency financing products;
- Databases on product and building energy performance and indicators for measuring progress.

Accelerating secondary legislation in the products sector could play a supporting role providing additional savings over and above those stemming from improved implementation. Preparatory work is under way for seven new product groups, including windows, servers and data centres, steam boilers and water-related products. Accelerated implementation (in collaboration with stakeholders, Member States and the European Parliament) could bring this legislation into force a year earlier – with adoption dates in 2015/16 rather than 2016/17. It is estimated that this acceleration would increase primary energy savings by a further 5 Mtoe.

Accelerating secondary legislation in the products sector would help achieving the target but is not a condition for achieving it since strengthened implementation of existing rules would be sufficient for that purpose. In order to bridge the gap Member States would not be expected to implement requirements over and above those

[44] Monitoring, Verification and Enforcement Capabilities and Practices for the Implementation of the Ecodesign and Labelling Directives in EU Member States, CLASP, 2011.
[45] Draft study commissioned by DG ENER for supporting the Energy Efficiency Review, section 2.

stemming from existing EU legislation, the cost of which has been already assessed when this legislation was proposed. For example in the case of the EPBD the impact assessments of the proposal estimated that the abolishing the 1000 m^2 threshold at which buildings had to meet minimum efficiency standards when undergoing major renovation would lead to €8 billion/year additional capital costs but would trigger €25 billion/year energy cost savings by 2020 and therefore create negative CO_2 abatement costs. Key conclusions from the impact assessments of the EPBD and of the EED are included in Annex X.

5.3. Ambition level 2030

5.3.1. Energy system impacts

The main results of PRIMES modelling estimate the impacts of EE on the energy system. All results for the different policy scenarios are compared with the Reference 2013 scenario (later "Reference"). If it were assumed that the European 2020 target on energy efficiency would be fully met (in the light of discussion in chapters above), the baseline scenario would need to be adjusted, also beyond 2020 and the comparisons would be different. As in this IA a conservative approach is taken, the Reference was not adjusted in this manner.

These impacts vary for different levels of ambition of EE as portrayed by the scenarios analysed in this IA. The energy saving (calculated against the 2007 PRIMES baseline projections for 2030) achieved by the scenarios is the key metric, which, because of its importance, is used for labelling of scenarios. The scenarios achieve respectively energy savings in 2030 of 27.4%, 28.3%, 29.3%, 30.7%, 35.0% and 39.8%. Later they are referred to as EE27, EE28, EE29, EE30, EE35 and EE40 scenarios.

For all scenarios presented in this IA, GHG40 scenario from the 2030 IA is the starting point. With an overall increasing energy efficiency ambition, the scenarios become more costly. Still they present additional benefits (notably in security of supply – see below) which should be weighed against the incremental cost increase.

Measured as an absolute value, **primary energy consumption**[46] is clearly reduced in all scenarios analysed (8 to 24% in 2030 and 13 to 32% in 2050 in comparison to the Reference scenario) despite the steady growth of the EU GDP that is assumed[47]. The reductions are higher for all new scenarios than for the GHG40 scenario as the concrete EE policies have more impact than the carbon values assumed in the GHG40. It should be also noted that some reduction in primary energy consumption is due to the RES target of (at least) 27% present in all new scenarios - thanks to high statistical efficiency of RES in electricity production. This was also the case in GHG40.

[46] Gross Inland Consumption minus non-energy uses.

[47] The GDP growth projections are established by DG ECFIN and they are on avg. 1.6% p.a. over the period 2015-2030 and avg. 1.4% p.a. over the period 2030-2050).

As a result of reduced gross inland energy consumption, the **energy intensity of the EU economy** is reduced under all scenarios. The higher the energy savings, the lower the energy intensity of the EU economy gets. Among the sectors, lowering of the energy intensity is most visible in the residential and tertiary sectors reflecting the fact that the policies proposed for the policy mix in all scenarios affect mostly these two sectors.

The policy scenarios demonstrate also significant differences in terms of **the consumption of various primary energy sources**. **Table 4** below shows both the changes in the relative shares of fuels, as well as the changes in absolute consumption compared to Reference. It has to be borne in mind that all the scenarios achieve decreases in total energy consumption impacting the relative fuel shares.

- As regards **solid fuels** (notably coal), already in 2030 their consumption in absolute terms declines substantially under all scenarios except EE35 scenario (between 16 and 8% in comparison to the Reference). The EE35 has a high ambition of EE measures and consequently a rather low ETS prices are necessary to achieve the 40% GHG reduction allowing maintaining the same consumption of solids as in the Reference scenario (only 0.7% reduction compared to the Reference). In longer term, only EE30, EE35 and EE40 achieve a reduction of solids consumption (in comparison to Reference).

  The share of solids in the fuel mix in 2030 remains largely stable (in comparison to Reference) for EE27, EE28 and EE29 while it grows slightly for all other scenarios.

- For **oil**, the reduction of consumption in absolute terms is higher the more the energy savings and becomes more substantial with time (in 2030 between 7 to 14% and in 2050 between 59-63% in comparison to the Reference) – closely linked with CO_2 standards for light duty vehicles becoming more stringent.

  The share of oil in the fuel mix 2030 remains very stable (in comparison to Reference) in EE27, EE28, EE29 and EE30 scenarios at 32-33%, while it grows slightly in EE35 and EE40 scenarios.

- For **natural gas,** the reduction of consumption in absolute terms is the most pronounced among all the fuels. The reduction is higher the more the energy savings and becomes more substantial with time (in 2030 between 16 to 42% and in 2050 between 30-50% in comparison to the Reference) – closely linked to policies improving the thermal integrity of buildings.

  The shares of natural gas decline slightly as the scenarios get more ambitious. In 2030, they go from 25% for Reference to 23% for EE27 and to 19% for EE40.

- The consumption of **nuclear** in absolute terms decreases in 2030 in all scenarios in comparison to the Reference but in 2050 perspective it grows strongly for EE27, EE28 and EE29 scenarios, slightly for EE30 scenario and declines in

EE35 and EE40. The strong EE makes the nuclear less necessary for the achievement of decarbonisation.

The shares of nuclear in 2030 remain very stable (in comparison to Reference) in all scenarios at between 11-13%.

- Finally, the absolute consumption of **renewables** grows in 2030 for EE27, EE28 and EE29 scenarios (in comparison to Reference) but declines in the scenarios with more energy savings, where by the sheer reduction of energy consumption there is less need for the development of RES in absolute consumption. The main driver of renewables is the RES target which is around 27% for all scenarios. In longer perspective, the consumption of RES grows very strong for all scenarios driven by the decarbonisation and facilitated by enabling conditions. It should be noted that increased share of RES strengthens the effects of EE through increased statistical efficiency in power generation.

  The shares of renewables in 2030 are slightly higher (than in Reference) in all scenarios at: between 22-23%.

The changes described above will have some effects on the power generation capacity (growing for RES and declining for other fuels) as well as the necessary investments.

The **share of renewables in final energy consumption** as specified by the RES target present in all scenarios can be translated into specific shares in electricity, heating & cooling and transport. The scenarios analysed in this IA show very little variation for the shares in these specific sectors.

Table 4. Impacts on gross inland energy consumption in 2030 and 2050

Indicator *(figures are presented in a 2030/2050 format)*	**Ref**	**GHG40**	**Decarbonisation Scenarios**					
			EE27	**EE28**	**EE29**	**EE30**	**EE35**	**EE40**
Gross Inland Energy Consumption (Mtoe)	1611 / 1630	1534 / 1393	1488 / 1423	1470 / 1380	1450 / 1338	1422 / 1286	1337 / 1196	1243 / 1129
Primary Energy Consumption (Mtoe)[48]	1490 / 1510	1413 / 1294	1369 / 1319	1352 / 1281	1333 / 1239	1307 / 1188	1227 / 1098	1135 / 1031
Energy Savings % in 2030[49]	21.0	25.1	27.4	28.3	29.3	30.7	35.0	39.8
Energy Intensity (2010 = 100) (*primary energy to GDP)*	67 / 52	64 / 44	62 / 45	61 / 44	61 / 42	59 / 41	56 / 38	52 / 36
- Industry[50]	81 / 68	78 / 55	74 / 50	74 / 48	73 / 48	72 / 48	68 / 48	68 / 48
- Residential[51]	72 / 54	67 / 40	65 / 44	63 / 41	61 / 38	58 / 35	52 / 29	43 / 24
- Tertiary[52]	65 / 49	59 / 34	58 / 42	55 / 40	52 / 37	50 / 34	43 / 29	33 / 24
- Transport[53]	71 / 56	70 / 44	68 / 44	68 / 44	68 / 44	68 / 44	68 / 43	68 / 43

48 Refers to Gross Inland Energy Consumption excluding non energy uses.
49 Evaluated against the 2007 Baseline projections for Primary Energy Consumption
50 Energy on Value added.
51 Energy on Private Income.
52 Energy on Value added.

Gross Inland Energy Consumption in Reference and % change compared to Reference	1611 / 1630	-4.8 / -14.5	-7.7 / -12.7	-8.8 / -15.3	-10 / -17.9	-11.8 / -21.1	-17 / -26.6	-22.8 / -30.8
- Solid fuels	174 / 124	-10.8 / 7.2	-15.7 / 8.4	-12.1 / 5	-9.5 / 1.3	-7.5 / -3.7	-0.7 / -13.1	-11.6 / -16.5
- Oil	520 / 498	-3.3 / -62.1	-7.3 / -59.4	-8 / -59.9	-8.8 / -60.2	-9.7 / -60.4	-12 / -62.5	-13.6 / -62.8
- Natural gas	397 / 397	-13.2 / -36.9	-15.6 / -30.1	-18.9 / -33.8	-21.7 / -37.1	-24.9 / -40.6	-35.3 / -44.9	-42.2 / -49.9
- Nuclear	201 / 216	-0.2 / 17.1	-6.2 / 13.1	-6.6 / 11.2	-8.1 / 7.8	-11.7 / 2	-21.7 / -8.4	-31.5 / -17.2
- Renewables	320 / 398	3.5 / 43.6	5 / 42.6	2.9 / 38.2	1.1 / 34.3	-1.1 / 29.8	-8.3 / 22.7	-14.4 / 16.8
Gross Inland Energy Consumption Share of :								
- Solid fuels	10.8 / 7.6	10.1 / 9.5	9.9 / 9.5	10.4 / 9.4	10.8 / 9.4	11.3 / 9.3	12.9 / 9	12.4 / 9.2
- Oil	32.3 / 30.5	32.8 / 13.5	32.4 / 14.2	32.6 / 14.5	32.7 / 14.8	33 / 15.3	34.2 / 15.6	36.2 / 16.4
- Natural gas	24.6 / 24.3	22.5 / 17.9	22.5 / 19.5	21.9 / 19	21.5 / 18.6	21 / 18.3	19.2 / 18.3	18.5 / 17.6
- Nuclear	12.5 / 13.2	13.1 / 18.1	12.7 / 17.2	12.8 / 17.4	12.7 / 17.4	12.5 / 17.1	11.8 / 16.5	11.1 / 15.8
- Renewables	19.9 / 24.4	21.6 / 41	22.6 / 39.9	22.4 / 39.8	22.3 / 39.9	22.3 / 40.1	22 / 40.8	22.1 / 41.2
Renewables Share - Overall	24.4 / 28.7	26.5 / 51.4	27.8 / 49.9	27.7 / 50.1	27.7 / 50.4	27.7 / 50.56	27.4 / 51.8	27.4 / 52.3
- Share in electricity, heating & cooling	31 / 36.8	34.2 / 51.4	36.2 / 50.4	36.2 / 50.7	36.4 / 51.3	36.5 / 51.5	36.9 / 53	37.8 / 53.9
- Share in heating & cooling	23.8 / 26.6	25.9 / 49	27.4 / 46.4	27.4 / 46.6	27.5 / 46.9	27.5 / 45.9	27.4 / 46.1	27 / 46.3
- Share in electricity	42.7 / 50.1	47.3 / 53.2	49.7 / 53.8	49.4 / 54.1	49.3 / 54.6	49.6 / 55.8	50.3 / 58.1	52.7 / 59.3
- Share in transport	12 / 13.9	12.8 / 67.9	13.7 / 65	13.7 / 65.2	13.9 / 65.5	14 / 66	14.2 / 68.5	14.4 / 68.9

Source: PRIMES 2014

The impacts of EE on overall energy consumption and on the fuel mix have important effects on **energy imports**. Clearly, the energy efficiency policy can contribute to reducing the demand for imported fuels and thus increasing the security of supply, which is currently a high political priority in the context of events in Ukraine.

In the **Table 5** below it is visible that **net energy imports** decrease significantly for all scenarios already in 2030. While the reduction of net energy imports in 2030 (in comparison the year 2010) is 4% for the Reference, the scenarios achieve between 14 and 26% reductions - the reductions are getting higher, the more is the energy savings. All scenarios achieve higher reduction than the GHG40 scenario presented in the 2030 IA. The trend is even more pronounced in 2050 (where for all scenarios the imports practically halve in comparison to the year 2010). In this longer term perspective, the drivers are both EE policies and higher share of (domestically produced) renewables in the context of decarbonisation.

[53] Energy on GDP.

Looking at specific imported fuels in 2030:

- the **imports of solids** decrease for all scenarios and up to 41% for EE40 scenario (in comparison to 2010) whereas the Reference achieves only 23% reduction;
- the **imports of oil** decrease for all scenarios and up to 19% for EE40 (in comparison to 2010) whereas the Reference achieves only 7% reduction;
- the **imports of gas** decrease for all scenarios and up to 40% for EE 40 scenario (in comparison to 2010) whereas in Reference imports grow by 5%.

Import dependency – if defined as the ratio between fuel imports and total energy consumption - is in the short term only to some extent affected by policy choices and there are little differences between scenarios in 2030 with respect to the Reference and even present levels. In 2050, however, the Reference still has 57% import dependency whereas all other scenarios decrease it to below 40%, due to reduced demand for imported fossil fuels – brought about by the EE policies. In general, the import dependency indicator should be interpreted with caution. As shown in the **Table 5**, the import dependency values slightly increase from the EE29 to the EE40 scenario. At first glance, this seems to be contrary to the reduced absolute imported fuels. But it has to be also borne in mind that EE reduces global energy consumption in total, which decreases the denominator of the indicator *import dependency* (imported fuels divided by energy consumption). As both values of this indicator - the imported fuels and the energy consumptions - change with increased EE, it is better to use the absolute numbers for comparability reasons to assess the increase of **security of supply**.

The key role of EE in increasing security of supply was already acknowledged in the impact assessment underpinning the 2030 Communication and again in the European Energy Security Strategy. In the current context, it is more relevant to look at the impact that EE has on gas imports than overall energy dependency. As well as a risk of severance of energy provision, insecurity in the natural gas market can significantly contribute to increasing prices for industries and households. Approximately 65% of the EU's gas use is for heating buildings, and energy efficiency measures are well attuned to cutting this. Already with 27% energy savings, gas imports would already be 17% lower in 2030 than in the Reference. Every additional 1% in energy savings leads to a further reduction of about 2.6% in gas imports, reaching, for example, a 36% cut in gas imports in EE35(116 bcm) compared with Reference. Above 35% energy savings, the rate of reduction of gas imports from additional energy savings falls off sharply.

Decreasing import dependency under all EE scenarios demonstrates that EE policy reduced energy consumption of imported fuels to a greater extent than consumption of those produced domestically.

Another manner of illustrating the impact of EE on imports is calculation of **fossil fuel net imports in monetary value** which already in 2030 decreases for all scenarios and most markedly for EE30, EE35 and EE40. In2050 perspective, the value of imports under the Reference would increase taking into account growing fossil fuel prices but it decreases even further in all scenarios analysed reflecting their strong impact on curbing the demand, which even outweighs the effect of growing prices.

Net energy import decreases translate into **savings in the energy fossil fuels imports bill** (calculated here as a cumulative value over a 20 year period). For the period 2011-2030 cumulative savings range from €285 billion to €549 billion and for the period 2031-2050 from €3349 billion to €4360 billion. These savings indicate that rather than paying for imports, the EU economy can have these resources invested either in technology development and/or new assets and/or education, all of which contribute to job creation and economic growth.

Energy efficiency cannot, of course, constitute an entire energy security strategy on its own. It needs to be part of a broader set of measures, including the diversification of suppliers and supply points, ensuring proper fuel stocks and building interconnectors. With reduced energy demand but without these additional elements countries would be still exposed to sudden disruptions and price shocks. Neither this analysis nor the analysis underpinning the European Energy Security Strategy attempts to quantify the respective role that these different measures can play. It can be however concluded on the basis of this analysis that energy efficiency has the effect of:

- Reducing the scale of impacts that sudden supply disruptions or price hikes can have on the economy thanks to lower absolute consumption of energy, and of imported fuels in particular;
- Changing the relative weight of certain fuels in the energy mix, with a reduced share of gas where the exposure to these risk factors is particularly high and increased share of other fuels where this risk is relatively smaller, either because they are primarily domestically – produced (e.g. renewables) or because they are traded in a much more liquid market than gas (e.g. oil). This is linked to the design on the policies modelled which target buildings in particular, where the share of gas for heating is especially high.

While the potential of energy efficiency in this respect depends on the specific situation of different Member States, it needs to be stressed, as in the European Energy Security Strategy, that the EU's energy system is increasingly integrated, while at the same time Member States are importing from the same supplier countries and it is therefore important to consider energy security from an EU perspective. Choices taken on the level of fuel supply, infrastructure development, energy transformation or consumption lead to spill-over effects on other Member States.

Table 5. Impacts on energy security in 2030 and 2050

Indicator *(figures are presented in a 2030/2050 format)*	**Ref**	**GHG40**	**Decarbonisation Scenarios**					
			EE27	**EE28**	**EE29**	**EE30**	**EE35**	**EE40**
Net Energy Imports Volume (2010=100)	96 / 101	89 / 56	86 / 59	85 / 57	83 / 56	82 / 54	78 / 51	74 / 49
- Solid	77 / 49	68 / 42	61 / 40	65 / 38	61 / 38	62 / 34	70 / 30	59 / 29
- Oil	93 / 96	90 / 41	86 / 44	85 / 43	85 / 43	84 / 43	82 / 41	81 / 41
- Gas	105 / 122	91 / 74	88 / 82	84 / 78	81 / 74	78 / 69	67 / 65	60 / 59
- Renewable Energy Forms	492 / 601	505 / 1043	509 / 1002	500 / 972	493 / 947	482 / 924	458 / 875	433 / 852

Import Dependency (% net imports to total gross inland energy consumption)	55.1 / 56.6	53.6 / 36.8	53 / 38.1	53 / 38	52.6 / 38.2	52.8 / 38.3	53.5 / 38.6	54.4 / 39.1
Value of Fossil Fuel Net Imports (bn €'10) *(average annual 2011-30 and 2031-2050)*	461 / 548	452 / 377	447 / 380	446 / 373	444 / 366	441 / 358	436 / 340	434 / 330
- Oil	330 / 390	327 / 263	323 / 265	323 / 262	322 / 259	321 / 257	319 / 248	318 / 245
- Gas	115 / 146	110 / 104	108 / 107	107 / 102	106 / 98	105 / 93	101 / 84	100 / 76
- Solid	16 / 12	15 / 10	15 / 9	15 / 9	15 / 9	15 / 8	15 / 8	15 / 8
Fossil Fuels Import Bill Savings compared to reference (bn € '10) *(cumulative 2011-30 and 2031-2050)*	n.a	-190 / -3404	-285 / -3349	-311 / -3490	-346 / -3637	-395 / -3798	-503 / -4145	-549 / -4360

Source: PRIMES 2014

The **final energy demand** is projected to decrease differently in the different sectors. Looking at the specific sectors in detail, the residential and tertiary sectors experience the strongest reduction (in comparison to the Reference) as they are affected by a majority of energy efficiency policies with the biggest changes brought about by improving thermal integrity of buildings – consequently their share in total final energy demand decreases. The share of industry in final energy demand almost does not change from the Reference case demonstrating the countervailing effects of EE policies and ETS prices. Finally, the share of transport grows slightly in EE25 and EE28 and more significantly in the scenarios with more energy savings reflecting relatively smaller potential for GHG abatement in transport.

Gross electricity generation decreases by 2030 for all scenarios in comparison to Reference. In a 2050 perspective, however, it grows (except for EE35 and EE40 scenarios) reflecting increasing demand for electricity from heating, appliances and transport. In electricity generation, for all scenarios the share of gas declines while the share of RES increases. Electricity grid losses remain the same for all scenarios and Reference except for EE35 and EE40 scenarios, in which losses decline slightly.

Among impacts on **technologies**, a key impact to be observed is the increase of shares of electricity produced from **combined heat and power (CHP)** up to 17% already in 2030 in EE27, EE28, EE29 and EE30 scenarios (from 16% in the Reference). The increase in 2030 is due to synergies between the RES target and co-generation which mainly uses biomass as a feedstock. In 2050 perspective, however, the CHP indicator declines (in comparison to the Reference) for all scenarios as there is increasing competition for biofuels/biomass feedstocks in transport.

Concerning **CCS** development, the % of electricity it represents is higher than in Reference in EE27 and EE28 scenarios but its role is lesser than in the Reference in scenarios with more energy savings reflecting low ETS prices.

Energy related CO_2 emissions decrease strongly in all scenarios already in 2030 and then even more in 2050 reflecting the declining demand for energy as well as declining carbon intensity of power generation, the latter mostly influenced by ETS and renewables policy.

Table 6. Other energy system impacts

Indicator *(figures are presented in a 2030/2050 format)*	**Ref**	**GHG40**	**Decarbonisation Scenarios**					
			EE27	**EE28**	**EE29**	**EE30**	**EE35**	**EE40**
Final Energy Demand (Mtoe)	1126 / 1151	1073 / 885	1039 / 904	1020 / 876	1002 / 848	981 / 819	920 / 759	859 / 712
- Industry share	27.3 / 26.8	27.5 / 28.3	26.8 / 24.9	27.3 / 24.9	27.6 / 25.6	27.8 / 26.4	28.1 / 28.4	29.8 / 30.2
-Residential share	26.4 / 26.4	25.9 / 25.5	26.2 / 27.1	25.7 / 26.4	25.3 / 25.2	24.8 / 23.8	23.4 / 21.4	21 / 18.8
-Tertiary share	14.9 / 15	14.2 / 13.4	14.5 / 16.1	13.9 / 15.8	13.6 / 15.3	13.2 / 14.6	12 / 13.5	10.1 / 11.9
-Transport share	31.4 / 31.8	32.4 / 32.9	32.5 / 31.9	33.1 / 33	33.6 / 34	34.3 / 35.2	36.5 / 36.7	39.1 / 39.1
Gross Electricity Generation (*TWh*)	3664 / 4339	3532 / 5040	3469 / 5038	3461 / 4936	3423 / 4796	3336 / 4560	3080 / 4267	2804 / 3969
- Solids Share	13 / 8.4	11.6 / 10.1	10.9 / 10.8	11.9 / 10.7	12.5 / 10.5	13.4 / 10.1	16.6 / 9	15.5 / 9
- Oil Share	0.6 / 0.5	0.5 / 0.1	0.5 / 0.1	0.5 / 0.1	0.5 / 0.1	0.5 / 0.1	0.5 / 0.1	0.5 / 0.1
- Natural Gas Share	19.5 / 17.3	15.3 / 12.5	14.8 / 12.5	14.2 / 12.3	13.8 / 11.9	13 / 11.2	10.2 / 11	9.8 / 10.3
- Nuclear share	21.8 / 21.3	22.6 / 21.6	21.5 / 20.8	21.5 / 20.9	21.3 / 20.8	21 / 20.7	20 / 19.8	19.1 / 19.1
- Renewables share	44.5 / 51.6	49.3 / 54.2	51.7 / 54.4	51.3 / 54.6	51.2 / 55.2	51.5 / 56.4	52.1 / 58.5	54.6 / 59.8
- of which hydro share	10.8 / 9.8	11.2 / 8.6	11.5 / 8.7	11.5 / 8.8	11.6 / 9.1	11.9 / 9.5	12.8 / 10.1	13.9 / 10.8
- of which wind share	21 / 24.8	23.9 / 26.5	24.8 / 27	24.5 / 27.1	24.4 / 27.2	24.4 / 27.3	24.2 / 27.8	25.2 / 27.6
- of which Solar, tidal, etc share	5.8 / 8.4	6.4 / 9.5	6.8 / 9.6	6.6 / 9.4	6.6 / 9.4	6.6 / 9.5	6.7 / 9.8	6.9 / 9.8
- of which Biomass & waste share	6.6 / 7.9	7.5 / 8.6	8.3 / 8.2	8.4 / 8.4	8.4 / 8.7	8.4 / 9.2	8.1 / 9.9	8.3 / 10.7
CCS indicator (% of electricity from CCS) (difference in p.p.)	0.45 / 6.9	0.77 / 14.72	0.65 / 14.53	0.58 / 13.67	0.41 / 12.98	0.27 / 11.83	0.29 / 10.65	0.3 / 10.19
CHP indicator (% of electricity from CHP) (difference in p.p.)	16.1 / 16.2	16.4 / 14	17 / 14.9	17 / 14.6	16.9 / 14.7	17 / 15.1	16.2 / 15.2	16.3 / 15.3
Carbon intensity of power generation *(per MWhe+MWhth)*	17.8 / 7.9	15.1 / 0.7	14.4 / 1.1	15 / 1.2	15.5 / 1.2	16.1 / 1.2	17.7 / 1.3	16.9 / 1.1
Electricity Grid Losses[54]	6.4 / 6.7	6.3 / 6.4	6.4 / 6.6	6.4 / 6.6	6.3 / 6.6	6.1 / 5.8	5.6 / 4.9	5.5 / 4.9

Source: PRIMES 2014

[54] Ratio of electricity transmission and distribution losses to electricity supply excluding self consumption

5.3.2. Economic impacts in the energy system

The EU Reference scenario 2013 - projecting the consequences of already adopted policies as well as developments largely unrelated to policy (renewal of ageing power generation capacity in Europe, growing international fossil fuel prices) - shows, until 2030, the **ratio of total energy system cost to GDP** will be increasing from 12.8 % in 2010 to 14.0% in 2030, before decreasing to 12.3 % in 2050. The policy scenarios evaluated in the 2030 IA all showed higher energy system costs up to 2030 and beyond, with costs being the lowest for the GHG40 scenario and highest for the scenarios with the most energy savings.

This chapter revisits the costs estimation and shows the level of cost increase brought by different levels of ambition of EE policies, including the GHG40 scenario presented in the 2030 IA. Looking at **differences in average annual costs for the period 2011-2030** across all scenarios, they range between 0.01 and 0.79 percentage points of GDP higher compared to the Reference. Looking specifically at the year 2030, energy system costs in policy scenarios are between 0.13 and 3.97 percentage points of GDP higher than the Reference. The additional increases are higher in 2050, reflecting the costs necessary to achieve decarbonisation, in addition to the costs of energy efficiency policy.

Regardless of the method of comparison, these additional increases of system costs are much smaller than those resulting under the Reference scenario itself.

Total energy system costs from an end user perspective (as calculated in the modelling) comprise mainly three elements: 1) annuities for capital expenditure on energy using equipment, 2) fuel and electricity costs (energy purchasing costs[55]), including capital expenditure for the production and distribution of electricity and 3) the as so-called direct energy efficiency investment costs[56] (not related to energy equipment itself), such as expenditure for insulation. The latter being also expenditures of capital nature are also expressed in annuity payments.

These components of energy system costs differ substantially across policy scenarios analysed in this IA:

- **Energy purchases** are significantly reduced in all scenarios, most significantly in EE30, EE35 and EE40. For the period 2011-2030, average annual energy purchasing costs are between €33 bn to €89 bn lower than for the Reference.

[55] Energy purchase costs include the capital costs corresponding to power & gas infrastructure (plants & grids), refineries and fossil fuel extraction, recovered in the model through end-user prices of energy products.
[56] Direct efficiency investment expenditures include the costs relating to (a) thermal integrity of buildings, i.e. for building insulation, triple glazing and other devices for energy savings including building management systems, and (b) for the industry sector they also include the investments that relate to the horizontal (not related to specific processes) energy saving investments, such as for energy control systems and heat recovery systems.

Across all scenarios, the reductions are mainly achieved in residential and tertiary sectors.

- On the other hand, **direct efficiency investments**, representing mainly investment in the thermal integrity of buildings, increase in all scenarios and sharply in EE35 and EE40 scenarios. For the period 2011-2030, average direct efficiency investment costs are between €16 bn to €181 bn higher than for Reference.
- **Capital costs** remain relatively stable across scenarios and mainly concern the residential and transport sectors. For the period 2011-2030, average annual capital costs are between €15 bn to €19 bn higher than for Reference.

It is to be recalled from the previous sections that all scenarios analysed in this IA are in the enabling settings, which lower the overall costs of achieving the targets because of necessary market coordination, public acceptance of policy choices and supportive policies in RDI and infrastructure. All costs (also linked to enabling settings) are fully accounted for.

The **Table 7** below shows various system cost comparisons as in the 2030 IA (e.g. total system cost as average annual 2011-30 and 2031-2050 or total system costs in 2030 as % of GDP increase). In addition, the values are shown for the different sectors.

It is worth noting that although GHG40 is less costly than EE27 over 2011-2030 in terms of average yearly total energy system costs (by €0.5 bn), EE27 presents lower total energy system costs in 2030. In the periods afterwards, both EE27 and EE28 appear to be less costly than GHG40, both in 2050 and in average yearly terms over 2031-2050. This can be mainly explained by the lower ambition of EE27 and EE28 in terms of GHG emissions reductions over the projection period, but also the introduction of some low-cost EE policies for dismantling non-market barriers (barriers that do exist in GHG40) and which enable to reap the relevant EE potential available in EU – at a lower cost.

This IA does not look into costs and benefits to be borne by specific sectors of final energy demand or specific economic actors (e.g. landlord, tenants, car manufacturers, specific industries). Such assessment will be done for policy/legislative proposals that will follow the agreement on the overall energy efficiency target.

Table 7. Energy system costs and its components[57, 58]

[57] Total system costs do not include any disutility costs associated with changed behaviour, nor the cost related to auctioning – but do include an attribution of monetary costs to non-financial barriers such as the effort needed to find out energy performance of appliances, and the deterrent to tenants' adoption of energy-saving behaviours when their landlord is responsible for paying energy bills.

[58] The small difference between the total system costs and the summation of capital costs, energy purchase costs and direct efficiency investment costs is due to the inclusion of the supply side auction payments under energy purchases, embedded in the energy prices (but not included under the reported total system costs which exclude auction payments).

Indicator *(figures are presented in a 2030/2050 format)*	Ref	GHG40	Decarbonisation Scenarios					
			EE27	EE28	EE29	EE30	EE35	EE40
Total System Costs in bn €'10 *(average annual 2011-30 and 2031-2050)*	2067 / 2520	2069 / 2727	2069 / 2649	2074 / 2686	2082 / 2747	2089 / 2806	2124 / 3001	2181 / 3355
Total System Costs as % of GDP *(average annual 2011-30 and 2031-2050)*	14.3 / 13.03	14.31 / 14.1	14.31 / 13.7	14.35 / 13.89	14.4 / 14.2	14.45 / 14.51	14.69 / 15.52	15.09 / 17.34
Total System Costs as % of GDP increase *(average annual 2011-30 and 2031-2050)* compared to Reference in % points	0	0.01 / 1.07	0.01 / 0.67	0.05 / 0.86	0.11 / 1.18	0.15 / 1.48	0.39 / 2.49	0.79 / 4.32
Total System Costs as % of GDP in 2030 *(2010 value: 12.76 %)*	14.03 / 12.3	14.18 / 13.96	14.16 / 13.39	14.33 / 13.62	14.53 / 14.01	14.73 / 14.39	15.79 / 15.54	17.99 / 17.42
Total system Costs in 2030 as % of GDP increase compared to Reference in % points	0	0.15 / 1.65	0.13 / 1.09	0.3 / 1.32	0.51 / 1.71	0.7 / 2.09	1.76 / 3.23	3.97 / 5.11
Capital Costs in bn €'10 *(average annual 2011-30 and 2031-2050)*	590 / 939	598 / 1071	607 / 1076	607 / 1071	606 / 1068	609 / 1072	607 / 1070	605 / 1044
Industry	57 / 84	60 / 91	59 / 86	59 / 84	59 / 83	60 / 84	59 / 83	59 / 82
Residential	304 / 450	305 / 438	312 / 467	312 / 464	311 / 459	314 / 461	313 / 452	313 / 437
Tertiary	52 / 83	51 / 67	51 / 79	51 / 76	50 / 71	50 / 68	48 / 59	47 / 48
Transport	177 / 322	182 / 474	185 / 445	185 / 448	185 / 454	186 / 460	187 / 476	187 / 476
Direct Efficiency Investments in bn €'10 *(average annual 2011-30 and 2031-2050)*	35 / 35	47 / 274	52 / 184	62 / 257	76 / 355	89 / 452	146 / 731	216 / 1182
Industry	1 / 5	2 / 74	4 / 67	5 / 80	5 / 86	6 / 91	13 / 102	15 / 104
Residential	24 / 22	29 / 128	33 / 83	39 / 124	48 / 186	56 / 246	87 / 420	124 / 699
Tertiary	10 / 8	16 / 71	14 / 34	18 / 53	23 / 83	27 / 114	47 / 210	77 / 380
Transport	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
Energy Purchases in bn €'10 *(average annual 2011-30 and 2031-2050)*	1454 / 1586	1436 / 1394	1422 / 1402	1417 / 1370	1411 / 1335	1401 / 1290	1378 / 1206	1365 / 1130
Industry	279 / 291	273 / 258	271 / 246	271 / 240	270 / 237	269 / 233	264 / 225	263 / 223
Residential	426 / 498	421 / 455	416 / 442	414 / 427	410 / 408	405 / 384	395 / 342	388 / 299
Tertiary	238 / 262	234 / 218	232 / 236	230 / 226	228 / 213	225 / 198	217 / 171	212 / 139
Transport	510 / 534	508 / 463	502 / 478	502 / 478	502 / 477	502 / 475	502 / 468	502 / 469

Source: PRIMES 2014

Energy related investment expenditures can be practically divided in:

1. Investments in the supply side, namely in grids, power generation plants and boilers.
2. Investments on the demand side, split between energy equipment (covering appliances, vehicles, equipment, etc) and direct energy efficiency.

The table below describes the average annual investment expenditures across scenarios, providing an alternative view of the projected investment expenditures compared to the total system costs figures, which reflect the entire financial flows related to investment.

The investment expenditures increase in all scenarios - again most significantly in EE35 and EE40 scenarios and again mostly in residential and tertiary sectors. The average annual investment expenditure rises in the period 2011-2030 between €35 bn and €331 bn.

In the residential and tertiary sectors, increases are the most pronounced: the average annual investment expenditure rises in the period 2011-2030 between €9 bn and €154 bn for residential sector and between €6 bn and €156 bn for tertiary. It has to be, however, noted that energy investments in the residential increase property values because of their improved energy performance (for which the benefit is captured in the model through lower fuel costs) and amenity value by an amount that one study estimated to correspond to some 40% of the cost of investments in energy efficiency in the residential sector[59]. More efficient buildings offer the people who live and work in them other benefits. In one study, the "ancillary benefits" of better windows, such as better air quality and protection from external noise, have been found to be just as valuable to residents as the reduction in heating bills[60].

As discussed above, the introduction of some low-cost EE policies for dismantling non-market barriers, allows the EE scenarios to reap early and at low cost the relevant EE potential available in EU. As a result, EE27 presents lower investment expenditures over 2011-2030 than GHG40, mainly due to the removal of non-market barriers (that do exist in GHG40), which allow for “easy” EE gains in the residential and tertiary sectors, while at the same time giving the possibility to exploit a large part of the EE potential in the non-energy intensive industry.

In general, the investment expenditure figures increase more sharply compared to the total system costs. The reason for this is that in the system costs include energy

[59] BIO Intelligence Service. 2013. Energy performance certificates in buildings in their impact on transaction prices and rents in selected EU countries. Cited at: http://ec.europa.eu/energy/efficiency/buildings/doc/20130619energy_performance_certificates_in_buildings.pdf

[60] M. Jakob, Marginal costs and co-benefits of energy efficiency investments – The case of the Swiss residential sector, Energy Policy 34 (2006) 172-187. See also [BIO Intelligence Services report for Commission]; [IPCC report on mitigation options, 2014]; Phillips, Y., Energy Policy 45 (2012) 112-121, “Landlords versus tenants: Information asymmetry and mismatched preferences for home energy efficiency”; Scott, F.L., C.R. Jones and T.L. Webb, Energy Policy (2013), “What do people living in deprived communities in the UK think about household energy efficiency interventions?”.

purchases which decrease with a higher EE level and therefore counterbalance the increasing efficiency investments.

The magnitude of investments in the entire economy should be also interpreted as a huge potential for driving jobs and growth in the EU, in particular due to the local nature of much energy efficiency investment and the industrial and technological leadership the EU companies still have in terms of energy efficient and low-carbon technology.

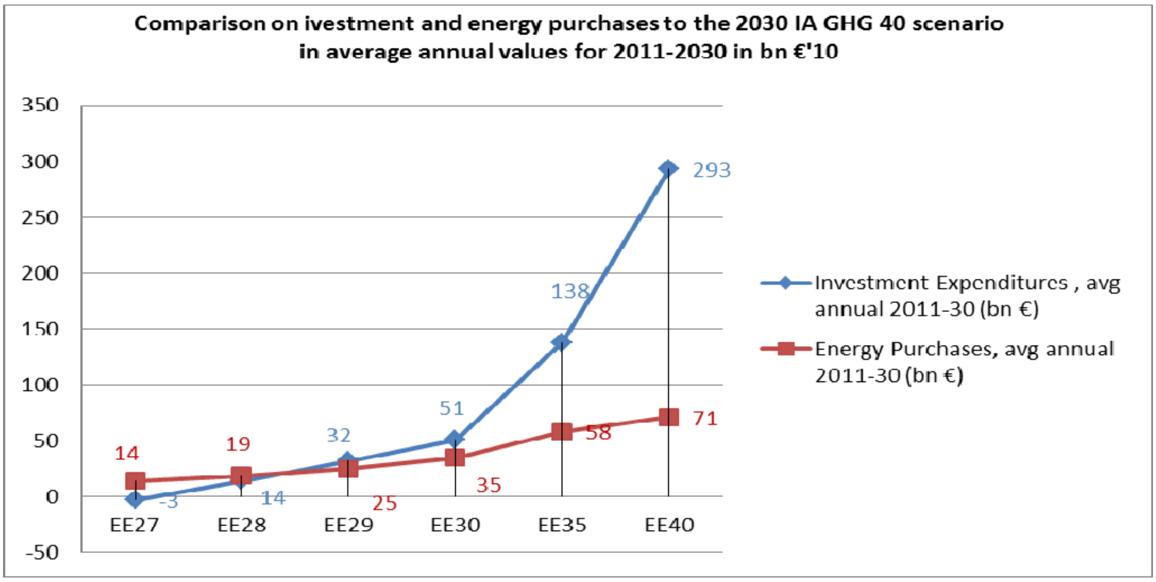
Table 8. Investment Expenditures

Indicator *(figures are presented in a 2030/2050 format)*	**Ref**	**GHG40**	**Decarbonisation Scenarios**					
			EE27	**EE28**	**EE29**	**EE30**	**EE35**	**EE40**
Investment Expenditures in bn €'10 *(average annual 2011-30 and 2031-2050)*	816 /949	854 /1189	851 /1110	868 /1126	886 /1149	905 /1170	992 /1203	1147 /1211
Industry	19 /30	24 /88	29 /72	30 /83	31 /82	34 /82	45 /69	49 /65
Residential	36 /28	49 /77	45 /49	54 /57	64 /75	73 /95	115 /130	190 /160
Tertiary	14 /10	25 /41	20 /16	28 /16	37 /23	45 /29	87 /33	170 /23
Transport	660 /782	662 /843	663 /834	664 /835	664 /837	665 /839	665 /852	665 /852
Grid	37 /41	40 /55	40 /54	40 /54	39 /52	38 /49	34 /48	29 /44
Generation and boilers	50 /59	53 /85	53 /86	52 /82	51 /80	50 /75	46 /72	44 /66

Source: PRIMES 2014

The incremental increases in investments as well as reductions in energy purchases can be also directly compared to GHG40 scenario as demonstrated in the figure below.

Figure 4. Comparison of average annual (2011-2030) investments with energy purchasing costs



Source: PRIMES

Other important economic impacts directly affecting all energy consumers are impacts on **electricity prices**[61] and the **ETS prices**. In the modelling underpinning this IA, the choice was made not to use carbon values but to model concrete EE policies. RES values and EE values representing the shadow values promoting respectively renewables and some (but by no means all) aspects of energy efficiency are also summarised in table 9 (see explanations of these metrics in Annex V). RES values change only slightly in comparison to the Reference scenario (as needed to achieve the RES target). On the other hand, the EE values grow very strongly reflecting measures aiming at improving thermal integrity of buildings by accelerated renovation and stricter building codes. The obligation so represented by EE values, which are internalized in the optimizing behaviors of the relevant actors who consider these values as a potential penalty per unit of non-achieved savings relative to the obligation. The Reference demonstrates that significant increases in electricity prices (31% increase in real terms until 2030, compared to 2010) should in any case be expected. Electricity price changes compared to Reference are very small in 2030 ranging from +0.85% to +3.34% in the year 2030. In a 2050 perspective, electricity prices grow slightly more and across all scenarios.

Contrary to electricity prices, differences between policy scenarios are very pronounced with regard to the ETS price although projections in this regard are associated with significant degrees of uncertainty as many assumptions on the future need to be made. Under Reference, the ETS price is expected to reach 35 €/tCO2 in 2030 and 100 €/tCO2 in 2050. In the policy scenarios, it is expected to reach between 39 and 6 €/tCO2 in 2030. In a 2050 perspective, different policy scenarios would result in 243 to 165 €/tCO2, depending on the scenario. The more the energy savings, the lower becomes the ETS price as EE policies reduce the demand for electricity in the ETS sector. Also EE improvements in industry reduce the demand for ETS allowances. In addition, in the EE40 scenario which significantly overshoots the GHG target, efficiency policies shift emission reduction efforts from ETS to non-ETS sectors. In 2030, the ETS prices in the EE scenarios with the highest energy savings are lower than in Reference. In 2050, the ETS prices are higher than in the Reference in all scenarios as the decarbonisation target in achieved.

Similarly as in the 2030 IA, the EU ETS is modelled in the energy efficiency scenarios via carbon prices, but of course emissions are also impacted by other policies, notably EE policies. Across scenarios, the cumulative ETS emissions approximate the cumulative ETS emissions of the GHG40 scenario, with particular focus on the time period until 2030. By doing so, the scenarios are consistent with the 2030 IA.

In general, the concrete impacts of EE policies on the ETS price will depend strongly on the sectors in which EE policies will be suggested in the future to reach a certain amount of energy savings in 2030. If the focus is mainly on the non-ETS sector, the impacts on the ETS price will be smaller than if the EE policies would focus on the ETS sectors.

[61] Fossil fuel prices are exogenous in the modelling.

Table 9. Electricity and carbon prices, energy related costs for energy intensive industries

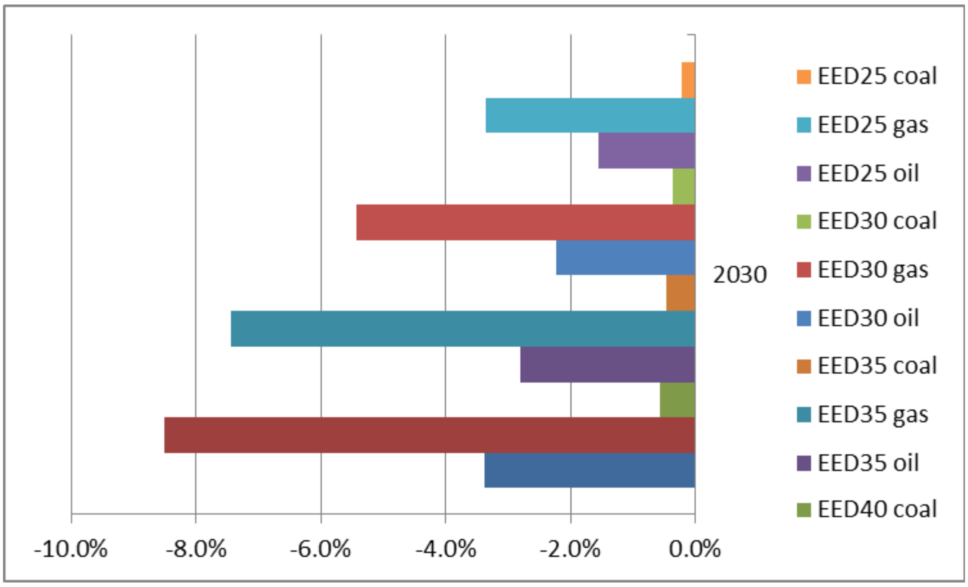
Indicator *(figures are presented in a 2030/2050 format)*	**Ref**	**GHG40**	**Decarbonisation Scenarios**					
			EE27	**EE28**	**EE29**	**EE30**	**EE35**	**EE40**
Average Price of Electricity[62] (€/MWh)	176 / 175	179 / 183	180 / 187	179 / 185	178 / 184	178 / 182	177 / 182	182 / 182
ETS carbon price (€/t of CO2-eq)	35 / 100	40 / 264	39 / 243	35 / 220	30 / 205	25 / 180	13 / 160	6 / 165
Implicit carbon price non-ETS (€/tCO2)	0 / 0	40 / 264	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
Average Renewables value (€/ MWh)	34 / 16	34 / 15	40 / 16	40 / 15	40 / 15	42 / 15	43 / 15	43 / 14
Average energy efficiency value (€/ toe)	181 / 95	184 / 604	402 / 574	619 / 847	822 / 1251	1011 / 1642	1768 / 2595	2937 / 3798

Source: PRIMES 2014

In addition, the impact of energy efficiency policies on international fuel prices was also modelled, using the POLES model. The results presented below show that the international gas price in 2030 would be 3-8% less than in Reference, and the international oil price would be 1-3% less, with energy savings of 25-40%.[63] These results should be further analysed, including their impact on energy consumption and GDP in the EU. In any case though, these results are an indication that the European EE policies would have some impact on international gas prices. This can be explained because of the significant reduction of the gas demand in the EE scenarios in the EU. Other elements, however, have not be taken into consideration, like the missing flexibility of the gas infrastructure produces a higher price effect on the European gas markets, since the gas producers cannot easily redirect their fuel exports to other markets

[62] Average Price of Electricity in Final demand sectors (€/MWh) constant 2010 Euros. For reference scenario, corresponding value was 134 €/MWh in 2010.
[63] See more details in Annex VI.

Figure 5. Projected impacts of EE policies on international fuel prices (in %)



Source: Poles

5.3.3. Macro-economic impacts

The **models E3ME and GEM-E3** were applied to assess the impacts on GDP and employment of policy scenarios, in which there is greater investment in energy efficiency. The complex interactions between different sectors of economy can thus be assessed at the macro-economic level and results can be compared to the respective Reference. (Each modelling exercise builds its own reference this is why the results are presented not in absolute figures but as a difference from the Reference. For the same reason, the results of the scenarios presented in this IA are not comparable with the results of macro-economic modelling in 2030 IA).

The macro-economic scenarios that have been modelled build upon PRIMES scenarios with 25, 28, 30, 35 and 40% energy savings. The scenario with 25% energy savings has ambition similar to GHG40 scenario but is built on the PRIMES scenario that has concrete EE policies rather than carbon values - for better comparability with other scenarios. The macro-economic modelling building on EE27 and EE29 scenarios would likely have very similar outcome to results presented in the chapter for EE28 and EE30, with little additional insight brought to the analysis – for practical reasons a smaller number of scenarios is presented.

The **path and magnitude of investment in energy efficiency** in each scenario is taken from projections made in PRIMES: the E3ME and GEM-E3 **models are then calibrated to represent these changes in the energy system so that their economy-wide impacts can be modelled**. The two macroeconomic models have many similarities. However, there are also important differences that arise from their underlying assumptions and respective structures. E3ME is a macro-econometric model, based on a post-Keynesian framework; GEM-E3 is a general equilibrium model that draws strongly on neoclassical economic theory and optimising behaviour of economic agents –see Annex VI for the description of methodology of each model.

Importantly, in this exercise the E3ME provides the projections only till the year 2030. GEM-E3 model provides projection till the year 2050. Both models estimate only the impact of the EE policies and not of the decarbonisation[64].

Impacts on GDP

Application of both models shows that energy efficiency expenditures lead, first of all, to increased demand in sectors providing goods and services to energy efficiency projects (construction, market services, metals, cement, chemicals, equipment goods, etc.). Depending on their linkages with other sectors of the economy the demand for inputs from these sectors is associated with chain changes in demand for inputs from other sectors of the economy (multiplier effect) as well as for imports. Secondly, additional effects are associated with a reduction in energy demand and subsequent imports for energy inputs resulting from energy consumption saving. Energy efficiency expenditures lead then to substitution of imported fuels with domestically produced goods and services.

In addition, however, in GEM-E3 model, increased expenditures in energy efficiency limit the funds available for other purposes and drive interest rates up (crowding-out effects). As there are no unused resources, this results in higher cost of capital which hampers the competitiveness of the economy further affecting trade and overall economic activity. The net outcome in the economy depends on the equilibrium resulting between the latter forces and assumptions about capital supply. In contrast, in E3ME model, there are some unused resources and the crowding-out effect does not automatically occur.

Importantly, both models make different assumption on the use of the ETS revenue. In GEM-E3 model, ETS revenue is used to lower the social security charges, which has a positive effect on GDP growth (but largely outweighed by the crowding-out effect). In E3ME modelling, ETS revenue is used to finance the EE investment. Whenever there is revenue left over from financing the EE investment, then this is used to reduce income taxes, but in general the EE investment needs are larger than the amount raised in ETS revenues, and the difference is therefore covered by an increase in taxation. The increase in income taxes leads to lower disposable income and, as a result, slightly lower consumer expenditure.

[64] The energy scenarios quantified using PRIMES have assumed that the energy efficiency policies for 2030 take place in the context of decarbonisation targets until 2050. The macroeconomic models, however, were required to assess the macroeconomic effects and particularly the employment effects of specific energy efficiency policies until 2030 not to assess in general decarbonisation pathways until 2050. Quantifying the macroeconomic impacts of decarbonisation until 2050 is out of the scope of the assessment of impacts of energy efficiency policy until 2030 because the restructuring and investment effort towards decarbonisation which has to be undertaken mainly after 2030 requires by far ampler resources of the economy than the energy efficiency policies until 2030.

<u>In GEM-E3 modelling,</u> for the scenarios simulating the effects of achieving higher energy efficiency targets, the assessment of impacts on GDP generally found small but negative impacts especially in 2030 when energy efficiency expenditures peak (see table 10). In fact, the effects of crowding-out leading to higher cost of capital and competitiveness losses surpass the effects of improved energy efficiency and the multiplier effect of increased economic activity in sectors providing inputs to energy efficiency projects[65]. The magnitude of the effects increases with the amount of expenditures undertaken for energy efficiency improvements. In 2030, the negative effects of different levels of ambition of EE policies (25 to 40%) range between -0.7 and -1.2% in comparison to the Reference.

In the long term, the negative effects tend to diminish as the sectors benefit from reduction of costs due to the achieved level of energy efficiency – but less so for scenarios with a high level of ambition.

Table 10. GDP impacts in EU28 (2030, 2040, 2050) in GEM-E3 model

% change from the Reference	2030	2040	2050
Reference (in bn 2010€)	16.766	19.277	22.129
EE25	-0,07	-0,03	0,00
EE28	-0,13	-0,04	-0,02
EE30	-0,22	-0,04	-0,02
EE35	-0,52	-0,15	-0,03
EE40	-1,20	-0,19	-0,04

Source: GEM-E3

<u>In E3 ME modelling,</u> the impacts on GDP are positive, owing to the approach which does not assume that optimisation in markets has previously occurred. Consequently, investment in one particular sector does not automatically lead to a crowding out effect on investment in other sectors. If there is spare capacity in the baseline case, then it is possible for there to be an increase in investment in the scenarios without necessarily having a reduction in investment elsewhere. As described above, investments are funded through higher taxes which will result in a reduction in consumption. Therefore, also the E3ME model assumes a certain amount of crowding out effects regarding consumption.

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[65] As explained in Annex VI, the policy scenarios analysed in this IA have assumed significant increase of expenditures for energy efficiency purposes especially in the period until 2030. These expenditures are assumed to be partly financed by economic agents (households and firms) and partly by economies' aggregate savings.
Consequently, a fairly realistic approach has been adopted assuming that the financing of the energy efficiency expenditures from saving resources in the economy is effectively leveraged throughout the projection period (till 2050); this implies less pressure until 2030 and a smaller crowding out effect. Should a full funding of the energy efficiency expenditures was made through the closure with savings till 2030, the macroeconomic impacts would be found increasingly negative after 2030 and higher in magnitude.

There is an increase in GDP in all scenarios compared to Reference, mainly driven by the investment in energy efficiency that occurs after 2025. The model results suggest that these positive changes could be in the range of 0.5 – 4.5% increase (for the range of scenarios achieving between 25 and 40% energy savings) in comparison to the Reference case. The EE40 scenario is subject to more uncertainty and possible resource constraints.

The table below confirms that the main driving force behind the increase in GDP is investment. The table also outlines the large scale of the energy-efficiency investment required to achieve the reductions in final energy demand. Despite higher GDP, household expenditure in all scenarios is *lower* than in the reference case. The reason for this is that higher taxation rates are required to fund the investment undertaken by industry sectors – and that energy efficiency measures reduce operational energy costs.

Although there is no measure of welfare in E3ME, in these types of model a reduction in household expenditure is typically interpreted as being consistent with a loss of welfare. However, there are cases where the two do not necessarily move together: in this case, the investment in energy efficiency means that households can achieve the same level of comfort while spending less on energy.

Table 11. GDP impacts in EU28 (2030) in E3ME model

% change from the Reference	2020	2025	2030
Reference (in bn 2010 €)	14.479	15.699	16.960
EE25	0,05	0,20	0,49
EE28	0,06	0,27	0,75
EE30	0,08	0,53	1,06
EE35	0,07	0,90	2,02
EE40	0,05	0,82	4,45

Source: E3ME

It is important to emphasise the assumption made in this modelling that revenues from auctioned ETS allowances are supposed to be recycled into financing the energy-efficiency investment. However, in all policy scenarios the revenues are not enough to cover the scale of the investment, leading to an increase in direct taxation to cover the investment spending and preserve budget neutrality. Although modest in the medium to high ambition cases, in the EE40 scenario there would be noticeable increases in European tax rates.

Regarding the projected GDP impacts the two used macroeconomic models differ. This is mainly due to different assumptions regarding crowding-out effects. Both models are used to analyse possible effects.

In general the analysis and the different results shows, that EE policies beyond 2020 should be designed in such a way that crowding-out is limited to avoid negative GDP effects. To make it possible, accompanying policies should tackle the factors that could prevent unemployed people to fill the vacancies created by energy efficiency, which are mainly related to labour skills shortages and barriers to mobility. The factors that could provide stimulus to higher investments, leading to a "virtous cycle" with higher growth and more savings to fund more investments, are more complex to identify. This is also related to the confidence of the banking system and investors which can in general be favoured by a credible policy scenario providing stable incentives in the medium and long term.

Sectoral impacts

Looking at impacts by sector, it is clear that higher energy efficiency ambition drives consumption expenditures towards sectors producing energy efficient equipment (i.e. more efficient electrical appliances for households, retrofits, materials improving thermal integrity of buildings, etc.) and savings towards the financing of energy efficiency projects (i.e. insulation to improve thermal integrity, etc.). Demand shifts from energy producing sectors towards sectors which provide inputs to energy efficiency projects. The direct positive effect of increased energy efficiency expenditures on domestic activity, especially for sectors producing and installing the energy efficient equipment, is further strengthened by multiplier effect, which is the increased intermediate demand for goods and services due to sectorial interconnections and long supply chains. In the GEM-E3 model (and not the E3ME model, however,), expenditures in energy efficiency projects exert crowding-out effects on other investment projects that would have otherwise been undertaken.

Table 12 summarizes the effects on sectoral production in the policy scenarios as simulated in GEM-E3 modelling. Sectors delivering to energy efficiency products and services record increases in their production (particularly the construction sector).

Sectors with low exposure to foreign competition record relatively higher increases in their activity (i.e. construction and market services) while for sectors characterized by higher trade exposure (i.e. electric goods and chemicals) part of the increased demand is satisfied by imports, depending on the degree of exposure to foreign competition, thus the positive effect of increased expenditures on their activity is weakened. Demand for energy products falls in all scenarios causing both domestic production and imports to decrease.

Table 12. Impacts on production by sector in EU28 (2030) in GEM-E3 model

EU 28 Domestic production in 2030 (bn €'2010) % change from Reference for policy scenarios	Reference	EE 25	EE28	EE30	EE35	EE40
Agriculture	547,4	-0,44	-0,27	-2,33	-4,21	-4,11
Coal	8,2	0,69	-1,15	-11,21	-18,58	-24,60
Crude Oil	2,8	-0,81	-3,26	-6,82	-13,24	-17,72
Oil	261,9	-0,95	-1,58	-4,78	-7,79	-10,84
Gas Extraction	4,6	-1,46	-4,10	-11,57	-18,03	-23,19
Gas	25,1	-1,33	-6,28	-24,63	-35,80	-44,17
Electricity supply	320,6	-1,17	-6,72	-20,11	-32,01	-41,32

Ferrous metals	242,8	2,52	8,83	11,54	24,22	27,81
Non ferrous metals	730,7	0,82	2,52	3,63	7,80	9,28
Chemical Products	1334,8	-0,33	3,12	6,05	9,07	12,75
Paper Products	623,7	-0,09	0,27	0,65	1,02	0,79
Non metallic minerals	437,9	2,13	6,18	10,06	17,72	24,35
Electric Goods	481,1	-0,09	-0,27	0,33	0,71	0,14
Transport equipment	1490,7	0,35	0,66	1,09	1,40	1,81
Other Equipment Goods	1852,7	0,17	0,78	1,32	2,82	0,43
Consumer Goods Industries	2066,1	0,05	0,34	0,22	0,16	-0,13
Construction	2524,9	0,99	3,42	6,07	11,14	16,28
Transport (Air)	295,4	1,68	1,62	2,69	2,28	2,19
Public Transport (Land)	1545,4	0,51	0,66	1,11	1,44	1,57
Transport (Water)	271,9	0,19	0,12	0,28	0,30	0,06
Market Services	11108,0	-0,02	0,01	0,44	0,63	0,65
Non Market Services	4623,2	-0,02	-0,05	0,06	-0,06	-0,09

Source: GEM-E3 model

The results in E3ME modelling are different because of the underlying assumptions about investment financing, which is not affected by the crowding-out. Table 13 shows the main impacts at broad sectoral level. Similarly as in GEM-E3 modelling, the sectors that benefit the most in all the scenarios are the ones that produce investment goods related to energy efficiency products and services, such as construction and engineering. The non-energy extraction sector is also expected to benefit, as it supplies the construction sector with raw materials.

The effects on other sectors are more nuanced. Consumer goods producing sectors are the most affected by the tax increase needed to finance the energy-efficiency investment. On the other hand, distribution activity also benefits from the increased activity in the investment sectors. Consequently, output in these sectors is expected to be higher, but by a smaller amount than in other sectors not so closely linked to consumer expenditure patterns.

The energy-efficiency savings are expected to lead to reduced use of electricity and gas, resulting in a fall in output in the sectors supplying them, and so output in the utilities sector is substantially lower than in the reference case.

Table 13. Impacts on output in key sectors in EU28 (2030) in E3ME model

EU28 Output in 2030 (in bn €2010) % change from Reference for policy scenarios	Reference	EE25	EE28	EE30	EE35	EE40
Agriculture	483	0,30	0,33	0,33	0,13	-0,14
Extraction Industries	116	-0,29	-0,23	0,23	2,39	7,02
Basic manufacturing	3.762	0,61	0,96	1,43	3,08	7,56
Engineering and transport equipment	3.752	1,06	1,86	2,80	6,18	14,67

Utilities	910	-3,04	-6,12	-8,01	-12,24	-17,92
Construction	2.175	1,61	4,46	7,64	18,13	41,88
Distribution and retail	3.401	0,53	0,56	0,58	0,65	1,40
Transport	1.609	0,35	0,53	0,77	1,51	3,03
Communications, publishing and television	2.971	0,56	0,86	1,21	2,22	4,74
Business services	7.331	0,51	0,72	0,98	1,73	3,74
Public services	4.958	0,13	0,13	0,12	0,01	-0,23

Sources: E3ME

Whereas in both models the negative and positive impact on certain sectors appears intuitive (e.g. construction and gas) other impacts necessitate further interpretation against the assumptions used in the model.

Employment effects

As an important assumption, the baseline modelling based on GEM-E3 projects persisting unemployment (frictional unemployment under equilibrium conditions) in the EU in 2030 which implies that unused labour resources exist and can be used in more labour-intensive scenarios with only small effects on the equilibrium wage rates. This modelling assumption is more realistic than standard general equilibrium projections that would assume no labour resources availability in the future.

In general, in GEM-E3, the energy efficiency expenditures inherent to each policy scenarios induce increased employment for all scenario mostly in 2030 and less afterwards without strong effects on wage rates (because of the assumption mentioned in the paragraph above). The positive labour impacts combined with negative impacts on GDP imply that the EU economy becomes more labour intensive under energy efficiency assumptions. The employment multiplier effect depends on the labour intensity of the sectors delivering inputs to energy efficiency projects (relatively high for sectors like market services, high-tech manufacturing) and the energy sectors (relatively low labour intensity) as well as on the share of domestically produced inputs to total inputs used in the production process (high shares of domestically produced inputs in the production process imply that an increase in the sectorial activity is associated with an increase in employment of sectors of domestic origin rather than that of sectors located outside the EU).

From the **GEM-E3** modelling results, it is clear that total labour demand and employment are affected to a greater extend by positive changes in the activity of the more labour intensive sectors of energy efficiency products and services as well as building renovation. The decreased labour demand in energy sectors is thus more than compensated. In 2030, the positive effects of different levels of ambition of EE polices range between 0.5 and 3% in comparison to the Reference.

Table 14. Employment impacts in EU28 (2030, 2040, 2050) in GEM-E3 model

% change from Reference for policy scenarios	2030	2040	2050
Reference EU 28 employment (in million people)	218,76	211,24	204,08
EE25	0,50	0,48	0,57
EE28	1,47	0,67	0,71
EE30	1,90	0,81	1,07
EE35	2,53	0,97	1,24
EE40	2,96	1,21	1,59

Source: GEM-E3 model

The time pattern of employment changes indicate strong positive effects at times of implementation of energy efficiency expenditures and smaller effects at times subsequent to implementation.

Changes in employment follow the changes in sectoral demand and production as a result of energy efficiency expenditures (see table 15), particularly the increase in production of relatively labour intensive sectors (services sectors which provide inputs to energy efficiency projects) or sectors with significant forward and backward linkages with other sectors of the economy (construction sector).

Table 15. EU28 sectoral employment impacts (2030) in GEM-E3 model

Sectoral Employment EU28 (% change from Reference)	Reference in millions of persons	EE25	EE28	EE30	EE35	EE40
Agriculture	7,75	1,09	2,92	1,07	-0,83	-1,17
Coal	0,11	1,89	2,16	-8,05	-14,69	-20,42
Crude Oil	0,01	4,65	9,31	9,52	2,74	2,76
Oil	0,16	0,43	1,65	-0,78	-4,18	-6,57
Gas Extraction	0,01	4,09	7,09	3,38	-2,51	-4,99
Gas	0,31	2,13	1,86	-10,95	-23,15	-29,62
Electricity supply	3,64	1,52	-0,89	-11,01	-21,39	-29,56
Ferrous metals	1,07	4,62	13,14	16,72	27,43	31,73
Non ferrous metals	4,63	1,46	4,08	5,41	9,16	10,78
Chemical Products	5,32	0,16	4,74	6,83	10,49	14,40
Paper Products	4,28	0,16	0,85	1,22	1,37	1,02
Non metallic minerals	2,90	2,60	7,76	11,41	18,88	25,79
Electric Goods	1,66	0,45	1,26	2,00	2,74	2,32
Transport equipment	5,83	0,89	1,93	2,30	2,61	3,15
Other Equipment Goods	11,82	0,77	2,28	2,89	4,26	2,08
Consumer Goods Industries	11,42	0,75	2,03	1,83	1,56	1,32
Construction	18,07	1,42	4,88	7,97	13,64	19,12

Transport (Air)	1,01	1,64	1,74	2,87	2,53	2,34
Public Transport (Land)	7,79	0,65	1,47	2,27	2,47	2,93
Transport (Water)	0,75	0,12	0,12	0,35	0,27	0,16
Market Services	53,65	0,23	0,66	1,25	1,47	1,59
Non Market Services	76,56	0,09	0,24	0,42	0,31	0,26

Source: GEM-E3

In **E3ME**, employment is determined primarily by the level/growth of economic output analysed above as well as relative labour costs and consequently shows less pronounced effects than in GEM-E3 modelling. As presented in the table below, up until 2020 there is very little change in overall EU28 employment levels in the scenarios and even up to 2025 the changes are quite small. However, once the energy-efficiency investment starts to grow quickly after 2025, employment is expected to increase substantially. In 2030, the positive effects of different levels of ambition of EE polices range between 0.3 and 1.5% in comparison to the Reference. In the EE40 scenario, the increase in employment levels could be up to 3.5% by 2030. These results of the EE40 scenario are of course subject to more uncertainty and possible labour market constraints.

Table 16. Employment impacts in EU28 (2030) in E3ME model

% change from Reference for policy scenarios	2020	2025	2030
Reference EU 28 employment (in million people)	233,503	232,971	231,726
EE25	0,02	0,07	0,23
EE28	0,02	0,08	0,29
EE30	0,02	0,19	0,35
EE35	0,02	0,31	0,62
EU28	0,01	0,27	1,50

Source: E3ME

The outcomes for sectoral employment as presented in Table 15 broadly follow those for sectoral output described above, with construction, engineering and their supply chains benefiting the most. The largest increase in employment is expected in the construction sector, on the assumption that a large share of the investment will require construction or installation activities. Relatively more modest increases are also projected in the engineering and transport equipment sector as well as basic manufacturing.

Employment in distribution and retail and business services is expected to fall, despite the increase in output in these sectors. The reason for this is that higher employment levels overall (mainly due to the relatively labour-intensive construction sector) and lower unemployment lead to increases in wage demands, a form of labour market crowding out. Employment in utilities is also predicted to fall, in line with the projected fall in output in the sector.

Table 17. EU28 sectoral employment impacts (2030) in E3ME model

Change from Reference for policy	Reference	EE25	EE28	EE30	EE35	EE40

scenarios	(in millions of persons)					
Agriculture	9,726	0,21	0,04	-0,10	-0,95	-3,06
Extraction Industries	0,479	-1,25	-1,67	-1,46	-0,84	-2,51
Basic manufacturing	14,868	0,28	0,32	0,46	0,94	2,11
Engineering and transport equipment	15,268	0,58	0,69	0,90	1,72	3,81
Utilities	2,274	0,09	-1,36	-3,47	-6,29	-8,00
Construction	16,524	0,71	2,11	3,59	8,57	19,77
Distribution and retail	35,266	0,13	-0,03	-0,18	-0,73	-1,75
Transport	9,388	0,17	0,14	0,18	0,22	0,12
Communications, publishing and television	20,278	0,23	0,27	0,36	0,62	1,45
Business services	40,985	0,33	0,24	0,12	-0,12	-0,28
Public services	66,671	0,05	0,07	0,03	0,02	0,36

Source: E3ME

5.3.4. Environmental impacts

As explained in Annex V, all scenarios feature assumptions on policies which reduce non-CO_2 GHG emissions. The volume of reduction of these emissions as achieved by the GHG40 scenario from the 2030 IA has been used as a starting point. The policies to reduce non-CO_2 GHG emissions do not belong to the domain of the energy efficiency (mainly agriculture and waste treatment are concerned). In the GHG40 a certain amount of non-CO_2 GHG emissions reduction was necessary in order to reach 40% GHG reduction in 2030. Because of the higher level of energy savings in the EE policy scenario modelled in this IA the contribution of non-CO_2 GHG emissions to achieve the 40% GHG target decreases.

Total GHG reductions in 2030 for the modelling scenarios are in line with 40% GHG reduction target proposed in 2030 framework for EE27 to EE30 scenarios. While and EE35 overshoots this target slightly, reaching 41%, for EE40 the overshooting is significant (44%) taking into account the strong EE policies. All scenarios reach in 2030 between 42-46% **reductions in the ETS sector** (in comparison to 2005) and in **non-ETS sectors** between 28-35% reductions (in comparison to 2005) – broadly in line with the respective reductions referred to in the 2030 Communication.

With regard to **emission reductions in 2050**, the scenarios are all consistent with deep decarbonisation in 2050 and show rather similar additional emission reductions to Reference ranging from 76 to 80%, with scenarios EE27 to EE30 achieving less.

Table18. ETS and non-ETS emissions

Indicator *(figures are presented in a 2030/2050 format)*	**Ref**	**GHG40**	**Decarbonisation Scenarios**					
			EE27	**EE28**	**EE29**	**EE30**	**EE35**	**EE40**

Total GHG emissions (% to 1990)	-32.4 / -43.9	-40.6 / -79.6	-40.1 / -77.6	-40.2 / -78	-40.1 / -78.3	-40.1 / -78.5	-41.1 / -79.5	-43.9 / -80.2
ETS (% to 2005)	-36.1 / -59.3	-43.3 / -87.1	-45.3 / -85.6	-44.4 / -85.7	-43.3 / -85.7	-42.2 / -85.7	-41.8 / -85.8	-45.6 / -86.5
Non-ETS (% to 2005)	-20.3 / -22.9	-30.5 / -70.3	-27.6 / -67.6	-28.7 / -68.3	-29.5 / -68.9	-30.5 / -69.4	-32.9 / -71.2	-35.3 / -72

Source: PRIMES 2014

Some differences between the scenarios are visible in **sectoral GHG emission** reductions in comparison to 2005. Looking at scenarios that achieve close to 40% GHG reductions[66], in a 2030 perspective, the **power generation** and **tertiary** sectors are projected to experience the biggest reduction across all policy scenarios. For power generation, reductions remain relatively constant across scenarios from -54 to -60% (wrt 2005), with the effectiveness of the EE policies in reducing energy consumption taking over ETS prices as the driving force for emission reductions in the sector as EE ambition increases. In the residential sector, reductions range from -34 to 63% (wrt 2005) and for the tertiary sector, reductions range from -51 to -73% (wrt 2005). In both sectors reductions increase together with the ambition of EE policies, reducing the effort required for industry and power generation, and are significantly higher than those achieved by Reference. In **transport**, the reductions are smaller (between -16.7 and -17.5%) and only slightly deeper than in Reference.

In a 2050 perspective, again only looking at scenarios that achieve close to 40% GHG reductions, emission reductions increase significantly across all sectors as they are all compatible with the 2050 GHG objective. The power sector is almost fully decarbonised as with -95 to -97% reductions compared to 2005 it remains the sector with the highest reductions. The transport sector sees the lowest: -61% to -64% reductions.

If changes in sectoral GHG emissions are compared to Reference, the key insight in a 2030 perspective is that in all final energy demand sectors the reductions are increasing their magnitude in line with the level of ambition of the scenarios, except for the power generation sector where strong EE policies result in slightly smaller reductions because of lower ETS prices and the fact that majority of GHG reductions happen in non-ETS sector.

Table 19. Sectoral CO2 emission impacts compared to 2005

Indicator *(figures are presented in a*	**Ref**	**GHG40**	**Decarbonisation Scenarios**					
			EE27	**EE28**	**EE29**	**EE30**	**EE35**	**EE40**

[66] For EE40 scenario the trend described below does not show because of higher GHG reduction.

2030/2050 format)								
Power generation. CHP and district heating	-46.7 / -72.9	-56.5 / -97.7	-57.9 / -95.6	-56.6 / -95.3	-55.5 / -95.5	-54.6 / -95.7	-54 / -96.1	-60 / -97.2
Industry (energy + processes) [67]	-22.5 / -43.8	-27.4 / -77.8	-31.5 / -76.7	-30.8 / -77.1	-29.8 / -76.8	-28.6 / -76.2	-29.1 / -75.7	-29.7 / -76
Residential	-26.7 / -34.1	-34.1 / -80.3	-33.8 / -75.7	-37.5 / -78.2	-40.3 / -80.8	-44 / -82.9	-53.1 / -86.8	-62.9 / -90.3
Tertiary [68]	-40.1 / -48.3	-48.2 / -85.6	-50.5 / -77	-55.6 / -79.4	-58.5 / -81.4	-60.8 / -82.9	-66.6 / -85.4	-73 / -87.7
Transport	-11.6 / -10.3	-13.6 / -63.5	-16.7 / -61.3	-16.8 / -61.4	-17.1 / -61.5	-17.3 / -61.7	-17.5 / -64.2	-17.4 / -64.2

Source: PRIMES 2014

Table 20. Sectoral CO2 emission impacts compared to Reference

Indicator *All indicators are presented as % increase/decrease in comparison to the Reference for 2030/2050*	**GHG40**	**Decarbonisation Scenarios**					
		EE27	**EE28**	**EE2**	**EE30**	**EE35**	**EE40**
Power generation, CHP and district heating	-9.8 / -51	-11.2 / -48.9	-9.9 / -48.6	-8.8 / -48.8	-7.9 / -49	-7.2 / -49.4	-13.2 / -50.5
Industry (energy + processes) [69]	-4.9 / -55.3	-9.1 / -54.2	-8.3 / -54.7	-7.3 / -54.3	-6.1 / -53.7	-6.6 / -53.2	-7.2 / -53.5
Residential	-7.5 / -53.6	-7.1 / -49	-10.8 / -51.5	-13.7 / -54.2	-17.3 / -56.2	-26.4 / -60.1	-36.2 / -63.7
Tertiary [70]	-8.1 / -45.5	-10.4 / -36.9	-15.5 / -39.4	-18.4 / -41.3	-20.7 / -42.9	-26.6 / -45.3	-32.9 / -47.6
Transport	-1.9 / -51.9	-5.1 / -49.7	-5.2 / -49.7	-5.4 / -49.9	-5.6 / -50	-5.8 / -52.5	-5.8 / -52.5

Source: PRIMES 2014

5.3.5. Additional environmental and health impacts

As indicated in the 2030 IA environmental and health benefits associated with higher energy efficiency should also be taken into account when considering costs and benefits. Although these effects were not modelled as part of this specific impact assessment the 2030 IA indicates that *"reduced fossil fuel consumption improves health conditions through lower emissions of pollutants and lowers costs for air pollution control with benefits being disproportionately larger in lower income Member States expressed as a % of GPD and much larger in scenarios with ambitious energy efficiency policies and a renewables target."* These findings based on modelling find

[67] Including energy industries, such as refineries and coke production.
[68] The tertiary sector includes the small energy-related emissions from agriculture.
[69] Including energy industries, such as refineries and coke production.
[70] The tertiary sector includes the small energy-related emissions from agriculture.

confirmation in ex-post evaluations of existing energy efficiency programmes. For example research undertaken in Northern Ireland on the impact of the Warm Homes Scheme 2000-2008 (a free, government-funded retrofit scheme for households in energy poverty) has demonstrated that 42% of the cost of the programme could be offset against reduced healthcare costs. This implies that every euro spent on house retrofits yields a saving of 42 cents in terms of healthcare no longer needed.

In addition to health impact and lower GHG emissions other environmental impacts associated with higher energy efficiency include the following:

- Reduction of pollution resulting from energy extraction, transformation, transportation and use. This applies primarily to air pollution resulting from energy combustion but it also applies to e.g. soil and water pollution. Co-benefits in terms of human health and ecosystems state can subsequently be expected;

- Reduction in resources used for energy extraction, transformation, transportation and use: For instance, water used for energy purposes (hydropower, cooling of power stations, irrigation) is significant. Therefore, increasing energy efficiency also leads to water savings. And this also applies to land and materials use, hence leading to several co-benefits in terms of resource efficiency.

The higher the energy efficiency target, the higher these environmental co-benefits would be.

5.3.6. Competitiveness and Affordability of energy

From the perspective of **affordability of energy**, the key items are both operational and capital expenditure related to energy use. Operational expenditure (cost) is clearly dependent on both energy prices (which are projected to rise in the longer term) and consumption volumes, the latter impacted by the efficiency of energy use. These expenditures need to be compared to available household income. Energy costs as such are of particular relevance for those consumers which have very low incomes or that, for other reasons, cannot take advantage of cost saving energy efficiency investments.

While fossil fuel prices are treated as exogenous in the PRIMES modelling work, the **price of electricity** is not. The analysis in the chapter above indicates that most significant price increases happen already in the Reference scenario, mainly until 2020. After 2020, prices are rather stable in the Reference scenario. Average **electricity price changes** in different scenarios (compared to the year 2010) are very small. For example, while average electricity price increase (compared to 2010 price) in Reference is 31%, it ranges between 32 and 35% in policy scenarios in 2030 and the changes are only slightly higher in 2050 perspective. **Electricity price changes compared to the Reference** are also very small in 2030 ranging from 1 to 3% in the year 2030, with smallest increase in the EE35 scenario.

The share of energy costs in value added created by energy intensive industries remains stable among the Reference and policy scenarios in 2030. It grows slightly in longer-term perspective. For households, the share of energy-related costs (both including and excluding transport) grows slightly already in 2030 as the scenarios achieve more energy savings and continues to grow in 2050 perspective.

Table 21. Share of energy costs in household expenditure and energy intensive industries value added

Indicator *(figures are presented in a 2030/2050 format)*	**Ref**	**GHG40**	**Decarbonisation Scenarios**					
			EE27	EE28	EE29	EE30	EE35	EE40
Share of energy costs in energy intensive industries value added[71]	41.8 / 41.0	42.1 / 54.2	43.9 / 50	43.7 / 51.5	43.6 / 51.5	43.5 / 51.2	43.8 / 50.1	44.1 / 49.8
Share of energy related cost (including transport) in household expenditure (In 2010: 12,4)	14.6 / 12.6	14.8 / 14.1	14.8 / 13.6	15 / 13.8	15.2 / 14.3	15.5 / 14.8	16.5 / 16.3	18.6 / 18.5
Share of energy related cost (excluding transport) in household expenditure (In 2010: 7.5)	9.3 / 8.0	9.4 / 8.7	9.5 / 8.3	9.7 / 8.6	9.9 / 9	10.1 / 9.5	11.1 / 11	13.2 / 13.2
Avg. electricity price incr. compared to 2010 price	30.8 / 30.1	33.3 / 36.2	34.1 / 38.9	33.2 / 37.7	32.6 / 36.7	32.4 / 35.12	31.9 / 35.3	35.2 / 35.6
Average electricity price change compared to Ref. (percentage points)	n.a.	1.9 / 4.7	2.5 / 6.8	1.8 / 5.8	1.4 / 5.1	1.2 / 3.9	0.8 / 4	3.3 / 4.2

Source: PRIMES 2014

5.4. Architecture of the 2030 energy efficiency policy framework

5.4.1 Overall architecture

Chapter 4 identified the following options:

I No action

II Indicative EU target coupled with specific EU policies and indicative MS targets

III Binding EU target coupled with specific EU policies and indicative MS targets

IV Binding MS targets

[71] Percentage of energy costs excl. auction payments to value added in energy intensive industries in PRIMES. For Reference Scenario corresponding value was 38.2% in 2010.

These options will be compared against the following criteria:

- Effectiveness (achievement of the objectives identified in Chapter 3)
- Economic efficiency (cost-effectiveness)
- Coherence (with the overall EU energy and climate policy framework and its objectives)

Under Option I the policy framework post 2020 would not include a target for energy efficiency. This implies that the framework would not benefit from: (i) a benchmark for tracking progress and making policy adjustments; (ii) a signal to relevant actors, such as investors and consumers, about the policy direction; (iii) a basis for additional policy elements, such as prioritisation for funding through the European Structural and Investment Funds. Without an overall target trade-offs between energy efficiency solutions in different sectors of the economy could be harder to assess, potentially increasing the marginal cost of energy efficiency improvements. Certain policy tools, such as Ecodesign and the EPBD, would continue to apply. Nevertheless, the contribution of energy efficiency would certainly be lower and its cost for a given ambition level would be likely to be higher. Given the low carbon abatement cost of many energy efficiency options and their contribution to GDP and job creation, this would be neither coherent with the current energy and climate goals nor economically efficient. The effectiveness of Option I in achieving the EU's energy and climate goals would also be limited compared to the current setting.

Option II would be a continuation of the current approach, retaining the benefits described above and the added value of ensuring a continuity of a framework to which relevant stakeholders, including Member States, have become accustomed. An indicative energy efficiency 2030 target would accommodate the differences in the national/domestic markets and their energy efficiency potentials. It would also limit the risk of imposing too much rigidity on the overall energy and climate framework which includes also the GHG and RES targets, and thus potentially limit costs of GHG abatements. On the other hand, the indicative nature of the current target has sometimes made it difficult to mobilise the necessary policy effort. For example, experience with the setting of indicative national targets under Article 3 of the EED in 2013 has shown that there is only limited scope for adjusting them when their sum remains below the overall EU target. While being coherent with the current energy and climate policy framework and providing for economic efficiency, the effectiveness of this approach is in some respects limited.

Option III would replicate the approach proposed by the Commission in the 2030 Communication for a future RES target. National plans would include an explicit aim of contributing to the overall EU target for energy efficiency[72]. If a review by the

[72] In particular, the national plans should set out a clear approach to achieve domestic objectives regarding greenhouse gas emissions in the non-ETS sector, renewable energy, energy savings, energy security, research and innovation and other important choices such as nuclear energy, shale gas, carbon capture and storage.

Commission showed an insufficient level of ambition, an iterative process would take place with the aim of reinforcing the content of the plan(s). This approach implies that an additional lever is put in place to ensure that the collective national policy ambitions correspond to the EU target. This would increase effectiveness. This approach also has the merit of ensuring coherence with the governance of put forward in the 2030 Communication into which energy efficiency would be integrated, helping increase the economic efficiency of its implementation. In terms of economic efficiency the need to consult neighbouring Member States as part of the establishment of national plans would mean that decisions about managing energy demand and deciding on supply options would be better coordinated among Member States across the internal energy market. On the other hand it can be argued that, in theory, the setting of a binding energy efficiency target in addition to GHG and RES target could add rigidity to the system, bringing, under certain conditions, higher costs of GHG abatement than the marginal cost of abatement required to reach the cap in the ETS sector. This can be avoided by establishing the target at a level that is coherent with the other targets and allowing for periodical adjustments on the basis of developments in the economy or other. The analysis included in section 5.3 indicates that savings up to 35% are coherent with the 40% GHG and 27% RES targets, as they do not lead to overshooting the 40% target or to altering the size of emission reductions between the ETS and non-ETS sectors.

Under Option IV there would be a restructuring of the current policy setting. Much would be devolved to Member States, with EU-wide rules maintained only in areas fully relevant to the internal market, such as product efficiency requirements. This is because fully allocating policy responsibility to the national level implies that policy tools be allocated accordingly[73]. Experience with the renewable energy Directive shows that this approach can be a strong driver for national action: a target at Member State level can ensure political accountability and commitment to deliver results while providing flexibility to choose and apply the most suitable tools to achieve the target. On the other hand important synergies in policy making (e.g. common methodologies for establishing cost-optimal levels for building renovations) would be lost. The effectiveness of this approach remains uncertain, therefore. Regarding coherence this approach would run counter to recent proposals on governance. In addition, possible increases in administrative cost linked to fragmented EU action and potential harm to businesses operating across the internal market would limit the economic efficiency of this approach. Moreover, a basis for the shared efforts between Member States would have to be devised, taking into account for example such factors as the energy efficiency potential, early action, the structure of the economy. Such considerations are beyond the scope of this impact assessment.

[73] The opposite has been also argued, namely that a binding target would be a driver for Member States to make full use of existing provisions, notably under the EPBD and the EED (*How to shape a binding energy savings target for Europe that allows for effective evaluation?*, R. Harmsen, B. Wesselink, W. Eichhammer).

5.4.2 Formulation of a 2030 target

Chapter 4 identified the following options:

A. Consumption target

B. Intensity target

C. Hybrid approach

These approaches will be compared with regard to their effectiveness, efficiency and coherence, as well as their transparency and ease of monitoring (identified as key criteria for targets by the EU 2020 strategy[74]).

Energy **consumption** is the most straightforward option. It is most directly related to long term decarbonisation objectives. This indicator is, however, directly influenced by the development of the economy. If growth turns out to be higher than anticipated, realising the target will require additional energy efficiency measures, potentially making them no longer cost-effective. If on the other hand growth is lower than anticipated, the target can be met without the energy efficiency improvements that were originally envisaged and therefore some of the cost-effective potential will not be realised.

Energy **intensity** is defined as a ratio between energy consumption and an indicator of economic activity (GDP, added value). Its use can eliminate the dependency of the target on the rate of economic development. On the other hand, changes in energy intensity can sometimes result from structural changes that do not reflect real improvements (e.g. a shift from energy-intensive industries to higher value-added ones). And energy consumption in some sectors is not closely linked to the development of the economy.

Thus, consumption and intensity indicators each have pros and cons. Factoring in a target the dynamics of the economy can be done through the following options:

i. Formulating a target based on two components with an absolute energy consumption component corresponding to the share of energy consumption in those sectors where the correlations between energy consumption and economic growth is low (residential, services, and generation), and intensity component corresponding to the energy consumption of those sectors where this correlation is high (industry, transport). An analysis of these correlations is included in Annex IV.

[74] European Commission 2010.

ii. Establishing a single target formulated in absolute terms as it is today, with a review clause allowing for adjusting the target in case changes in the economy significantly differ from the assumptions made when the target was established.

Option i) has the downside of being expressed in a relatively complex way which potentially weakens the role of the target in benchmarking progress. The establishment of the target would also be fairly complex, including the decision on the split between the 'absolute' and 'intensity' shares and taking into account primary energy conversion factors in the different sectors. At the same time it provides for an automatic adjustment of the efforts required to the changes in economic cycles. The opposite can be said of option ii): while it is expressed in a clear way it would be up for revision providing less certainty for policy and market actors, and it would be devoid of an automatic adjustment mechanism. This could be however overcome if the circumstances under which a revision happens and the margin by which the target is corrected are clearly defined.

5.5. The role of financing

There is evidence of increasing momentum for energy efficiency financing. The draft Operational Programmes beginning to be submitted under the European Structural and Investment Funds indicate an increase in sums allocated for the low–carbon economy, in some cases significantly above the minimum requirements for this objective. Also there is a general shift from grants towards a greater use of financial instruments (leveraging private capital), such as soft loans or guarantees.

Reaching the level of energy-savings considered in this impact assessment will require significant additional investments which will have to be primarily private. Public money, including the European Structural and Investment funds will have to be used to leverage these private investments and the right regulatory framework will have to underpin them. About €38 billion that has been set aside for low carbon economy investments under the Structural and Investment Funds (ESIF) 2014-2020 – and this sum can be multiplied by attracting private capital through Financial Instruments to deliver the necessary investments.

The additional investments in energy efficiency will range from €48 bn to €216 bn annually over the period 2011 to 2030 depending on the chosen level of ambition. These sums are significant, especially at the upper end of the range, but it is useful to put them in perspective: For illustration, institutional investors in the EU (adherents of the Principles of Responsible Investments initiative) currently manage over €12 trillion of funds, and the amount invested in private real estate is estimated at over €1.5 trillion in 2012.

To unlock the desired level of investment[75], it will be necessary to address the main identified drivers of energy efficiency investment. According to the Energy Efficiency Financial Institutions Group[76], these are the following:

- The benefits of energy efficient refurbishments of buildings and energy efficiency investments in SMEs and industry need to be captured and well-articulated, with evidence, to key financial decision makers (public authorities, buildings owners, managers, householders, CEOs and CFOs of companies). To achieve this, three requirements need to be met: (a) the full benefits of energy efficiency investments must be identified, measured and presented for each investment in ways in which key financial decision makers can understand and respond to; (b) the evidence and data must be easy to access and cost effective to compile and assess in investment decision making processes; (c) internal procedures, reporting and accounting systems should be adapted so as not to additionally handicap viable energy efficiency investments.

- Processes and standards for energy performance certificates, building codes and their enforcement need to be strengthened and improved. A step change in how energy efficiency potential is identified, measured, reported and verified is needed and achieving this is fundamental to unlocking the market at scale.

- Making it easy to get the right data to the right decision makers: There are too many hurdles between the relevant and credible data and the decision makers who need it; and the processes and resources required to extract that data and qualify it appear specialist and costly. For energy efficiency investments in buildings to enter the mainstream, it must be as easy for a key property decision maker to understand and value the benefits of those investments as it is for other comparable decisions. The data structures must clearly enable the connection and validation of value increases (in the broadest sense) with energy efficiency investments[77].

- Standards should be developed for each element in the energy efficiency investment process, including legal contracts, underwriting processes, procurement procedures, adjudication, measurement, verification, reporting, energy performance (contracts and certificates) and insurance.

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[75] For illustration, the institutional investors (signatories of the charter of Principles of Responsible Investment) manage over €12 trillion of funds (amount invested in private real estate is estimated as over €1,5 trillion in 2012).

[76] Energy Efficiency Financial Institutions Group Report (2014); http://ec.europa.eu/energy/efficiency/studies/doc/2014_fig_how_drive_finance_for_economy.pdf

[77] Bullier, A., Sanchez, T., Le Teno, J. F., Carassus, J., Ernest, D., & Pancrazio, L. (2011). *Assessing green value: A key to investment in sustainable buildings.* Retrieved from: http://www.buildup.eu/sites/default/files/content/Assessing%20Green%20Value%20-%20Bullier,%20Sanchez,%20Le%20Teno,%20Carassus,%20Ernest%20and%20Pacrazio%20-%20ECEEE%202011.pdf

The use of standardised MRV and legal documentation is particularly important to facilitate the bundling of investments for recycling to the bond market – creating a route to significant volumes of capital market finance.

- Priority and appropriate use of EU Funds (in particular ESIF) and ETS revenues through public-private financial instruments from 2014-2020 will boost investment volumes and help accelerate the engagement of private sector finance through scaled risk-sharing: Scalable models and successful case studies of dedicated credit lines, risk sharing facilities and on-bill repayment schemes abound. Member States should be encouraged to move away from traditional grant funding and look more to identifying the working models which best address the energy efficiency refurbishment investment needs in their buildings (as articulated in their National Buildings Refurbishment Strategies). ESIF 2014-2020 funding (and other sources such as ETS revenues) will be required to kick-start and complement national energy efficiency funds (EED Art 20) and energy supplier obligations (Art 7) to deliver Europe's 2020 targets and National Buildings Renovation Strategies (Art 4).

6. CONCLUSIONS

6.1. Policy options for 2020

The analysis suggests that the best approach for **achieving the 2020 target** is to focus on the implementation of existing legislation. This is based on the following premises:

- The gap to the 2020 target is not expected to exceed 2 percentage points;
- Proposing new legislation now would not have a significant effect by 2020 and could be disruptive;
- A better implementation of current legislation and policies can close the gap.

Efforts need to be focused on the proper implementation of the EED, improved implementation of the EPBD and strengthened enforcement of product regulations – exploiting opportunities for improved financing, including from the European Structural and Investment Funds, to the full.

6.2. Ambition level 2030

6.2.1 Energy system impacts including security of supply

The analysis shows that, in all scenarios, energy efficiency policies reduce effectively energy consumption (both primary and final) and decrease the energy intensity as compared to the Reference scenario.

The different policy scenarios demonstrate some differences in terms of the consumption of various primary energy sources. Notably for solids, their share in fuel mix in 2030 does not change in EE27, EE28 and EE29 in comparison to the Reference whereas for EE30, EE35 and E40 their share grows slightly. The absolute consumption of solids in 2030 declines substantially in all except EE35 scenario. The shares of natural gas in 2030 decline slightly in all scenarios (in comparison to the Reference) with the declines more pronounced as the scenarios achieve more energy savinggs. The reductions in absolute consumption are, however, more pronounced – with more energy savings. The absolute consumption of RES grows but with high levels of energy consumption sheer reduction of energy consumption lessens the need for RES development in absolute consumption. The shares of renewables grow, however, in all scenarios – driven by the RES target as proposed in the 2030 framework and decarbonisation in longer term perspective.

Energy efficiency has a significant impact on security of supply and the level of gas imports in particular. Energy efficiency policies achieving 40% savings, would result in 2030 in lowering gas imports by as much as 40% in comparison to 2010, whereas in the Reference the imports would grow by 5% in that year. Already energy savings of 30% achieve a 22% decrease. Net energy import decreases translate into savings in the energy fossil fuels imports bill. For the period 2011-2030 cumulative savings range from €285 bn to €549 bn and for the period 2031-2050 from € 3349 bn to € 4360 bn.

6.2.2 Economic impacts

Energy system costs increase in all scenarios compared to the Reference. Increased energy efficiency ambition leads to average annual energy system costs (2011-2030) in policy scenarios that are between 0.01 and 0.79 percentage points of GDP higher than the Reference.

The additional increases are higher in 2050 and reflect the costs necessary to achieve the overarching decarbonisation objective, including also the costs of energy efficiency policy. Regardless of the method of comparison, the additional increases are smaller than those resulting under the Reference itself.

There is a general shift in the structure of costs with diminishing energy purchases and increasing capital costs and direct efficiency investments. The decreasing energy purchases with higher EE levels counterbalance to a certain extent the other two components. For the period 2011-2030, the average direct efficiency investments are between €16 bn to €181 bn higher than for the Reference.

Investments increases sharply in all scenarios - more significantly in more ambitious scenarios and again mostly in residential and tertiary sectors.

Electricity price changes compared to the Reference are also very small in 2030 ranging from 1% to 3% in the year 2030, with smallest increase in the EE35 scenario.

The ETS price differs substantially across the various scenarios, reflecting the important contribution of energy efficiency to emission reductions in the ETS sectors. Under EE35 and EE40, EE policies reduce significantly both costs and incentives from the ETS itself for other types of abatement. Regarding the ETS price, it is expected that the influence of EE policies on the ETS price will be mitigated by the structural ETS measures (back loading) and the market stability reserve which was proposed by the Commission.

GDP impacts for scenarios reducing emissions by 40% GHG can be either negative or positive depending on theoretical approach in modelling with the main driver being the magnitude of investments. In general-equilibrium modelling, the crowding out effect leads to negative results. If it is not assumed that all resources are fully employed, the effects on GDP are positive.

6.2.3 Social impacts

The overall net employment impacts, as for GDP, depend on the theoretical approach to modelling which determines the impact of investment on economic growth as well as the assumptions on the use of revenue from carbon pricing and the employment level assumed in the baseline. In general, employment is positively impacted by using carbon pricing revenue to lower labour costs. The analysis also suggests that the employment effect will overall be more positive in scenarios with stronger energy efficiency policies reflecting the significant job-creation potential in these areas – with magnitude of effect depending on theoretical approach.

Affordability of energy for households is already negatively affected under the Reference, but is not significantly affected compared to the Reference in policy scenarios. The scenarios with most energy savings slightly increase the share of energy-related costs in household budgets as energy efficiency improvements typically need investment resulting in capital cost increases. The extent to which households are able to proceed with such investment depends on the means of financing it.

6.2.4 Environmental impacts

In order to ensure consistency with the other objectives of the 2030 energy and climate framework, all scenarios (except for EE40) demonstrate reduced GHG emissions compared to the Reference in line with the GHG target proposed in 2030 framework as well as decarbonisation objective. All scenarios are consistent with the (at least) 27% share of renewables target.

Scenarios are broadly in line with regard to respective reductions in ETS and non-ETS sectors as proposed in 2030 framework. In all scenarios, the reductions in ETS sectors are close to 43% (wrt 2005) and the reductions in non-ETS sectors are close to 30% (wrt 2005). Only the EE40 scenario diverges from this pattern.

The balance of GHG reductions in the various sectors of the economy does not change between the scenarios as the mix of energy efficiency policies is not altered among the scenarios (it always follows the logic of current legislation and only the overall level of ambition intensifies). The highest reductions occur in the power generation sector (driven by ETS as proposed in 2030 framework) and in residential and tertiary sector (as the key EE policies address specifically these two sectors).

6.3. Architecture of the 2030 policy framework

The 2020 target proved to be a useful element of the policy framework providing a benchmark for tracking progress and making policy adjustments; a signal to relevant actors, about the policy direction; and a basis for additional policy elements. A post-2020 policy framework without a target would not benefit from these elements.

A purely indicative target would be economically efficient and coherent with the 2030 energy and climate policy framework. National binding targets would be incoherent with the proposed energy and climate policy framework. Their effectiveness and economic efficiency is uncertain.

The target formulation should take into account unexpected developments in the economy. This can be done either automatically (by formulating a hybrid target, with a component fluctuating according to changes in the economy) or through periodical revisions. Both approaches have advantages and drawbacks.

6.4. Financing

Significant energy efficiency improvements will require significant investments. These will have to be primarily privately financed although public investments, notably under the European Structural and Investment Funds will continue to play a role, notably in leveraging private capital. The business case for investing in energy efficiency need therefore to become more apparent to the financial sector and this will entail a number of actions, such as establishing reliable procedures for measuring and verifying energy savings, developing standards for energy efficiency investment processes and providing technical assistance in order to make energy efficiency projects bankable.

The table below gives an overview of the main impacts of the different scenarios assessed in Chapter 5. All impacts are with respect to 2030 if not otherwise stated, while keeping in mind that impacts and differences between scenarios may be quite different in a post 2030 perspective.

Table 22. Overview table with the key results for the IA for the different scenario projections

	Reference	GHG40	EE27	EE28	EE29	EE30	EE35	EE40
ENERGY SYSTEM IMPACTS								
Energy Savings in 2030 (*evaluated in % against the 2007 Baseline projections for Primary Energy Consumption)*	21.00%	25.10%	27.40%	28.30%	29.30%	30.70%	35.00%	39.80%
Gross Inland Energy Consumption (Mtoe)	1611 / 1630	1534 / 1393	1488 / 1423	1470 / 1380	1450 / 1338	1422 / 1286	1337 / 1196	1243 / 1129
- Solids share	10.8 / 7.6	10.1 / 9.5	9.9 / 9.5	10.4 / 9.4	10.8 / 9.4	11.3 / 9.3	12.9 / 9	12.4 / 9.2
- Oil share	32.3 / 30.5	32.8 / 13.5	32.4 / 14.2	32.6 / 14.5	32.7 / 14.8	33 / 15.3	34.2 / 15.6	36.2 / 16.4
- Natural gas share	24.6 / 24.3	22.5 / 17.9	22.5 / 19.5	21.9 / 19	21.5 / 18.6	21 / 18.3	19.2 / 18.3	18.5 / 17.6
- Nuclear share	12.5 / 13.2	13.1 / 18.1	12.7 / 17.2	12.8 / 17.4	12.7 / 17.4	12.5 / 17.1	11.8 / 16.5	11.1 / 15.8
- Renewables share	19.9 / 24.4	21.6 / 41	22.6 / 39.9	22.4 / 39.8	22.3 / 39.9	22.3 / 40.1	22 / 40.8	22.1 / 41.2
Energy Intensity (2010=100)	67 / 52	64 / 44	62 / 45	61 / 44	61 / 42	59 / 41	56 / 38	52 / 36
Renewables share in final consumption	24.4 / 28.7	26.5 / 51.4	27.8 / 49.9	27.7 / 50.1	27.7 / 50.4	27.7 / 50.6	27.4 / 51.8	27.4 / 52.3
Gross Electricity Generation (TWh)	3664 / 4339	3532 / 5040	3469 / 5038	3461 / 4936	3423 / 4796	3336 / 4560	3080 / 4267	2804 / 3969
- Gas share	19.5 / 17.3	15.3 / 12.5	14.8 / 12.5	14.2 / 12.3	13.8 / 11.9	13 / 11.2	10.2 / 11	9.8 / 10.3
- Nuclear share	21.8 / 21.3	22.6 / 21.6	21.5 / 20.8	21.5 / 20.9	21.3 / 20.8	21 / 20.7	20 / 19.8	19.1 / 19.1
- CCS share	0.45 / 6.9	0.77 / 14.72	0.65 / 14.53	0.58 / 13.67	0.41 / 12.98	0.27 / 11.83	0.29 / 10.65	0.3 / 10.19
ENVIRONMENTAL IMPACTS								
GHG reductions vs 1990	-32.4 / -43.9	-40.6 / -79.6	-40.1 / -77.6	-40.2 / -78	-40.1 / -78.3	-40.1 / -78.5	-41.1 / -79.5	-43.9 / -80.2
GHG emissions reduction in ETS Sectors vs 2005	-36.1 / -59.3	-43.3 / -87.1	-45.3 / -85.6	-44.4 / -85.7	-43.3 / -85.7	-42.2 / -85.7	-41.8 / -85.8	-45.6 / -86.5
GHG emissions reduction in non-ETS Sectors vs 2005	-20.3 / -22.9	-30.5 / -70.3	-27.6 / -67.6	-28.7 / -68.3	-29.5 / -68.9	-30.5 / -69.4	-32.9 / -71.2	-35.3 / -72
CO2 emission reductions vs 2005								
Power generation +District Heating	-46.7 / -72.9	-56.5 / -97.7	-57.9 / -95.6	-56.6 / -95.3	-55.5 / -95.5	-54.6 / -95.7	-54 / -96.1	-60 / -97.2
Industry	-22.5 / -43.8	-27.4 / -77.8	-31.5 / -76.7	-30.8 / -77.1	-29.8 / -76.8	-28.6 / -76.2	-29.1 / -75.7	-29.7 / -76
Residential, Services & Agriculture	-26.7 / -34.1	-34.1 / -80.3	-33.8 / -75.7	-37.5 / -78.2	-40.3 / -80.8	-44 / -82.9	-53.1 / -86.8	-62.9 / -90.3
Transport	-11.6 / -10.3	-13.6 / -63.5	-16.7 / -61.3	-16.8 / -61.4	-17.1 / -61.5	-17.3 / -61.7	-17.5 / -64.2	-17.4 / -64.2

	Reference	GHG40	EE27	EE28	EE29	EE30	EE35	EE40
SECURITY OF SUPPLY								
Import dependency	55.1 / 56.6	53.6 / 36.8	53 / 38.1	53 / 38	52.6 / 38.2	52.8 / 38.3	53.5 / 38.6	54.4 / 39.1
Net Energy Imports (2010=100)	96 / 101	89 / 56	86 / 59	85 / 57	83 / 56	82 / 54	78 / 51	74 / 49
Net Imports of Gas (2010=100)	105 / 122	91 / 74	88 / 82	84 / 78	81 / 74	78 / 69	67 / 65	60 / 59
Fossil Fuels Import Bill Savings compared to reference (bn € '10) *(cumulative 2011-30 and 2031-2050)*	n.a	-190 / -3404	-285 / -3349	-311 / -3490	-346 / -3637	-395 / -3798	-503 / -4145	-549 / -4360
SYSTEM COSTS *(2011-30/2011-2050)*								
Total System Costs, avg annual (bn €)	2067 /2520	2069 /2727	2069 /2649	2074 /2686	2082 /2747	2089 /2806	2124 /3001	2181 /3355
compared to reference (bn €)	n.a.	2 / 207	2 / 129	7 / 166	15 / 227	22 / 286	57 / 481	114 / 835
Total System Costs as % of GDP (average annual)	14.3 /13.03	14.31 /14.1	14.31 /13.7	14.35 /13.89	14.4 /14.2	14.45 /14.51	14.69 /15.52	15.09 /17.34
compared to reference (bn €)	n.a.	0.01 / 1.07	0.01 / 0.67	0.05 / 0.86	0.11 / 1.18	0.15 / 1.48	0.39 / 2.49	0.79 / 4.32
INVESTMENTS AND ENERGY PURCHASES								
Investment Expenditures , avg annual (bn €)	816 /949	854 /1189	851 /1110	868 /1126	886 /1149	905 /1170	992 /1203	1147 /1211
compared to reference (bn €)	n.a.	38 / 240	35 / 161	52 / 177	70 / 200	89 / 221	176 / 254	331 / 262
Energy Purchases, avg annual (bn €)	1454 /1586	1436 /1394	1422 /1402	1417 /1370	1411 /1335	1401 /1290	1378 /1206	1365 /1130
compared to reference (bn €)	n.a.	-18 / -192	-32 / -184	-37 / -216	-43 / -251	-53 / -296	-76 / -380	-89 / -456
Fossil Fuel Net Imports, avg annual 2011-30 (bn €)	461 / 548	452 / 377	447 / 380	446 / 373	444 / 366	441 / 358	436 / 340	434 / 330
compared to reference (bn €)	n.a.	-9 / -171	-14 / -168	-15 / -175	-17 / -182	-20 / -190	-25 / -208	-27 / -218
OTHER ECONOMIC IMPACTS								
Average Price of Electricity (€/MWh)	176 / 175	179 / 183	180 / 187	179 / 185	178 / 184	178 / 182	177 / 182	182 / 182
compared to reference (€/MWh)	n.a.	3 / 8	4 / 12	3 / 10	2 / 9	2 / 7	1 / 7	6 / 7
ETS price (€/t of CO2-eq.)	35 / 100	40 / 264	39 / 243	35 / 220	30 / 205	25 / 180	13 / 160	6 / 165

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DOCUMENTO DE TRABALHO DOS SERVIÇOS DA COMISSÃO

SÍNTESE DA AVALIAÇÃO DE IMPACTO

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Comunicação da Comissão ao Parlamento Europeu e ao Conselho

Eficiência energética e a sua contribuição para a segurança energética e o quadro político para o clima e a energia para 2030

{COM(2014) 520 final}
{SWD(2014) 255 final}

RESUMO DA AVALIAÇÃO DE IMPACTO

1. Contexto político

1. Em 2007, o Conselho Europeu estabeleceu o objetivo de 20% de poupança de energia primária até 2020 (em comparação com as projeções de 2007). A Diretiva Eficiência Energética (DEE) estabelece um quadro comum de medidas para a promoção da eficiência energética a fim de assegurar o cumprimento do referido objetivo. A Comissão é convidada a avaliar, até junho de 2014, se é provável que a UE atinja o objetivo e, se necessário, a propor novas medidas.

2. A recente Estratégia Europeia de Segurança Energética (EESE)[1] salienta que *«a moderação da procura energética é uma das ferramentas mais eficazes para reduzir a dependência de energia externa da UE e a exposição à subida dos preços»*.

3. A Comunicação relativa a 2030 estabelece as modalidades gerais do quadro político da UE em matéria de clima e energia para o período de 2020 a 2030[2]. Embora a Comunicação declare que *«um objetivo de redução das emissões de gases com efeito de estufa de 40% implicaria um nível mais elevado de poupanças energéticas de aproximadamente 25% em 2030»*[3], indica também que o nível exato de ambição da futura política e medidas em matéria de poupança de energia necessário para a sua concretização deve ser estabelecido na revisão da DEE, com base na análise subjacente ao quadro para 2030 e nas metas e objetivos relativos à redução dos gases com efeito de estufa e às energias renováveis, propostos na Comunicação relativa a 2030.

2. Ensinamentos retirados e definição do problema

4. Apesar de ter aumentado de 1618 Mtep em 2000 para 1721 Mtep em 2006, o consumo de energia primária da UE tem vindo a descer desde então. Embora a crise económica que teve início em 2008 tenha tido um impacto significativo na procura de energia, o efeito dos ganhos de eficiência (impulsionados pelos preços e políticas) foi superior. Verificou-se uma melhoria da eficiência desde 2000 e uma aceleração da taxa de melhorias a partir de 2008. No entanto, se as tendências atuais se mantiverem até 2020, cerca de 1/3 da redução do consumo de energia, em comparação com o ano de referência de 2007, resultará de um crescimento inferior ao previsto e apenas cerca de 2/3 de melhorias da eficiência energética

5. Entre 2008 e 2012, o consumo de energia primária diminuiu na maior parte dos Estados-Membros. As alterações no nível de atividade económica desempenharam um papel importante, bem como as alterações no cabaz de produção de eletricidade e as mudanças na estrutura industrial. Em determinados países, o efeito destes fatores foi neutralizado por alterações ao nível do consumo (por exemplo, aumento da dimensão média das habitações).

1 COM(2014) 330

[2] COM(2014) 15 final.

[3] As poupanças de energia relativas ao objetivo de redução de 40% de emissões de gases com efeito de estufa correspondem ao cenário GHG40 da Avaliação de Impacto para 2030, que foi considerado a forma mais eficaz em termos de custos para atingir poupanças de 40% de GEE.

6. Nos últimos anos, verificou-se uma evolução significativa da política em matéria de eficiência energética. O objetivo da UE de 20% de poupança de energia está agora claramente definido, proporcionando dinamismo político, orientações para os investidores e um padrão de referência para aferir os progressos obtidos. A nível europeu, as políticas mais eficazes até à data têm sido as normas de eficiência aplicáveis aos produtos, incluindo a conceção ecológica e a rotulagem energética dos produtos, e a legislação em matéria de emissões de CO_2 aplicável a automóveis de passageiros e a veículos comerciais ligeiros. A Diretiva Desempenho Energético dos Edifícios (reformulação de 2010) e a Diretiva Eficiência Energética de 2012 têm potencial para promover a eficiência energética na UE desde que sejam adequadamente aplicadas pelos Estados-Membros. No entanto, o potencial a longo prazo da DEE está limitado, em certa medida, pelo facto de algumas das disposições-chave deixarem de ser aplicáveis em 2020.

7. A nível nacional, os Estados-Membros referem o sucesso de diferentes medidas políticas. As informações atualizadas apresentadas pelos Estados-Membros nos seus Planos de Ação Nacionais de Eficiência Energética de 2014 indicam um maior reforço das políticas nacionais, incluindo novas medidas relativas à aplicação da Diretiva Eficiência Energética, em muitos Estados-Membros.

8. Apesar destes progressos, a análise sugere que, ao ritmo atual, o objetivo de eficiência energética da UE de poupança de 20% de energia até 2020 não será cumprido por 1 a 2 pontos percentuais.

9. Diversas análises das perspetivas para além de 2020, realizadas nomeadamente pela Agência Internacional da Energia e a Fraunhofer ISI, indicam que o atual quadro político não será suficiente para a plena realização do potencial de poupanças de energia com uma boa relação custo-eficácia. A Avaliação de Impacto que acompanha a Comunicação relativa a 2030 torna também claro que as atuais políticas (conforme descritas no cenário de referência[4]) não seriam suficientes para assegurar a transição, com uma boa relação custo-eficácia, para uma economia hipocarbónica, limitando-se a atingir uma poupança de 21% até 2030, em comparação com as projeções de 2007.

10. A principal razão pela qual se prevê que o objetivo para 2020 não será cumprido reside no facto de, apesar de recentes desenvolvimentos mais positivos, se verificar por vezes uma falta de empenhamento a nível dos Estados-Membros na aplicação do quadro legislativo existente. No que diz respeito às perspetivas para além de 2020, alguns dos principais instrumentos políticos foram concebidos para uma escala temporal até 2020, pelo que não proporcionam incentivos a longo prazo para o investimento em eficiência energética. Além disso, mesmo no atual contexto regulamentar, persistem ainda importantes obstáculos à eficiência energética.

11. Devido a estes fatores subjacentes, o problema geral é que o potencial de poupança de energia com uma boa relação custo-eficácia (tanto a curto como a longo prazo) não é plenamente explorado e, por conseguinte, a eficiência energética não contribui suficientemente para os objetivos da política energética da UE. As consequências são as seguintes: a) um nível elevado de procura de energia aumenta a dependência da UE de importações de energia, nomeadamente de gás; b) o potencial de eficiência energética desperdiçado tem um impacto negativo na acessibilidade do preço da energia e limita a

[4] *EU ENERGY, TRANSPORT AND GHG EMISSIONS TRENDS TO 2050 - REFERENCE SCENARIO 2013,* disponível em: http://ec.europa.eu/energy/observatory/trends_2030/.

competitividade da economia da UE; c) um nível elevado de procura torna a transição para uma economia hipocarbónica mais onerosa, uma vez que muitas medidas de eficiência energética se encontram entre as opções para atenuação das emissões de GEE ao menor custo

3. Subsidiariedade

12. Os Estados-Membros estão no centro da política de eficiência energética, pelo que a intervenção da UE deve ser corretamente orientada e apoiar as ações dos Estados-Membros. O papel da UE consiste em: a) estabelecer um quadro comum que proporcione a base para um reforço mútuo e coerente dos mecanismos, deixando simultaneamente a cargo dos Estados-Membros o estabelecimento dos meios para atingir os objetivos acordados; b) criar uma plataforma para o intercâmbio de melhores práticas e promover o desenvolvimento de capacidades; c) estabelecer requisitos mínimos nos domínios em que exista um risco de distorção do mercado interno caso os Estados-Membros adotem medidas individuais; d) utilizar os instrumentos da UE para promover a eficiência energética, por exemplo, através de financiamentos.

4. Âmbito e objetivos

13. O objetivo geral é garantir que a eficiência energética contribua para o desenvolvimento de um sistema energético competitivo, sustentável e seguro na UE.

14. Os objetivos específicos são:

- Acordar as medidas necessárias para atingir o objetivo de 20% de eficiência energética em 2020, proporcionando assim aos intervenientes relevantes informações sobre as ações que devem ser empreendidas a curto prazo;

- Acordar o nível de ambição da política de eficiência energética a longo prazo, proporcionando assim aos Estados-Membros e aos investidores uma maior previsibilidade e segurança.

5. Descrição das opções políticas e da metodologia

15. No que diz respeito às opções políticas para colmatar o fosso existente a fim de atingir o objetivo para 2020, são considerados os seguintes elementos:

    a. Inação.
    b. Nova legislação primária que estabeleça objetivos nacionais vinculativos ou medidas vinculativas adicionais.
    c. Reforço da aplicação das atuais políticas.

    A opção a) foi excluída de uma análise mais pormenorizada uma vez que o objetivo para 2020 não seria plenamente atingido e não se concretizariam os benefícios associados ao seu cumprimento.

16. No que diz respeito à análise do nível ótimo de poupança de energia para 2030, foram modelizados seis cenários com um aumento gradual na intensidade dos esforços de melhoria da eficiência energética necessários em todos os setores visados pelas atuais medidas políticas. Comparando os resultados dos cenários com o cenário de referência, os

impactos desses esforços no sistema energético (incluindo os aspetos de segurança do aprovisionamento), na competitividade e na sustentabilidade são avaliados não só perspetiva de 2030, mas também na perspetiva de 2050. Os cenários permitem atingir em 2030, respetivamente: 27,4%, 28,3%, 29,3%, 30,7%, 35,0% e 39,8% de poupanças em comparação com o cenário de referência PRIMES 2007, sendo seguidamente designados cenários EE27, EE28, EE29, EE30, EE35 e EE40. A análise tem por base e é plenamente coerente com a Avaliação de Impacto subjacente à Comunicação relativa a 2030, incluindo 40% de redução das emissões de GEE e (pelo menos) uma quota de 27% de energias renováveis no consumo de energia final propostos pela Comissão como objetivos vinculativos para 2030. Tem em conta os progressos realizados pelos Estados-Membros no sentido da realização dos seus objetivos nacionais ao abrigo da DEE.

17. Em relação às opções para a arquitetura do quadro de eficiência energética após 2020, foram identificadas as seguintes opções:

    a. Inação. Isso significa que, após 2020, não haveria qualquer objetivo de eficiência energética;
    b. Objetivo indicativo da UE, associado a medidas específicas da UE. Tratar-se-ia de uma continuação do quadro atual;
    c. Objetivo vinculativo da UE, associado a medidas específicas da UE. Tratar-se-ia de uma replicação da abordagem proposta pela Comissão na Comunicação relativa a 2030 no que diz respeito às fontes de energia renováveis;
    d. Objetivos vinculativos dos Estados-Membros, associados a políticas da UE exclusivamente em domínios relacionados com o mercado interno.

18. Além disso, independentemente da natureza e nível de um possível objetivo, importa examinar qual poderia ser a sua formulação. São identificadas as seguintes opções para a formulação de objetivos:

    a. Objetivo de consumo;
    b. Objetivo de intensidade;
    c. Abordagem híbrida.

6. Análise dos impactos e conclusões

Opções políticas para colmatar o fosso existente para o cumprimento do objetivo para 2020

19. Relativamente a 2020, a análise de impacto mostra que a aplicação correta do atual quadro político seria simultaneamente necessária e suficiente para colmatar o fosso previsto. Em contrapartida, seria pouco provável que a proposta de nova legislação primária desse um contributo significativo para colmatar o fosso, tendo em conta o tempo mínimo necessário para a execução do processo legislativo ordinário e a transposição para o direito nacional.

Análise do nível ótimo de ambição para 2030

20. Em termos de impactos no sistema energético, incluindo a segurança do aprovisionamento, todos os cenários mostram que as políticas em matéria de eficiência

energética permitem reduzir eficazmente o consumo de energia (tanto primária como final) e diminuir a intensidade energética. Os diferentes cenários políticos revelam algumas diferenças em termos do consumo de diversas fontes de energia primária.

21. A eficiência energética tem um impacto significativo na segurança do aprovisionamento e, em particular, no nível de importações de gás. A redução das importações líquidas de energia traduzem-se em poupanças na fatura de importação de combustíveis fósseis. Relativamente aos cenários EE27, EE28 e EE29, a poupança de custos na importação de combustíveis fósseis no período de 2011-2030 pode atingir entre 285 mil milhões de euros e 346 mil milhões de euros. No que diz respeito aos objetivos mais ambiciosos de poupança de energia de 30% ou superiores, as poupanças podem atingir entre 395 mil milhões de euros e 549 mil milhões de euros.

22. Em termos de impacto económico, os custos do sistema energético aumentam em todos os cenários, em comparação com o cenário de referência. Nos vários cenários políticos, o aumento da eficiência energética resulta num aumento da média anual (2011-2030) de custos do sistema energético de 0,01 a 0,8 pontos percentuais do PIB relativamente ao cenário de referência. Os aumentos em termos absolutos (média anual no período de 2011-2030) situam-se entre 2 mil milhões de euros e 114 mil milhões de euros.

23. Observa-se uma mudança geral na estrutura de custos com a diminuição das compras de energia e o aumento dos custos de capital e dos investimentos diretos em eficiência energética. As despesas de investimento aumentam acentuadamente em todos os cenários — de forma mais significativa nos cenários mais ambiciosos — e, mais uma vez, principalmente nos setores residencial e terciário.

24. As variações de preços da eletricidade em comparação com os preços de referência são muito limitadas em 2030, variando de 1% a 3% no ano de 2030. Os preços RCLE são substancialmente diferentes consoante os cenários, refletindo o contributo importante da eficiência energética para a redução das emissões nos setores abrangidos pelo RCLE (pela via da redução da procura de eletricidade) e o facto de a eficiência energética permitir reduções significativas nos setores não abrangidos pelo RCLE. À medida que a sua ambição aumenta, as políticas de eficiência energética reduzem tanto os custos como os incentivos do próprio regime RCLE para a atenuação dos GEE.

25. Os impactos no PIB dos cenários de redução de 40% das emissões de GEE e de aumento da eficiência energética podem ser negativos ou positivos (dependendo da abordagem teórica e respetivos pressupostos), sendo o principal fator determinante a magnitude dos investimentos. Na modelização geral de equilíbrio, o «efeito de exclusão» tem resultados negativos. Caso não se presuma que os recursos são atualmente utilizados em pleno, os efeitos no PIB são positivo.

26. Em termos de impactos sociais, os impactos gerais líquidos no emprego, tal como no caso do PIB, dependem de um grande número de pressupostos. Em geral, o impacto no emprego é positivo com a utilização das receitas provenientes da fixação do preço do carbono para baixar os custos do trabalho. A análise sugere que o efeito no emprego será globalmente mais positivo em cenários com políticas mais ambiciosas em matéria de eficiência energética que reflitam o significativo potencial de criação de emprego nestas

áreas (nomeadamente no setor da construção) — dependendo a magnitude do efeito da abordagem teórica.

27. A acessibilidade dos preços da energia para os agregados familiares não é significativamente afetada (em comparação com o cenário de referência) em cenários com uma poupança de energia até 28% (tanto na perspetiva de 2030 como de 2050). Os cenários mais ambiciosos resultam num ligeiro aumento (principalmente na perspetiva de 2050) da quota-parte de custos relacionados com a energia no orçamento das famílias, uma vez que as melhorias de eficiência energética exigem normalmente investimentos, pelo que implicam aumentos de custos de capital nesses cenários.

28. Em termos de sustentabilidade (e coerência com os objetivos do quadro em matéria de clima e energia para 2030), todos os cenários (exceto o EE40) demonstra uma redução das emissões de GEE em 2030, em consonância com o objetivo de emissões de GEE proposto na Comunicação relativa a 2030, e globalmente consentânea com a repartição das reduções de emissões (em 2030) entre setores abrangidos e não abrangidos pelo RCLE aí proposta. Todos os cenários têm como objetivo a descarbonização. Todos os cenários são consentâneos com o objetivo de 27% para as energias renováveis.

29. O saldo das reduções das emissões de GEE nos diferentes setores da economia não varia consoante os cenários, uma vez que a combinação de políticas em matéria de eficiência energética não é alterada nos diferentes cenários (segue sempre a lógica da legislação em vigor, sendo apenas intensificado o nível geral de ambição). As maiores reduções ocorrem no setor da produção de eletricidade (impulsionado pelo RCLE, conforme proposto no quadro para 2030) e nos setores residencial e terciário (uma vez que as políticas-chave em matéria de eficiência energética incidem especificamente nestes dois setores).

Arquitetura do quadro político para 2030

30. No que diz respeito à natureza jurídica de um possível objetivo de eficiência energética, a análise concluiu que um objetivo puramente indicativo seria eficiente do ponto de vista económico e coerente com o quadro de políticas em matéria de energia e clima para 2030. Os objetivos nacionais vinculativos seriam incompatíveis com o quadro proposto nesta matéria. A sua eficácia e eficiência económica são incertas. Uma outra opção é não propor qualquer objetivo, mas tal privaria o quadro político pós-2020 dos benefícios que este elemento tem proporcionado até à data, ou seja um parâmetro de referência para o acompanhamento dos progressos e o ajustamento das políticas; um sinal para os intervenientes relevantes sobre a orientação política e uma base para elementos políticos adicionais.

31. Independentemente do modo como um objetivo é formulado, a evolução económica deve ser tida em conta no acompanhamento dos progressos realizados.

Financiamento

32. A obtenção de melhorias substanciais da eficiência energética exigirá investimentos significativos, os quais terão de ser sobretudo financiados pelo setor privado. Por conseguinte, a argumentação comercial a favor do investimento em eficiência energética deve tornar-se mais evidente para o setor financeiro, o que implicará uma série de ações, tais como a criação de procedimentos fiáveis para a medição e verificação das poupanças

de energia, o desenvolvimento de normas para processos de investimento no domínio da eficiência energética e a prestação de assistência técnica a fim de tornar os projetos de eficiência energética aceitáveis para os bancos.

Quadro de síntese com os principais resultados da modelização para 2030 (salvo indicação em contrário)

	Referência:	GHG40	EE27	EE28	EE29	EE30	EE35	EE40
PRINCIPAIS ELEMENTOS DOS CENÁRIOS								
Reduções de GEE vs 1990	-32,4	-40,6	-40,1	-40,2	-40,1	-40,1	-41,1	-43,9
Quota de energias renováveis - Geral	24,4	26,5	27,8	27,7	27,7	27,7	27,4	27,4
Poupanças de energia em 2030 (*expressas em % em relação às projeções de referência de 2007 relativas ao consumo de energia primária)*	21,0%	25,1%	27,4%	28,3%	29,3%	30,7%	35,0%	39,8%
IMPACTOS NO SISTEMA ENERGÉTICO								
Consumo interno bruto de energia (Mtep)	1611	1534	1488	1470	1450	1422	1337	1243
- Quota de sólidos	10,8	10,1	9,9	10,4	10,8	11,3	12,9	12,4
- Quota de petróleo	32,3	32,8	32,4	32,6	32,7	33	34,2	36,2
- Quota de gás natural	24,6	22,5	22,5	21,9	21,5	21	19,2	18.5
- Quota de energia nuclear	12,5	13,1	12,7	12,8	12,7	12,5	11,8	11,1
- Quota de energias renováveis	19,9	21,6	22,6	22,4	22,3	22,3	22	22,1
Intensidade energética (2010=100)	67	64	62	61	61	59	56	52
Produção bruta de eletricidade (TWh)	3664	3532	3469	3461	3423	3336	3080	2804
SEGURANÇA DO APROVISIONAMENTO								
Dependência das importações	55,1	53,6	53	53	52,6	52,8	53,5	54,4
Importações líquidas de energia (2010=100)	96	89	86	85	83	82	78	74
Importações líquidas de gás (2010=100)	105	91	88	84	81	78	67	60
Poupanças na fatura de importação de combustíveis sólidos em comparação com o cenário de referência (milhares de milhões de € '10) *(cumulativas 2011-2030)*	n.a.	-190	-285	-311	-346	-395	-503	-549
IMPACTOS AMBIENTAIS								

Redução das emissões de GEE nos setores RCLE vs 2005	-36,1	-43,3	-45,3	-44,4	-43,3	-42,2	-41,8	-45,6
Redução das emissões de GEE nos setores não-RCLE vs 2005	-20,3	-30,5	-27,6	-28,7	-29,5	-30,5	-32,9	-35,3
	Referência:	**GHG40**	**EE27**	**EE28**	**EE29**	**EE30**	**EE35**	**EE40**
CUSTOS DO SISTEMA								
Custos totais do sistema, média anual 2011-2030 (em milhares de milhões de euros)	2067	2069	2069	2074	2082	2089	2124	2181
em comparação com o cenário de referência (milhares de milhões de euros)		+1	+2	+7	+15	+22	+57	+114
Custos totais do sistema em percentagem do PIB, média anual 2011-2030 (milhares de milhões de euros)	14,30%	14,31%	14,31%	14,35%	14,40%	14,45%	14,69%	15,09%
em comparação com o cenário de referência (milhares de milhões de euros)		+0,01%	+0,01%	+0,05%	+0,11%	+0,15%	+0,39%	+0,79%
Custos totais do sistema em 2030 (em milhares de milhões de euros)	2338	2364	2361	2389	2423	2455	2632	2999
Custos totais do sistema em 2030 em % do PIB	14,03%	14,18%	14,16%	14,33%	14,53%	14,73%	15,79%	17,99%
OUTROS FATORES ECONÓMICOS								
Despesas de investimento, média anual 2011-2030 (em milhares de milhões de euros)	816	854	851	868	886	905	992	1147
Compras de produtos energéticos, média anual (em milhares de milhões de euros)	1454	1436	1422	1417	1411	1401	1378	1365
Preço médio da eletricidade (€/MWh)	176	179	180	179	178	178	177	182
Preço RCLE (€/t de eq. CO_2)	35	40	39	35	30	25	13	6
MODELIZAÇÃO MACROECONÓMICA								
Impactos no PIB (alteração percentual em relação ao caso de referência) Resultados, em primeiro lugar	16,766 mil milhões de euros 16,960 mil milhões de euros	n.a.	n.a.	- 0,13/ +0,75	n.a.	- 0,22 / +1,06	- 0,52 / +2,02	- 1,20 / +4,45

para a modelização de equilíbrio e, em segundo lugar, para a modelização pós-Keynesiana								
Impactos no emprego (alteração percentual em relação ao caso de referência) Resultados, em primeiro lugar para a modelização de equilíbrio e, em segundo lugar, para a modelização pós-Keynesiana	219 milhões de pessoas 232 milhões de pessoas	n.a.	n.a.	+1,47 / +0,29	n.a.	+1,90 / +0,35	+ 2,53 / +0,62	+2,96 / +1,50

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ANNEXES 1 to 3

ANEXOS

da

COMUNICAÇÃO DA COMISSÃO AO PARLAMENTO EUROPEU E AO CONSELHO

Eficiência energética e a sua contribuição para a segurança energética e o quadro político para o clima e a energia para 2030

{SWD(2014) 255 final}
{SWD(2014) 256 final}

ANEXO I
Evolução das políticas comunicadas nos Planos de Ação Nacionais de Eficiência Energética (PANEE)

Áustria

- Obrigações de eficiência energética aplicáveis aos distribuidores de energia, incidindo sobretudo na eficiência dos edifícios existentes.
- Esforços renovados para aumentar a quota de aquecimento urbano.
- Auditorias, projetos-piloto e demonstrações para fins de eficiência energética industrial.
- Os impostos sobre a energia continuarão a desempenhar um papel significativo.

Bélgica

- Medidas centradas no setor dos edifícios.
- Isenções fiscais para a renovação de edifícios.
- Melhor contagem e faturação do consumo.

Chipre

- Patrocínios e planos de licenças de emissão para fins de conservação de energia.
- Campanha para a substituição de produtos consumidores de energia ineficientes.
- Projetos para promover a eficiência energética em automóveis particulares e outras medidas de eficiência energética nos transportes.

República Checa

O novo regime financeiro incidiu em:

- Medidas de poupança de energia em edifícios em todos os setores (envolvente de edifícios e tecnologia).
- Poupança de energia em processos na indústria e serviços.
- Infraestruturas energéticas mais eficientes (sobretudo sistemas de aquecimento urbano); redução das perdas na rede de distribuição de eletricidade e calor.
- Promoção da cogeração de elevada eficiência.

Dinamarca

- Maior nível de ambição das obrigações de eficiência energética, passando de poupanças anuais de 2,6% para 3%.
- Informação dos consumidores (por exemplo, melhores certificados de desempenho energético para edifícios).
- Informação sobre a eficiência energética para bancos e sociedades hipotecárias.

Estónia

- Novos programas para a renovação de edifícios, apoio a auditorias energéticas e a investimentos em eficiência energética na indústria e substituição da iluminação pública.
- Subvenções, empréstimos preferenciais e garantias para apoio à renovação de prédios de apartamentos e um regime de apoio para melhorar a eficiência de pequenos edifícios residenciais.
- Papel contínuo dos impostos.

Finlândia

- Reforço das medidas existentes, tais como acordos voluntários com a indústria, em lugar da introdução de novas medidas. Os acordos voluntários integrarão elementos como auditorias energéticas, incentivos fiscais e formação.
- Serão também reforçadas as medidas que visam edifícios. Estas medidas associam códigos de construção, campanhas de informação e vários incentivos, incluindo créditos fiscais. Os aspetos mais visados continuarão a ser o aumento da eficiência do aquecimento (as vendas anuais de bombas de calor já aumentaram de menos de 1000, em 1999, para 60 000 em 2012).

França

- Duplicação do nível de ambição do regime de obrigações de eficiência energética.
- Fundo específico para a renovação de edifícios, funcionando como uma garantia para a mobilização de investimento privado.
- A tributação no setor dos transportes poderia gerar poupanças adicionais.

Alemanha

- Um cálculo atualizado com base em estatísticas recentes revela que o consumo de energia primária da Alemanha será quase 10% inferior ao objetivo notificado em 2013.
- Serão reforçadas as medidas políticas existentes, incluindo os requisitos de eficiência energética dos edifícios, fiscalidade, aconselhamento/sensibilização fiscal e apoio ao investimento, nomeadamente através do regime KfW.
- Um elemento importante dos novos esforços políticos será o desenvolvimento do mercado de empresas de serviços energéticos (ESCO).

Irlanda

- Prevê-se que as medidas incluídas no plano resultem em poupanças marginalmente superiores ao objetivo nacional.
- No setor dos edifícios, incidência no desenvolvimento de sistemas de medição e verificação para aferir com exatidão as poupanças obtidas.
- Será esta a base do incentivo para a oferta e procura de habitações mais eficientes (por exemplo, no setor bancário).

Itália

- Reforço das normas mínimas aplicáveis à construção de novos edifícios e à renovação dos edifícios existentes.

- Consolidação de deduções fiscais para a renovação de edifícios e reforço dos incentivos para os edifícios que são propriedade de organismos públicos.
- Reforço do sistema de certificados de eficiência energética («certificados brancos»).
- Incentivo à renovação da frota de veículos e camiões até 3,5 toneladas.

Letónia

- Serão aplicadas obrigações de eficiência energética aos distribuidores de energia.
- Estas obrigações, em combinação com um novo Fundo Nacional de Eficiência Energética renovável, incidirão principalmente no financiamento da renovação de edifícios.

Lituânia

- Os regimes de obrigações de eficiência energética serão aplicados às grandes empresas de distribuição de energia que se espera que apoiem investimentos em eficiência na utilização final de energia, especialmente no setor da construção de edifícios e na indústria.
- Regime de apoio para a melhoria da eficiência das redes de aquecimento urbano local.
- Fundo Nacional para melhorar o desempenho energético dos edifícios.

Malta

- Aumento de 12% no nível de ambição do objetivo indicativo nacional.
- Regime de obrigações de eficiência energética.
- Auditorias energéticas gratuitas para os agregados familiares e as PME, mediante pedido.
- Outras áreas de interesse: instalação de contadores inteligentes, campanhas de informação, renovação de edifícios, medidas no setor dos transportes, modernização das instalações de produção, melhoria da eficiência energética da distribuição de água.

Países Baixos

- Acordo em matéria de energia em prol do crescimento sustentável, incluindo a administração central, regional e local, as organizações patronais e as organizações de trabalhadores, outras organizações da sociedade civil e instituições financeiras, nomeadamente no domínio da eficiência energética. O acordo visa edifícios e a eficiência energética na indústria e no setor agrícola.

Portugal

- Portugal continuará a implementar os regimes existentes que estão a ser objeto de uma revisão a fim de concentrar os esforços nos que apresentem a melhor relação custo-eficácia.
- Os regimes que promovem o isolamento térmico das habitações são os que poderão ter maior impacto.

Espanha

- A ambição do objetivo indicativo nacional foi marginalmente revista em alta em comparação com 2013.
- Obrigação de eficiência energética para as empresas do setor da energia.
- Renovação de edifícios residenciais e comerciais com recurso a um Fundo Nacional de Eficiência Energética.
- Incentivos para transportes com boa eficiência energética, medidas fiscais, formação, campanha nacional de informação sobre eficiência energética.

Suécia

- A eficiência energética continuará a ser promovida principalmente pela via da tributação.

Reino Unido

- Maiores poupanças decorrentes dos requisitos de eficiência energética aplicáveis aos edifícios.
- Incidência na melhoria do regime de Pacto Verde (*New Deal*).

ANEXO II

Diretiva Desempenho Energético dos Edifícios — Estado da transposição em 16 de julho de 2014

Estado-Membro	**Transposição conforme declarada pelo Estado-Membro**	**Processos por ausência de comunicação**	**Relatório sobre níveis ótimos de rentabilidade (artigo 5.º)**	**Informações consolidadas relativas a edifícios com necessidades quase nulas de energia (NZEB)** **(artigo 9.º)**
Prazo:	*9 de julho de 2012*		*21 de março de 2013*	*4 de março de 2014*
Áustria	Não	Em curso	✓	✓
Bélgica	Não	Em curso	✓	✓
Bulgária	Sim	Concluídos	✓	✓
Croácia	Sim	Em curso[1]	Declarada como parcial	✓
Chipre	Sim	Concluídos	✓	✓
República Checa	Sim	Em curso	✓	✓
Dinamarca	Sim	Concluídos	✓	✓
Estónia	Sim	Concluídos	✓	✓
Finlândia	Não	Em curso	✓	✓
França	Sim	Concluídos	✓	✓
Alemanha	Sim	Concluídos	✓	✓
Grécia	Sim	Concluídos	Não	Não
Hungria	Sim	Concluídos	✓	✓
Irlanda	Sim	Concluídos	✓	✓

[1] Processo por infração na fase de carta de notificação formal.

Itália	Sim	Em curso	✓	✓
Letónia	Sim	Concluídos	✓	✓
Lituânia	Sim	Concluídos	✓	✓
Luxemburgo	Sim	Concluídos	✓	✓
Malta	Sim	Concluídos	✓	✓
Países Baixos	Não	Em curso	✓	✓
Polónia	Não	Em curso	✓	✓
Portugal	Sim	Concluídos	✓	✓
Roménia	Sim	Concluídos	Não	Não
Espanha	Sim	Concluídos	✓	Não
República Eslovaca	Sim	Concluídos	✓	✓
Eslovénia	Não	Em curso	✓	Não
Suécia	Sim	Concluídos	✓	✓
Reino Unido	Sim	Concluídos	✓	✓

ANEXO III
Diretiva Eficiência Energética — Estado da transposição em 16 de julho de 2014

Estado-Membro	**Objetivos de eficiência energética** **(artigo 3.º)**	**Estratégia de renovação de edifícios** **(artigo 4.º)**	**Regimes de obrigação de eficiência energética e/ou medidas alternativas** **(artigo 7.º)**	**Planos de Ação Nacionais de Eficiência Energética (PANEE)** **(artigo 24.º, n.º 2)**	**Transposição conforme declarada pelo Estado-Membro**
Prazo:	*30 de abril de 2013*	*30 de abril de 2014*	*5 de dezembro de 2013*	*30 de abril de 2014*	*5 de junho de 2014*
Áustria	✓	✓	✓	✓	Não
Bélgica	✓	✓	✓	✓	Não
Bulgária	✓	✓	✓	✓	Não
Croácia	✓	✓	✓		Não
Chipre	✓	✓	✓	✓	Sim
República Checa	✓	✓	✓	✓	Não
Dinamarca	✓	✓	✓	✓	Sim
Estónia	✓	✓	✓	✓	Não
Finlândia	✓	✓	✓	✓	Não
França	✓	✓	✓	✓	Não
Alemanha	✓	✓	✓	✓	Não
Grécia	✓		✓		Não
Hungria	✓		✓		Não
Irlanda	✓	✓	✓	✓	Não
Itália	✓	✓	✓	✓	Sim
Letónia	✓	✓	✓	✓	Não
Lituânia	✓	✓	✓	✓	Não
Luxemburgo	✓		✓		Não

Malta	✓	✓	✓	✓	Sim
Países Baixos	✓	✓	✓	✓	Não
Polónia	✓		✓		Não
Portugal	✓		✓	✓	Não
Roménia	✓	✓	✓		Não
Espanha	✓	✓	✓	✓	Não
República Eslovaca	✓	✓	✓	✓	Não
Eslovénia	✓		✓		Não
Suécia	✓	✓	✓	✓	Sim
Reino Unido	✓	✓	✓	✓	Não

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PART 2/3

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

Communication from the Commission to the European Parliament and the Council

Energy Efficiency and its contribution to energy security and the 2030 Framework for climate and energy policy

{COM(2014) 520 final}
{SWD(2014) 256 final}

Contents

Annex I. Report of the public consultation of the Review of progress on energy efficiency

Summary

This report presents the results of the public consultation on the Review of progress towards the 2020 energy efficiency objective and a 2030 energy efficiency policy framework. In total 721 responses were submitted to the on-line public consultation, with 242 organisations, 179 companies and 21 public authorities having taken part. 264 individuals also submitted their contributions to this consultation.

It was pointed out by several stakeholders that energy efficiency is a sound response to the prevailing energy security issue in Europe and also an effective tool for climate mitigation. It triggers innovation and creates new jobs for the EU economy.

Overall, a majority of stakeholders favoured energy efficiency targets or new measures as the right approach to addressing the shortfall (in achieving the 2020 objective), although a number of stakeholders also stated that the reinforced implementation of existing legislation including active policy on infringements is needed. A number of replies indicated other views in this regard. In general, stakeholders representing industry were in favour of targets expressed in terms of energy intensity improvements whilst non-governmental organisations advocated targets expressed as absolute energy savings.

Stakeholders also provided their views on whether further measures are needed at EU level to foster energy efficiency in different sectors such as buildings, industry, transport, electrical equipment and energy generation and distribution.

Many stakeholders indicated that there is still an untapped energy savings potential in **manufacturing** industry, where energy audits and energy management systems could help realise it.

Many respondents stressed that **energy production and supply** should be addressed by adopting mandatory energy efficiency requirements for new power plants and heating distribution systems, also promoting high-efficiency cogeneration. It was stated that a level playing field across the Single Market should be ensured, and that market transparency and better integration including modernisation of the national grids should be ensured.

As regards **buildings**, a majority of respondents acknowledged the need for strengthening the existing policy framework, by revising the Energy Performance of Buildings Directive (2010/31/EU) and establishing a target for 2030 with an intermediate milestone, to better address the renovation of existing buildings. On the other hand, a majority of stakeholders representing the **electrical equipment** sector did not see the need for additional measures

by stressing that the existing framework is sufficient to cover energy efficiency of products.

In order to achieve targets and implement policy measures, it was stated by many stakeholders that additional financing instruments and mechanisms should be put in place at EU level in order to stimulate needed investments in energy efficiency. A number of stakeholders stressed that the European Structural and Investments Funds 2014-2020 and Horizon 2020 are key instruments for implementing energy efficiency policies. Overall, it was emphasised that energy efficiency investments should go hand in hand with reducing the existing market and non-economic barriers and also raising awareness amongst market players about the underlying benefits of energy efficiency.

Finally, the public consultation sought views on what could be the most promising technology solutions in future that could help deliver energy savings in the 2020 and 2030 time horizon, and how their development and uptake could be supported at EU level. Several stakeholders stressed that new energy efficiency technologies and solutions are a crucial element of the 2030 framework and that the right demand side policies should be put in place at EU level. On the other hand, a number of respondents argued that the right technological solutions and technologies are already available in Europe and focus should be placed on promotion of best practice, awareness-raising and information.

A broad range of ideas for possible actions were put forward by respondents. This report explores the feedback in more detail. The policy conclusions drawn by the Commission will be set out separately and are not addressed in the present report.

1. PROCESS

The consultation consisted of a questionnaire in English with both closed and open questions. The on-line questionnaire can be found at the end of this report.

The public consultation complied with the Commission's minimum consultation standards, including the 12 week minimum duration (from 3 February to 28 April 2014). The standard Commission internet tool for Interactive Policy Making (IPM) was used. As participation was voluntary and based on self-selection, the views expressed by respondents are not necessarily representative of the views held by all stakeholders or citizens.

2. STAKEHOLDER COVERAGE

Overall 720 responses from individuals and organisations from 27 Member States were received through the IPM tool (the on-line questionnaire).

Type of stakeholder	**Number**	**Proportion**
Organisations	241	34%
Companies	179	25%
Individual citizens	264	36%
Public authorities	21	3%
Other	15	2%
Total number	**720**	**100%**

In total 241 organisations and 179 companies took part in the public consultation. In addition, 21 public authorities and 15 other entities submitted their replies. Furthermore, 264 individual citizens contributed their views to this consultation.

A few additional responses, 13 submissions, were submitted by organisations which did not make use of the web-based interface to reply to the questionnaire. Some of those who replied to the online questionnaire also submitted their position papers. The statistical data in this report refer only to responses made by the 720 responses submitted through the IPM tool. However, the views in all the submitted responses, including those submitted without using the IPM tool, have been considered by the Commission services.

3. STAKEHOLDERS' RECOMMENDATIONS

Public consultation was structured in 2 groups of questions. The first part was of a general nature which focussed on energy efficiency policy options and potential means of setting the binding or indicative targets and measures and the second part focused on energy efficiency in the specific sectors. In addition, the questionnaire contained horizontal questions on financing instruments to mobilise investments for energy efficiency, and also on building the capacity of actors in the energy efficiency sector and on ensuring the necessary technology solutions and their uptake at EU level.

a. Energy efficiency target(s) and measures

This part of the public consultation sought views on possible policy scenarios that could be undertaken to narrow the shortfall of reaching the 20% energy efficiency target by 2020 and also looking into the 2030 perspective. The questions covered the following options:

- Proposing energy efficiency targets;
- Reinforcing the implementation of existing legislation including active policy on infringements;
- Proposing new legislation;
- Other suggestions.

1) Energy efficiency targets

Several stakeholders emphasised that in general energy efficiency efforts should aim at reducing the EU's dependency on imported gas and serve as a political response to ensuring the security of energy supply. Energy efficiency also aims at mitigating climate change and creating new job opportunities for the European economy.

To the multiple-choice question on what could be the right approach to addressing the shortfall (of achieving the 2020 objective), most replies (312 or 43%) indicated a preference for energy efficiency targets, while 294 (41%) stated that the reinforced implementation of existing legislation including active policy of infringements is needed and 136 (19%) replies were in favour of new measures. 321 (48%) replies indicated other views in this regard which have been summarized below in the report.

To the question on how energy efficiency targets should be expressed, 134 (43%) respondents out of those favouring targets replied that these targets should be expressed as absolute energy savings, whilst 60 respondents (20%) indicated that they should be expressed in terms of energy intensity improvements of the economy and economic sectors. Moreover, 91 (29%) respondents believed that the targets should be expressed as a combination of absolute energy savings and energy intensity levels in order to represent a better benchmark upon which to frame a 2030 objective.

To the question at what level these targets should apply, many stakeholders argued that such targets should be set at EU level (218) or national level (207), while 110 favoured targets at sectoral level. Moreover, 221 respondents favoured legally binding targets whereas 70 would prefer indicative targets.

Those respondents that favoured legally binding targets stressed that addressing the shortfall should be closely linked to and consistent with the 2030 targets for energy efficiency. In addition, it was suggested that targets should be set beyond 2030 (until 2050) in order ensure a more stable and predictable environment for investors. Several stakeholders argued that targets should be realistic and achievable, with strictly defined monitoring and verification procedures in place demonstrating effective and credible progress towards achieving these targets, including appropriate sanctions for addressing non-compliance. Moreover, it was suggested that regular review of progress should be carried out on the basis of the intermediate milestones. In general, it was emphasised that binding targets would increase awareness amongst the general public and stakeholders, and that a high ambition level would trigger innovative solutions and create more jobs. Moreover, legally binding targets both at EU and national level would help in reinforcing the Energy Efficiency Directive (2012/27/EU).

Some stakeholders argued that legally binding targets should be set in proportionate terms for each Member State to avoid the situation where some Member States would dramatically under-perform and rely on other Member States to 'carry' them. However, such national targets would need to be accompanied by stricter legal requirements (of the Energy Efficiency Directive) and necessary commitments taken by all relevant actors in order to reach them.

It was also emphasised that an absolute energy savings target must be derived from a bottom-up approach based on the cost-effective energy savings potential for the various sectors, prioritising the sectors with the highest savings potential (e.g. buildings), and using a simplified harmonised calculation methodology and eligibility criteria similar to the requirements laid down in Article 7 and Annex V of the Energy Efficiency Directive. however, other stakeholders stressed that sufficient flexibility should be left to the Member States to take forward the necessary measures.

Some stakeholders stated that sectoral targets should also be considered for 2030 by arguing that binding targets work well in the renewable energy sector, and have provided confidence to investors allowing achieving a major increase of renewable energy sources. In these stakeholders' view lack of binding EU and/or national targets for energy efficiency was a reason for why the technologies have not yet been deployed at a larger scale.

In addition, it was pointed out by a number of respondents that a combination of targets at national and sectoral level should apply, since national targets would better take into account the priority sectors. National objectives should be combined with a sectoral plan to boost, for example, energy efficiency in buildings, taking into account supply-side and demand-side measures and involving the relevant stakeholders.

It was highlighted by many respondents that a large untapped energy savings potential lies within manufacturing industry and it should be addressed properly. This would also increase the competitiveness of EU businesses globally. It was suggested that the differentiation of energy efficiency targets for industry branches is needed by setting separate targets for SMEs and large companies within the same industry branch. Member States could also identify the sector potential in their National Energy Efficiency Action Plans. For instance, one of the quickest paybacks for industry would be investing in thermal insulation.

Moreover, several stakeholders suggested that targets for the buildings sector should reflect the 2050 climate objectives, especially for building renovations, to facilitate investment plans. A target for 2030 also is needed as an intermediate milestone for assessing the achievement of the renovations rate needed for the 2050 objective.

A suggestion was put forward that a legally binding savings target should be put in place for the transport sector. Energy savings targets should also be applied to the defence sector – as already in countries such as the U.S. and Denmark. Several respondents argued that a specific target should also be formulated for heating and cooling sector.

Those respondents who favoured targets expressed in absolute energy savings rather than in terms of energy intensity argued that targets expressed in energy intensity would not ensure a decrease of energy consumption in absolute terms. By contrast, stakeholders preferring targets expressed as intensity argued that absolute energy saving targets would limit economic growth and would lead to deindustrialisation and even carbon leakage. Moreover, it was stressed that the overall EU target should be expressed as an energy intensity target for the industry and service sectors in order to take into account structural effects and economic growth.

2) Reinforcing the implementation of existing legislation

294 respondents (41%) called for further reinforcement of the implementation of the existing legislation, many of them insisting on the more ambitious implementation of the Energy Efficiency of Buildings Directive and Energy Efficiency Directive. In their view these legislative instruments serve as the main driver of energy efficiency across the different sectors.

It was pointed out by several stakeholders that at this stage it is too early to assess the impact of the implementation of the Energy Efficiency Directive as the transposition deadline is still due (on 5 June 2014) and measures need some time to deliver results. This Directive defines a set of key innovative energy efficiency instruments. A better coordination and dialogue between the EU and Member States should be ensured to make the most effective use of the available tools in order to allow better achievement of the savings targets. In addition, it was stressed that a common implementation strategy could be developed engaging all the relevant stakeholders. This could increase the quality, support and ownership of results, help identify best practices, encourage coordination of financing instruments.

A number of respondents emphasised that EU financing is crucial for implementing existing measures, and that financial incentives should be linked to dissemination of best practice in achieving energy savings. Some stakeholders argued that more stringent infringement procedures and sanctions should be put in place to allow better enforcement of the existing legislation. Suggestions were put forward on putting more emphasis on public awareness activities pursued at EU level in order to inform market actors, including industry, about the benefits of saving energy and reducing costs. Energy efficiency in general should be promoted as an instrument for improving industrial competitiveness and serving to combat the energy poverty.

A number of stakeholders believed that energy audit schemes established under Article 8 of the Energy Efficiency Directive should be linked to concrete savings targets. It was also stressed that more stringent actions could help achieving the untapped energy savings potential in manufacturing industry. Moreover, several stakeholders pointed out that the reform of the ETS along with the recently proposed market stability reserve mechanism would better contribute to energy efficiency in the future.

Some stakeholders also pointed to the need for ensuring consistency between the provisions under the Energy Efficiency Directive on the use of energy performance contracting by public authorities and EU rules on public accounting to facilitate the use of energy performance contracting.

3) Proposing new legislation

135 (19%) respondents called for new legislation to foster energy efficiency, which in their view would create stronger demand, reduce remaining economic and non-economic barriers and provide long-term predictability to investors. It was argued that the main issue is the lack of action and ambition level to drive the uptake of energy efficiency. Therefore, new legislation and requirements, for example, aiming at extending the scope of building renovation or implementation of energy audits along with recommendations on cost-effective improvements for enterprises should be further developed.

Several stakeholders put forward concrete ideas for revising the existing EU legislation. Notably, it was pointed out that in order to meet ambitious energy savings objectives for 2030, the 1.5% energy efficiency savings target laid down by Article 7 of the Energy Efficiency Directive should be retained and increased during the 2020-2030 period. It should also be considered whether 1.5% is sufficiently ambitious for the current 2014-2020 obligation period. Moreover, it was suggested that exemptions allowed under the Energy Efficiency Directive could be removed, for example, concerning the transport sector which currently can be excluded from the baseline for calculating the energy efficiency savings targets under Article 7. In addition, it was stressed that exemptions under Article 5 to achieve the 3% annual renovation rate for public buildings should also be removed. The 3% rate should apply to all public buildings (owned or rented) irrespective of floor area and location (without the limitation to central government buildings).

Some stakeholders emphasised that technical standards and definitions should be harmonised in the Energy Performance of Buildings Directive, and that the Energy Performance Certificate should be strengthened by incorporating additional information. Furthermore, a longer term outlook beyond 2020 is needed for the Ecodesign Directive and Energy Labelling Directive. Finally, it was stressed that emission performance standards for the transport sector need to be expanded to other modes of transport.

It was pointed out that new legislation should consider institutional and governance reforms to strengthen accountability at national level for delivering commitments in current and future National Energy Efficiency Plans and to reporting on progress. Economic reforms are also needed to create the enabling environment for energy efficiency. This should be done with the support of appropriate financing and investment measures including State Aid.

4) Other suggestions

322 respondents (45%) used the open option to provide their views on the question on what could be possible policy scenarios to address energy efficiency. Several respondents stated that they favour a single, realistic energy and climate target addressing the reduction of GHG emissions on a global level playing field, complemented by an equal-ranking target for industrial growth. It was also stressed that energy efficiency and renewable energy would in in any case be drawn on in delivering this objective, and the retention of only a single objective would allow avoiding counterproductive effects, such as double regulation. Flexible energy efficiency improvements on a voluntary basis by taking into account specific sectors and national context could be the most effective means to reduce CO_2 emissions and foster economic growth.

Moreover some stakeholders argued that energy efficiency measures should not bring additional costs to sectors already covered by the ETS. Additional energy efficiency targets affecting these sectors would only increase the overall costs.

Several stakeholders stated that improved modelling of energy efficiency and energy savings, and identification of the cost-effective potential for energy savings would provide greater understanding of how energy savings can be achieved and where to concentrate efforts in terms of additional policies and measures and financial support mechanisms. Better understanding of the benefits of the energy savings potential in terms of jobs created, drivers of growth and competitiveness, reduction factors of energy costs, increased energy security and resulting reductions of greenhouse gas emissions would demonstrate that energy efficiency is a correct solution to many of the issues Europe is currently facing. Moreover, discount rates assumed for energy efficiency measures in existing modelling must be reduced in order to be more realistic and prevent unfairly high depicted costs of these measures.

It was argued that industry has a track record in reducing energy intensity as well as emissions. Further reductions must thus be economically justified. In this regard, binding targets and new legislation will only make Europe a less attractive place to invest and result in higher unemployment. Best practice sharing and development and deployment of new technologies could be the most constructive manner to further improve the energy efficiency.

Respondents stressed that in general it is hard to predict the development of the economic activities over the next decade and that energy consumption is correlated with many parameters, including the two most important ones, the level of economic activity in Europe and the cost of energy. Several stakeholders emphasised that energy production should follow economic development and not constrain it. Given the fact that Europe itself cannot produce more energy without endangering its environment, it requires more efficient coordination and cooperation across borders, and an integrated approach including energy storage and distribution that would allow flexible response mechanisms.

4. ENERGY EFFICIENCY AT SECTORAL LEVEL

The public consultation asked whether further measures are needed at EU level to foster energy efficiency in different sectors such as buildings, industry, transport, electrical equipment and energy generation and distribution.

1) Buildings

As regards the buildings sector, 359 respondents (50%) believed that further measures are needed whilst 301 (42%) thought that there is no need for further action, and 60 (8%) respondents had no opinion on this matter.

Many respondents underlined that buildings is one of the economic sectors where massive energy savings could be achieved. However, limited progress so far is often due to the lack of financing and other market barriers. In general, the policy framework for improving the energy performance of existing and new buildings needs to be strengthened and cooperation and coherence should be ensured between different policy and legislation measures, also covering all phases of a building's lifecycle. It was stressed that the implementation of the Energy Performance of Buildings Directive is key and should be supported with the significant EU investment, and that demonstration projects are key to enable increasing the uptake of these technologies from an economic point of view.

A number of respondents stressed that in order to exploit the untapped energy savings potential in buildings, the EU should define a long term objective with intermediate milestones, supported by the right policies and financial schemes to remove market barriers and incentivise renovation. A clear framework should entail wide-scale renovation programmes, the need for a skilled workforce in deep renovation combining building envelope insulation and other measures.

Moreover, it was emphasised that a binding target for 2030 would provide certainty and convergence for long-term financing decisions. Such a target should be set at national level due to different national circumstances, including the climate variations amongst the Member States. Moreover, a target for 2050 could serve as a driver for an increased rate of renovation of existing buildings. In general, cost effective reduction of energy consumption should be given a priority and it should be well reflected in the definition of the nearly zero-energy buildings, including reflecting it in national building renovation strategies under the EED on the basis of agreed mandatory templates for such strategies.

A number of stakeholders stressed the need for long-term EU funding such as the European Structural and Investment Funds to support major renovations, whereby, for example, the level of financing would depend on the achieved savings as a result of the renovation.

Some respondents suggested that minimum performance requirements for rental of existing buildings should be also established at EU level. It was suggested that the Energy Efficiency Directive must put forward measures with the long-term vision that would require extending the 3% renovation rate to all public buildings and publicly supported buildings, set stricter standards than cost-optimal levels for these buildings, require the use of new business models that remove barriers for increased energy efficiency, mandatory requirements for the implementation of cost-effective solutions in buildings. This must also be reflected in the national long- term strategies for building renovations.

It was seen by some stakeholders as important that any additional requirements are set in terms of energy performance rather that pressing for specific technical requirements that might not be cost efficient. In addition, it was suggested that the extension of the scope of requirements for the energy performance of buildings is needed, for example covering also lifts, escalators and moving walkways. Fiscal incentives should also be strengthened, including applying a "polluter pays principle". Stakeholders argued that financing incentives would encourage final consumers and enterprises to better meet the energy savings targets embedded in the EU and national buildings legislation.

A number of stakeholders shared the view that Energy Performance Certificates (EPC) should be strengthened, by making them harmonised at EU level. It is also necessary to improve their overall quality and functions which could foresee mandatory on-site visits and setting up a database at national level. The EPC should be better explained to ensure transparency. Moreover, EPCs should become comprehensive "building passports" to follow each building throughout its lifetime and which could be made publically available in national registries.

Some stakeholders called for revision of the Energy Performance of Buildings Directive and relevant parts of the Energy Efficiency Directive to include a measurable definition of deep renovations and a quantifiable objective to accelerate deep renovations of residential and tertiary buildings. Furthermore, it was emphasised that long term renovation roadmaps need to become a key planning tool setting comprehensive strategies, including financial incentives, in order to refurbish national building stocks. It was also underlined that Member States should introduce legal minimum energy efficiency requirements for rented buildings which are very often the least efficient.

In addition, it was underlined by several respondents that initiatives promoting energy efficiency in buildings should in general follow a holistic approach and focus on the whole value chain covering efficient technologies, district heating and smart metering and billing information. It was stressed that remaining obstacles in national property laws should be removed and that the issue of “split incentives” between landlords and tenants should be properly addressed. In addition, obstacles for effective energy performance contracting should also be tackled.

It was also emphasised by some respondents that participation of SMEs should be facilitated, e.g. SMEs in the construction sector should have access to training as well as access to self-assessment instruments enabling them to check the quality of energy efficiency improvements.

Several respondents called for new measures to trigger mass-scale deep renovation of existing buildings. As regards new buildings, it was stressed that a revised Energy Performance of Buildings Directive should propose a harmonised technical definition of Nearly Zero Efficient Buildings (NZEB) to converge on common nomenclature, objectives and calculation methods, and that buildings-related provisions of the Energy Efficiency Directive (Articles 4 and 5) should be incorporated in the revised Energy Performance of Buildings Directive to have a single and powerful policy instrument.

Moreover, it was also emphasised that Energy Efficiency Obligations should become a useful tool for providing renovation investments and should continue also after 2020.

2) Industry

A majority of stakeholders (424 or 59%) believed that further policy measures are needed at EU level to foster energy efficiency in industry with (192 or 27%) against and (83 or 12%) having no opinion in this regard.

A number of respondents stressed that the market and its technological breakthroughs should play a role in achieving the necessary cost savings. It was also stressed that strong political commitment and legislation are needed to ensure that the cost-effective savings potential in industry is realised. For example, adapting business models to energy efficient production processes would allow producing high quality products at lower cost, thus increasing competitiveness. It was argued by several stakeholders that a strong potential for additional savings and reduced GHG emissions lies in recycling.

A majority of respondents who favoured additional measures addressing energy efficiency in industry suggested that in order to achieve the unrealised energy-saving potential in industry, energy efficiency should become part of strategic decision-making within energy management systems involving a wide range of areas for improvement such as circular economy, resource efficiency, insulation, use of efficient electric motors and variable speed drivers, use of automation and control equipment, monitoring systems and maintenance, including behavioural change.

Moreover, it was emphasised by many stakeholders that there is a great potential associated with energy audits required by the Energy Efficiency Directive; however, this instrument should be strengthened by ensuring that resulting recommendations become mandatory, at least for those recommendations that address actions with a short pay-back period. In addition, energy audits could be extended to cover also SMEs to help smaller companies to find the best solutions to adapt to increasing energy prices. Some stakeholders were more cautious by pleading that existing energy audit requirements should be continued. It was underlined by a number of respondents that energy audit provisions should be used to encourage companies to trigger investment decisions in order to improve energy efficiency in processing and peripheral energy use. In general, additional financial mechanisms and instruments are needed in order to pursue these necessary measures.

Several respondents argued that best practices and benchmarks should be developed to increase the use of energy audits, and that benchmarking should be developed for the relevant industry sectors. An assessment of the cost-effective potential of each particular sector of industry is needed to identify gaps, design tailor-made energy efficiency objectives and measures to target relevant sectors.

Several stakeholders suggested that appropriate energy efficiency benchmarks should be defined in the Best Available Techniques (BAT) reference documents (BREFs). These benchmarks should be used for setting ambition levels and be more frequently reviewed. Moreover, ambitious requirements on energy efficiency in the relevant sector BREF reviews should be adopted.

Some respondents called for voluntary initiatives, to be encouraged through practical and cost-effective support measures, rather than additional mandatory requirements. Such voluntary initiatives, for example, would ensure implementation of practical energy management solutions while avoiding the additional administrative burden stemming from the additional regulations.

To this end, it was argued that greater information for all market actors, especially on the benefits associated with energy efficiency in industry should be promoted, alongside information on concrete solutions, especially for those that have relatively short payback periods. In addition, it was highlighted that specific requirements for facility manager training, workforce development and alignment of training needs and workforce development are needed to achieve the necessary results. It was suggested that "Learning energy efficiency networks" could be an effective instrument to learn about energy saving potentials, particularly for SMEs, and that financial support for the establishment of such networks could be provided at EU level.

Those respondents who were against additional measures expressed views that there is no need for additional targets or other mandatory requirements imposed on the energy intensive industries that are part of the ETS. They argued that new industrial installations are already energy-efficient and that ambitious top-down EU policies would cut investments resulting in higher cost burden for industry. In general, they argued that long term climate and energy policies will only be achieved by working in accordance with economic and growth needs.

It was noted that at industry level, the ETS is the right instrument for energy efficiency improvements. In order to provide incentives for energy efficiency measures the ETS should be strengthened to contribute its role as the central market-based instrument. It was also argued that the ETS should be strengthened as the single steering method in the sector, and that heating and cooling sector should also be included.

Many respondents underlined the need for reforming the ETS in order to contribute in a cost-efficient manner to the reduction of greenhouse gas emissions during the period 2020-2030. Furthermore, it was stressed that it should be ensured that funds generated by ETS are earmarked for further energy efficiency measures in energy intensive industries. However, when reforming the ETS, competitiveness aspects and risks of carbon leakage should be taken into account.

A number of respondents stressed that caution should be employed as regards the implementation of Energy Efficiency Obligation schemes, and that company-specific targets should be avoided, arguing that such targets would diminish early action and add disproportionate administrative burden. Increased costs for industry would hamper the investments needed for expanding the business and would risk delocalisation to third countries. However, it was pointed out that energy intensive industries are contributing with their manufactured products and technologies to energy efficiency in buildings, transport and other economic sectors.

Several respondents perceived high energy prices as a helpful driver to take the necessary action to boost energy efficiency in industry. Nevertheless, others perceived energy efficiency policies as an additional burden to the competitiveness.

Several respondents believed that the completion of the internal energy market would ensure more energy savings in the energy supply and distribution markets. National policies could deliver more as regards the promotion of efficient co-generation and industrial heat recovery in line with the requirements of the Energy Efficiency Directive, as could the linking of regulated remuneration levels for network operators to the achievement of specific energy efficiency targets or connection of co-generation.

Some views were expressed that market failures mean regulatory action is required to motivate businesses to pursue the necessary energy saving actions since raising awareness of energy efficiency alone will not trigger the necessary actions. The EU should learn lessons from national schemes that have used financial instruments to drive energy efficiency as in the UK and Denmark, for example.

Finally, it was stressed by a number of respondents that it is of utmost importance that the existing legislation is implemented and that it is too early to judge whether additional measures are needed before the Energy Efficiency Directive is fully in place.

3) Transport

As regards transport, a majority (473 or 66%) of respondents had the opinion that further policy measures are needed with 102 (14%) respondents being against, and 121 (17%) having no opinion in this regard. Stakeholders in favour of additional energy efficiency measures in transport suggested that existing non-binding measures in transport should be made compulsory and that better integration with other sectoral policies is needed - such as urban development, innovation, financing, public health and regional development and access to resources.

In general, it was stressed by many stakeholders that transport should be one of the priority sectors to address energy efficiency. To this end, a transformation of the entire transport system is needed since it is the largest consumer of final energy. A combination of different measures should be used, e.g. increase in the use of non-road alternatives or taxation policies to achieve a level playing field across the transport modes.

It was argued by some respondents that transport should be covered by the Energy Efficiency Obligations schemes or alternative approaches in order to achieve further energy savings. EU transport policy should aim at reducing energy demand, achieving modal shifts to more efficient transport modes and vehicle efficiency improvements.

In order to improve energy efficiency in transport, the Trans-European Transport Networks (TEN-T) should be strengthened. This could be accomplished by the international, cross-border application of existing logistic concepts and aerodynamic modifications to vehicles. Moreover, new mobility solutions including vehicle and bike pooling and sharing must be further developed, and better integrated into public transport systems. In order to pursue these measures the EU should develop a comprehensive strategy, including investment, incentives and market design.

Moreover, it was stressed by a number of respondents that the provisions of the Fuel Quality Directive on greenhouse gas emissions from fuels should be continued beyond 2020.

Those respondents who favoured additional measures in the transport sector suggested that electrification of transport presents a great opportunity for reducing fuel imports and also GHG emissions. However, the electrification of transport is linked to many questions that need to be addressed in order to make this transition effective. These would include transition guidelines from hybrid to plug-in hybrid and fully electric vehicles, and implications of regional climate for vehicle battery performance. Research should be carried out for the development of alternative and promising battery technology, hydrogen fuel cells, structures for distributor networks and service, public charging infrastructure and grid implications.

To this end, Horizon 2020 could be instrumental in creating a research and/or collaboration platform for responding to these issues. Furthermore, it was stressed that deployment of pilot projects in this area would be essential. Moreover, continued innovation for efficient and clean transport through, for example, superior light-weight and tailored materials such as plastic based composites should be fostered. To make all these innovations happen, a multifaceted approach is needed. Technologies should be developed and different industry sectors, and the research community, should collaborate across the whole value chain.

It was stressed that in order to promote sustainable transport solutions an interoperable, alternative fuels infrastructure in Europe should be put in place, also diffusion of innovative and interoperable technologies that could help save energy and reduce CO_2 emissions. Efficient road lighting and traffic control systems should be fostered on one hand, and obstacles impeding cross-border transport or infrastructures should be removed on the other. To this end, the recently adopted Directive on the Deployment of Alternative Fuels Infrastructure will enable improving the energy efficiency of road transport.

It was pointed out that regulators should ensure that recharging points are compatible with smart grids and that an ambitious minimum number of recharging points is set for 2020 to send the right signal to investors and industry that will produce the necessary technological solutions. In addition, national policy frameworks should be given flexibility to define national targets and objectives for the deployment of an alternative fuels infrastructure. Policy to support standards in electrification of transport can drive optimization of the design of the electricity grid and infrastructure, where features such as load balancing, metering and the charging infrastructure are important.

Overall, demand-side systems together with smart grid solutions will provide an intelligent platform for the smooth integration of electric and plug-in vehicles into the electric grid. It was also stressed that in addition to measures fostering the electrification of transport, other alternative fuels like biofuels from waste and residues or fuels based on power-to-liquid/power-to-gas conversion should be developed for those transport modes that cannot be electrified.

Some stakeholders stated that the Clean Transport Package provides a framework to guide investments and technological developments in alternative fuels and that it also provides a positive signal to national authorities and investors for encouraging the market uptake of alternative fuel vehicles and vessels. However, such measures should be flexible and cost efficient to preserve the competitiveness of the different transport sectors, especially for shipping. As regards maritime transport, international binding measures on reducing CO_2 emissions should be implemented via the International Maritime Organisation.

It was suggested that fostering energy efficiency in transport should be further supported by measures based on detailed EU-wide monitoring of the use of alternative vehicles and impact of their infrastructure on local energy grids to assess the impact of policy measures and their contribution to achieving the EU ambition of reducing the number of conventionally fuelled vehicles in urban areas by 2030. It was argued that although urban sustainable mobility plans are a good way forward, a EU wide roadmap is also needed, which should be developed in close cooperation with the most polluted regions in Europe, setting out the parameters that would determine progress and identify the most energy efficient alternative fuel solutions. Measures such as training schemes to reduce fuel consumption, financial support for mobility management, investment in energy efficient vehicles (CNG, LNG, hybrid and electric vehicles) and telematics services for public transport to ensure a change towards energy efficient mobility should be urgently addressed. Member States could financially support investments for uptake of vehicles propelled by alternative fuels and co-finance the expansion of a supply network for alternative fuels. It was argued that better integrated management of transport infrastructure is needed to increase uptake of more efficient transport modes. Some stakeholders argued that fiscal incentives and tax measures should play a role in this regard, also introducing the "polluter pays principle". It was pointed out that high energy prices have led to the increasing efforts in fostering energy efficiency in transport.

Some respondents called for modal shifts to more efficient transport modes, for example to rail transport or shipping, including also freight. It was argued that rail technologies are already 3 to 4 times cleaner than road or air transport. EU support could be provided via regulations or infrastructure projects. A suggestion was put forward that a carbon tax on petroleum products should be applied to road transport to align its level since rail transport is impacted by the ETS as its main power source, electricity, is covered by the cap-and-trade scheme. This would ensure a level playing field across the transport modes.

On the other hand, some stakeholders argued that forced modal shift should be avoided. Measures should aim at greening individual modes at source and they should not favour one mode over the other and should be technologically neutral. A reflection should be made at EU level on whether a sustainable freight transport network can be best achieved from an economic, social as well as environmental perspective by further electrifying rail infrastructure or by using these funds to electrify main road corridors. The use of taxes and levies in order to change behaviour should be redirected to avoid the situation that these tools are used only for fiscal purposes and are not encouraging greening at source through the earmarking of fiscal revenues. It was stressed that the use of alternative fuels in commercial road transport operations should be further encouraged and their refuelling infrastructure further deployed and harmonised.

It was stated by several stakeholders that public transport plays a key role to improve energy efficiency of transport including shifting from road transport to other transport modes such as railways and ships. Intermodality must become the core principle underlying all mobility policies, especially in public transport where the interplay between services must be enhanced (e.g. with joint planning of networks, coordination of timetables, better information provision, common reservation and ticketing systems, common baggage handling, enhancing passenger rights). Information and communication technologies and services can play a role in fostering this.

As regards emission performance standards, it was stressed by many respondents that existing standards need to be continued and improved further, and that work should continue on standards for heavy-duty vehicles. The next revision of CO_2 emission performance standards for light-duty vehicles shall explore possible options (e.g. energy efficiency parameters, super-credits, tailpipe CO_2 standards or GHG emissions). In addition, CO_2 label should be further discussed by considering possible options such as e.g. absolute or relative CO_2 emission performance levels.

Some views were expressed that ambitious targets for 2025 and 2030 should be set. Targets for 2030 should reflect continued progress and advances in technology. To avoid rebound effects, economic measures such as ETS (at refinery level) and taxation should be applied. It was also pointed out that additional measures are needed to address energy efficiency in aviation and that the EU should push harder to implement the Single European Sky.

4) Electrical equipment

To the question whether additional measures for electrical equipment sector are needed, 259 (36 %) stakeholders replied affirmatively, whilst 279 (39 %) respondents believed that there is no need for further measures, with 159 (22 %) not having any opinion on this matter.

A majority of those who replied affirmatively stressed that even though the Ecodesign Directive (2009/125/EC) and Energy Labelling Directive (2010/30/EU) have contributed to a significant reduction of energy consumption, in the light of the upcoming Review of this legislation several aspects should still be addressed. Concerning the Ecodesign Directive these should be: speeding-up the process that leads to the adoption of implementing regulations, setting minimum requirements that are not quickly outpaced by market developments and strengthening market surveillance by cutting red tape.

As regards the Energy Labelling Directive, there is an urgent need to improve the design of labels. The 2010 decision to add additional classes with plusses instead of ensuring a rescaling of the label has reduced the ability of the label to guide consumers' choices. It was also argued that energy labels should include broader information on other environmental aspects and absolute energy consumption, especially for larger products which have higher overall energy consumption.

It was suggested by several stakeholders that both directives should be reviewed in light of the 2030 framework to foster development of innovative technologies due to a greater predictability for the investors. Several stakeholders also called for increasing synergies and aligning the decision-making process between the ecodesign and energy labelling measures to allow reduced inconsistencies in the drafting phase and speed up the implementation of the measures. Moreover, synergies with other legislation such as the Ecolabel, Green Public Procurement, and recycling, waste and chemical legislation should be ensured.

Several respondents indicated that demand side policies should be designed to stimulate demand for higher efficiency products in the market. It was emphasised that even though the existing ecodesign legislation is sufficient the extension of its scope could be considered. In addition, the ecodesign directive should be coupled with measures speeding up the replacement rate of old equipment such as vouchers or eco-cheques. Furthermore, the directive should seek to optimise not only the end-use equipment, but the entire system in which it operates.

It was pointed out that financial incentives such as reduced VAT rates for the most efficient appliances could also be promoted.

Some stakeholders argued that legislative processes should be accelerated and become more dynamic in order to reflect current market transformation processes. The level of ambition of ecodesign standards needs to be increased. The criterion of least-life-cycle-costs should be reviewed and the criterion of the best available technology (BAT) should be considered as the benchmark. Moreover, the future regulatory framework needs to support innovation as the current framework fails to provide incentives for frontrunners.

A number of stakeholders viewed the importance of electrical equipment sector in the broader energy efficiency policy context, notably seeing it as an integral part of other sectors such as buildings or energy supply, where electric installations and systems play an increasing role to optimise overall energy performance. This is in particular important in the development of smart grids, where the efficient management of infrastructure in combination with efficient appliances interoperating with the future energy system including smart metering would ensure significant energy savings. Furthermore, demand response should provide consumers with real-time control signals motivating them to adjust their consumption. Moreover, peak load management, according to the respondents, was regarded as a significant element that allows optimising the functioning of power plants and the power system as a whole, and also contributes to the security of supply.

It was also suggested that in order to increase the energy efficiency of electrical appliances, manufacturers should be required to conduct a design assessment of their products at an early development stage. Such an assessment, based on generic data, would aim to optimise resource use in the product design together with durability and quality requirements of the specific product. Ultimately, this would drive production towards a best-cost producer model. It was argued that the approach of ecological profiling would not remove the need for specific energy efficiency parameters that could be verified on the product itself.

Some stakeholders argued that the ecodesign directive should omit the use of primary energy conversion factors as these mislead consumers that cannot choose their energy system. The electricity conversion factor should be treated as a CO_2 neutral one in order to meet the 2050 vision of a low carbon future.

It was suggested to set-up a publicly available, producer-supplied product-database for both directives that would improve monitoring and transparency of market development and would facilitate the revision of existing and the drafting of new legislation.

Those respondents who were against additional measures for the electrical equipment sector stated that the Ecodesign Directive and the Energy Labelling Directive already cover most significant aspects of energy efficiency concerning electrical equipment. Instead of adopting new measures, these two pivotal directives should be enforced and implemented, and a comprehensive assessment should be carried out and discussed with stakeholders before launching new initiatives.

Moreover, it was underlined by several stakeholders that the current review of the energy labelling regulation and certain aspects of ecodesign set a favourable framework for increasing energy efficiency in electrical equipment. It was stated that demand-side policies are key for triggering innovative solutions; however, market-based mechanisms should be also considered.

A number of stakeholders argued that any further extension of the scope of the ecodesign directive targeting product groups or industrial systems and processes, in their view would generate complex trade-offs and create more regulatory burden for businesses, especially for SMEs. Thus it is crucial to ensure proper functioning of the decision-making process under the existing directive, especially with regard to the participation and interests of SMEs, and conduct a cost-benefit-analysis of its implementing measures before proposing further ecodesign measures.

On the other hand, some stakeholders acknowledged that the implementation of both directives could be improved. For instance, in order to better address the efficiency potential of business-to-business products within the ecodesign framework, the option of setting generic requirements and developing product-specific standards should be reverted to, since it was argued that many complex products of the capital goods sector have differing applications and as a result no constant operating point so that specific energy efficiency requirements can often not be determined.

5) Energy generation and distribution sectors

418 (58%) stakeholders believed that additional measures are needed to address the energy generation and distribution sectors, while 148 (21%) were opposed to it and 119 (17%) did not have an opinion in this regard.

Those respondents who favoured additional measures for energy generation and distribution suggested that mandatory energy efficiency requirements for new power plants and heating distribution systems are needed. It was stated by several respondents that a level playing field across the Single Market should be ensured, and that market transparency and better integration including modernisation of the national grids should be ensured. The priority should be the completion of the internal market for energy to ensure the energy supply and access to customers in all Member States. To this end, it was emphasised by a number of respondents that the expansion of cross-border infrastructure, in particularly cross-border interconnectors, which also foresees decentralised energy distribution, is required. It was pointed out that the current restrictions regarding the development and improvement of European networks of interconnections should be overcome to foster market integration, diversification of energy supply and energy efficiency. In addition, some respondents underlined that energy trade with third countries should be based on a level playing field.

Moreover, the development of smart grids and high-efficiency district heating systems, including the successful rollout of smart meters should be secured by 2020. Several respondents argued that smart grids including energy buffering and storage are indispensable for an improved interconnectivity and managing the flow of electricity according to demand and supply. It is also important for the integration of renewable energy and the successful liberalisation of energy markets. To this end, the development of standards should be properly addressed due to the involvement of many different sectors along the value chain.

Several stakeholders argued that the rules on market design for electricity and heating should allow more active and informed consumer participation than today, and allow new actors such as aggregators to enter the market. Stakeholders argued that aggregators could also facilitate a more decentralised generation of electricity.

Many respondents emphasised that a regulatory framework developing a sustainable and smart energy system in the EU shall be further harmonised. Moreover, it was stated that a flexible and intelligent energy system would deliver a high level of security of supply and efficiently integrate various sustainable technologies. To this end, emphasis should be put on establishing a 2030 target at EU level for smart infrastructure by taking into account potential of demand-side management and proper measures aiming to improve the efficiency and flexibility of energy networks, on the basis of a holistic approach - in addition to the deployment of efficient equipment such as transformers.

A number of stakeholders emphasised that solutions aiming at increasing flexibility in energy systems are important, as they facilitate the efficient deployment of renewable sources. Demand side management and response measures can contribute to this significantly, helping to reduce the need to build generation capacity, particularly to cover peak loads. Stakeholders regretted that these measures have not been considered on an equal footing to supply side options and their penetration in the system has been limited. Many of these measures are implemented in the distribution grid, which has been overlooked by the Commission in recent legislative initiatives such as the Energy Infrastructure Regulation and the Connecting Europe Facility. Building on the provisions of the Energy Efficiency Directive, the rules for the participation of these solutions in the system should be made clearer by removing remaining barriers. It was suggested that the Large Combustion Plant BREF should be improved to refer to firm provisions for improving energy efficiency in existing plants.

Furthermore, respondents stated that greater emphasis should be put on increasing the overall efficiency of the energy system rather than the efficiency of its single components, and that legislation should promote the implementation of energy efficiency measures by distribution system operators rather than by energy producers. Thus, renewed effort should be placed on promoting infrastructure projects aimed at increasing the efficiency of how the different components of energy, and especially electric, systems interact.

Several stakeholders stressed that regulators should encourage the use of smart meters to provide easy and quick access to consumption information in real-time, allow energy-efficient behaviour and a more active participation by consumers through advanced services such as demand response. It was underlined that demand response will enable consumers to become active players rather than passive users.

Moreover, new measures should enable transmission system operators (TSOs) and distribution system operators (DSOs) to take into account the benefits of demand response and energy efficiency programmes prior to investing in regional network capacity. Regulation should ensure that they are rewarded and not penalised for increasing their efficiency. Taking into account their key position in managing the local grid and the consumer's data, DSOs could play a more active role in the implementation of energy efficiency measures at consumer level.

Respondents suggested that an integrated approach to the energy system should be built on the process established under Article 14 of the Energy Efficiency Directive through lowering the thresholds for data collection and conducting the comprehensive assessment, including a more focused approach to waste heat. In order to have a fair burden sharing of the costs incurred by investors and customers, respondents expressed views that the list and the values of the externalities to be used in the cost-benefit analyses should be better explained.

In the context of the implementation of the requirements laid down in Article 15 of the EED, a number of stakeholders stated that EU and national regulators should establish tariff structures that reward an energy efficient operation of the electricity, gas and heating markets. Furthermore, a specific focus should be placed on the power sector, containing tangible CHP elements; possibly building on the existing guarantees of origin for high-efficiency CHP (the establishment at national level of "efficiently generated" electricity could be assessed). It was suggested that the Commission should aim at encouraging national and local authorities to use a system-wide approach via an extension of the scope focused on the power sector which is stipulated in annex VIII of the Energy Efficiency Directive.

As regards decentralised energy production, it was emphasised by a number of stakeholders that it increases energy efficiency thanks to cogeneration plants and thanks to reduced energy losses in transportation as well as infrastructure costs. Thus, local energy production including from renewable energy sources to reach energy efficiency targets should be considered. It was also stressed that ICT should play a role in decentralised energy production and distribution, which helps to optimise energy efficiency and to manage variations in the supply and demand of energy in real time.

Furthermore, it was stated that an inventory of barriers and opportunities for the development of efficient heating and cooling should be carried out based on reliable market data, using modelling that fully reflects the reality of energy use in Europe and the potential of local resources and flows as well as of relevant technologies.

Combined heat and power (CHP) is an important technology. Many industrial stakeholders consider the ETS as the main driver of energy efficiency in the power sector. On the other hand, it was recognised by a number of stakeholders that the implementation of the Energy Efficiency Directive (Article 14) creates potential for high efficiency cogeneration which could increase its development and also ensure its implementation throughout Europe, whilst preserving the competitiveness of EU industry.

It was pointed out by stakeholders representing industry that process industries use most of the heat from cogeneration internally and that the opportunities for economic links between industrial CHP plants and possible users such as district heating would not apply equally around Europe. Therefore, it was argued that promotion of CHP by market-based mechanisms could more appropriate than mandatory rules adopted at EU level. According to the respondents, some national schemes, for example in Italy, have already applied a market-based approach. It was stressed that criteria for determining the economic benefits of projects or installations cannot be the same across the entire EU. To this end, it was emphasised that barriers to the promotion of economic cogeneration should be removed and the need for companies to achieve economically sustainable rates of return on new projects should be recognised.

The significant energy efficiency potential in power generation could be partly tapped by removing derogations on energy efficiency under the Industrial Emissions Directive. The Large Combustion Plant BREF should include clear requirements to deliver energy efficiency improvements, particularly an incremental energy efficiency improvement for all existing combustion plants, and a CHP obligation for new plants. BAT conclusions should be drawn from the existing Energy Efficiency BREF, which should be reviewed without delay according to regular procedures but not become a simple guidance document. Increasing the flexibility of the energy system will improve efficiency and facilitate the deployment of renewable energy.

A number of stakeholders stressed that the EU should ensure that BAT energy efficiency levels are binding for thermal power generation and that a timeline for large combustion plants (LCP) to comply with it should be established. On contrary, it was argued that

Member States are implementing or have implemented strategic reserves or other forms of capacity mechanisms that often extend the lifetime of older power plants without incentivising their improvement.

Some stakeholders suggested that a single capacity mechanism design is needed at EU level, to prevent further fragmentation of the internal energy market. Optimally, this design should incentivise newer, more efficient, flexible, and part-load efficient thermal power generation.

Moreover, care is needed to ensure that European Network Codes are strongly linked to European standards to avoid the possibility of divergent national specifications, which could pose problems for efficient cross-border energy trades and functioning of retail energy markets.

It was also suggested that an Emissions Performance Standard for fossil fuel power plants to improve efficiency is introduced. This would also provide a clear investment signal for the decarbonisation of the sector by complementing the Emission Trading System (ETS). It was stressed that the Emissions Performance Standard is already becoming part of the EU climate and energy policy, following the European Investment Bank's decision to no longer fund power projects that emit more than 550gCO_2/kWh.

6) Financing mechanisms and instruments

A majority of respondents (534 or 74%) replied affirmatively that additional financial mechanisms and instruments are needed at EU level to mobilise investments targeting energy efficiency with 94 (13%) being against and 72 (10%) not having an opinion in this regard.

It was acknowledged by many respondents that access to finance remains the major obstacle to achieve the full energy savings potential across the different sectors. Therefore, more needs to be done to address the gap and the EU has a major role to play by providing a stable policy framework and facilitating long-term, low-rate financing structures as referred to in the recently published report by the Energy Efficiency Financial Institutions Group (EEFIG). Several stakeholders suggested pooling of public funding in appropriate funds and leverage private funding via public money, and that earmarked ETS auction revenue could be used for targeted energy efficiency programmes. Stakeholders argued that financing should apply to a holistic set of measures rather than single measures and that financial and fiscal incentives should be linked to concrete policy measures and targets. It was emphasised that EU funding shall allow reducing the cost of capital for companies (e.g. risk-sharing). Furthermore, it was argued that support is needed for small and medium sized enterprises to facilitate investment in uptake of more efficient technologies.

Several respondents noted that financing dedicated to energy efficiency has been increasing and that the European Structural and Investment Funds 2014-2020 and Horizon 2020 provide good opportunities for financing and should remain key instruments to support the implementation of energy efficiency policies. It was suggested that the individual starting point and progress of each Member State should be taken into account, whilst rewarding achievements and best practice. Some respondents regretted that national governments do not always consider energy efficiency as a priority. It was suggested that a specific EU funded energy efficiency programme would motivate governments who do not have energy efficiency as a priority to make such investments.

It was acknowledged by a number of stakeholders that lessons should be learned from the existing schemes that proved to be successful and that further financial mechanisms and instruments should be set up at EU level to step up the efforts of existing successful instruments such as ELENA, JESSICA, Mobilising Local Energy Investments - Project Development Assistance and the European Energy Efficiency Fund. Respondents stated that these experimental instruments triggered innovation and implementation of feasible, cost-effective and sustainable solutions at decentralised level. Amongst the views on new financing instruments, crowd-funding or cooperative societies were suggested which could provide new investment potential. In addition, an Energy Efficiency National Fund (referred to in Article 20 of the EED) could serve as an effective instrument that could aggregate multiple sources of public finance to leverage additional private investment. A number of respondents argued that such funds should become mandatory in Member States. Some respondents saw the potential in the Energy Performance Contracting mechanism, which could be encouraged through third party financing and loan guarantees in order to ease financing, especially for SMEs.

Many respondents shared views that access to finance for energy efficiency investments should go hand in hand with reducing the barriers by simplifying procedures and raising awareness amongst the market players about the underlying benefits of energy efficiency. Moreover, financing for energy efficiency measures should be provided under affordable and attractive conditions. This could be done via voluntary agreements by banks or subsidising loans for energy efficiency measures through credit lines, guarantees, etc. Such levers should be provided in a non-discriminatory manner to all market actors, which, according to respondents, is currently not the case in all Member States. In general, it was emphasised that effective coordination between public funding sources would allow getting the best leverage from financing instruments.

Furthermore, respondents suggested that Member States should establish "one-stop-shops" to help energy efficiency projects obtain funding. These structures should facilitate aggregation of projects and be accessible at the local level. It was also noted that further efforts should be dedicated to raising awareness of existing and future financial incentives and grants to foster energy efficiency investments. Several respondents stressed that financing should not place a burden on consumers who are already facing the highest level of billing to their homes, especially concerning more vulnerable consumer groups.

In the context of the Energy Tax Directive and the State Aid guidelines on environmental and energy, it was mentioned that Member States could be allowed to apply tax reductions and payback time reductions facilitated by state intervention to counteract negative impacts on competitiveness for globally competing companies. Differentiation of value added tax targeting energy efficiency shall be re-considered at EU level. Moreover, many stakeholders stressed that State Aid rules should not prevent the use of public funds to support public and commercial energy efficiency projects and that guidelines must take a progressive approach on national energy efficiency funding. Therefore, clear guidance on the state aid exemptions would be needed. On the other hand, some respondents called for tightening the rules on state aid in the fields of environment and energy.

Many stakeholders underlined the need for streamlining of financing to address energy efficiency in certain sectors of the economy such as buildings and industry.

As regards industry, views were expressed that pan-European funding is needed to stimulate investments in energy efficiency and that R&D should be promoted to support innovative technologies and solutions. For instance, investment in research and pilot projects for funding more efficient manufacturing processing of energy intensive industries could greatly contribute to the achievement of energy savings. Support for bringing new innovative technologies along the entire value chain to the market is essential, especially in the deployment phase, but should be technology neutral to ensure a level playing field. Some stakeholders from industry regretted that prevailing barriers perceived by industry are payback periods that are longer than businesses often are willing to contemplate. As an option it was suggested that measures identified during energy audits (in line with Article 8 of the Energy Efficiency Directive) which would have a payback time of less than 4 or 5 years should be mandatory. To this end, the increased use of life cycle cost analysis in energy audits (required by Article 8 of the Directive) by industry shall be secured. It was also argued that "green" public procurement and public-private partnerships should be considered. The EU could become more active in the development of risk financing for industrial large scale demonstration projects of new energy efficient technologies. Finally, direct access for energy-intensive manufacturing industry to EU Framework Programmes via e.g. the SPIRE public private partnership should be maintained and intensified.

Concerning the buildings sector, several stakeholders stated that there is an urgent need to ensure stable and long term financing for renovation programmes that goes hand in hand with political will and sufficient public funding for guarantees and incentives to ensure sufficient action in the Member States. It was stated by several respondents that the Renovation Loan in the new round of the European Structural and Investment Funds may provide a good basis for addressing part of the financing challenge is taken up by the Managing Authorities. The building sector was mentioned as a specific case in which bottom-up legislation also for financing would be necessary to correct market failures. Some respondents stressed that incentives are also needed for homeowners and landlords. A suggestion was put forward that a special fund to address renovations of buildings could be established at EU level.

7) Measures to build the capacity of actors in the energy efficiency sector

322 (45%) stakeholders replied affirmatively that additional measures are needed to build the capacity of actors in the energy efficiency sector, whilst 230 (32 %) stated that there is no need and 131 (18%) did not have an opinion in this regard.

A number of respondents stated that there is a need for active stakeholder involvement and interaction of the different market actors within the wider energy system in order to build needed capacity.

Public authorities, including at local and regional level, need EU support to develop long-term visions, update knowledge of the EU *acquis*, best practices and best available technologies, and trigger technical, financial and social innovation in order to ensure the roll-out of large-scale energy efficiency measures and investments. In order to establish a strong energy services market, there is a need to put in place education and training programmes, certification and accreditation schemes. Moreover, several stakeholders stressed that mutual recognition across the EU of professional qualifications in the field of energy efficiency should be considered.

Moreover, respondents emphasised that further awareness raising measures targeting consumers and public authorities should be implemented. Awareness raising campaigns were mentioned as an effective tool to motivate final consumers to implement energy efficiency improvement measures. It was argued that only strong customer demand will ensure the creation of adequate supply of products and services.

As regards public authorities, it was stressed that they should also play an important role by ensuring the necessary framework to facilitate the implementation of energy efficiency measures and functioning of the energy services market.

Concerning municipal authorities, it was suggested that the Covenant of Mayors should receive additional support in order to build the required capacities and disseminate good practices since it allows reaching a large number of municipalities and enables cross-sectoral policies to be implemented at local level.

8) Energy Efficient Technology solutions and their development and uptake at EU level

The public consultation also sought views on what would be the most promising technology solutions that could help deliver energy savings in the 2020 and 2030 time horizon and how their development and uptake can be supported at EU level.

Many stakeholders stressed that the required technologies to deliver the cost-effective energy savings potential to 2030 are already available. However, a strong policy framework, underpinned by a robust 2020 and 2030 energy savings target and measures to achieve it, will give industry the necessary confidence and will send the right signal to investors. It was stressed that a level playing field as regards the uptake of new technologies should be ensured and that technological solutions must also be complemented by non-technological innovation.

In the 2030 time horizon, new forms of decentralized low-carbon heating technologies such as micro-cogeneration, solar thermal, heat pumps, biomass boilers and various hybrid systems have a major role in delivering energy savings. The key advantage of the aforementioned decentralized heating technologies is their adaptability to a broad range of climatic environments and structural conditions. However, it was stressed that the uptake of these technologies requires a clear and stable regulatory framework that incentivises investments for low-carbon heating technologies. Moreover, promotion of energy management and energy auditing standards could play a role (e.g. ISO 5001/ISO 50002, EN16427).

A number of stakeholders emphasised that existing energy performance requirements should be reviewed on a more regular basis, for example, setting more stringent CO_2 emission standards for passenger cars. Also other transport modes could play a role. For instance, shipping has a vast potential for energy savings including more energy efficient engines, hull and propeller cleaning for reducing energy consumption. Some stakeholders also saw the potential for introducing automation and control systems especially in buildings to achieve energy savings.

Respondents stressed that it is equally important to support the development of new market structures and business models in order to accelerate the functioning internal market for energy services, which has been perceived by stakeholders as a driver for energy savings.

Moreover, smart cities and communities could serve as living laboratories to showcase potential solutions. In this context, R&D should play a key role in delivering further energy efficiency improvements. It was suggested that first priority could be the promotion of innovative low-carbon technologies in the context of the Strategic Energy Technologies Plan (SET-Plan), operating under the Smart Cities concept.

5. FURTHER COMMENTS:

As a last open question, the public consultation invited the stakeholders to provide further comments on energy efficiency strategy.

Here it was suggested that the EU should ensure awareness amongst the general public of efficient use of energy, including behavioural change. Moreover, it was stressed by respondents that more rapid and successful approaches are needed to phase-out inefficient products and processes from the EU market, and to ensure that sufficient numbers of experts receive the needed training for different sectors (e.g. residential and commercial buildings, industrial processes) in order to realise the energy efficiency potential in the EU.

It was stressed by several stakeholders that before adopting new measures, the impact of current policies should be analysed and evaluated. This would allow securing the needed investment and ensure better planning of industry, fostering its willingness to invest in new technologies. Stakeholders stated that the diversity of European energy efficiency markets must be taken into account and that the development of the future framework should leave the flexibility to Member States to achieve their efficiency targets.

Annex II - EU and national energy efficiency policies and their implementation

1. TARGETS AND FRAMEWORK INSTRUMENTS

Since 2007 the overall target (20% energy saving by 2020) proved to be an essential part of the regulatory framework providing political momentum, guidance for investors and a clear mandate for the Commission to act. Until 2012 there was some ambiguity as to what the 2020 target actually was. The EED solved this by clearly indicating that it is understood as primary energy consumption in 2020 not exceeding 1483 Mtoe and/or final consumption not exceeding 1086 Mtoe. The target is non-binding but allows the monitoring of Member State progress.

Defined as absolute energy consumption in 2020, the target provides a clear benchmark to measure progress. The economic crisis displayed however the limits of this approach: if the economy had developed at the rate projected in 2007 when the target was set, the projected gap would be significantly higher. Therefore even if the target is achieved some of the identified cost-effective saving potential for 2020 will remain untapped.

In its Article 7, The EED provides a powerful overarching policy instrument which obliges Member States to achieve average annual energy savings - nominally of 1.5% and, including exceptions, of at least 1.125% - on energy sales by obliging utilities to implement energy efficiency measures among final users, or through alternative measures with the same effect. Such schemes are already implemented in a number of Member States with some success. This will potentially act as a strong driver of energy efficiency as such schemes overcome several market failures, provide a stable source of financing and stimulate the development of the ESCO (energy services company) market. They should improve finance supply and incentives for building renovation.

At present, sixteen Member States have chosen an energy efficiency obligation scheme, twelve in combination with other measures. Four Member States have opted solely for an energy efficiency obligation scheme and twelve intend to achieve their energy efficiency savings targets only with the alternative measures.[1] It is considered that this policy instrument will serve as a strong driver of energy efficiency in the EU over the coming years, although it remains to be seen how well Member States will fare in terms of implementation. The 2016 review of Article 7 will assess the impact and effectiveness of this instrument.

Some cross-sectoral policies and measures lead to energy efficiency benefits. These include the Emissions Trading Directive, energy taxes and the greenhouse gas Effort Sharing Decision (ESD). Policies promoting renewable energy also lead to primary energy efficiency gains because many renewable energy sources, such as hydro, wind and solar PV, have attributed to them an efficiency factor of 1; thus, the penetration of renewable energy, in particular in power generation, reduces primary energy consumption.

[1] Study by CE Delft for European Commission, 2014

2. EFFICIENCY REQUIREMENTS FOR BUILDINGS AND PRODUCTS

With the EED, the recast of the Energy Performance of Buildings Directive (EPBD) and the implementing measures under the Ecodesign and Energy Labelling Directives (e.g. for boilers and lighting), a comprehensive regulatory framework for energy efficiency in buildings is now in place at the EU level.

This includes minimum energy performance requirements for new buildings and for existing buildings undergoing major renovation; energy performance certificates (EPCs) for buildings that are constructed, sold or rented out; and inspections of heating and air-conditioning systems; long-term building renovation roadmaps; and a requirement to renovate central government buildings.

The scale of potential improvements is vast: a recent analysis[2] shows that in the majority of Member States current efficiency requirements for new buildings, existing buildings undergoing major renovations and retrofitted or replaced elements of the envelope are significantly less stringent than cost-optimal levels, in some cases by a factor of two. Nevertheless, the effect of energy performance standards for buildings is hampered by the often limited volume of new construction and the low renovation rate (below 1% of the building stock per year in many Member States).

Compliance checking and quality control of EPCs and of inspection of heating and cooling systems is critical to tap the saving potential of buildings. Enforcement of EPCs remains an issue; for example in 2011 only 7 Member States checked the presence of EPCs at the moment of sale/renting transactions[3]. The reliability of EPCs also requires improvement and fraud needs to be avoided. Limited compliance checking of energy performance requirements in new and renovated buildings may also reduce the impact of the regulatory requirements. For instance, there is evidence of only 12 Member States having carried out quality checks of the calculation for new and existing building certificates.

Ecodesign and energy labelling requirements for energy-related products have shown their effect in improving the design of products, guiding consumers towards efficient appliances and driving a cost-effective market transformation towards more efficient products. With the recently adopted requirements for space and water heaters, requirements will cover almost the entirety of energy consumption in the household sector and a significant share in the tertiary and industrial sectors. An engineering calculation estimates that the combined savings from these measures will total 760 TWh in 2020[4]. Seven further priority product groups have been identified under a new Working Plan (including windows, servers and data centres, steam boilers and water-related products) with projected savings of around 500 TWh in 2030.

[2] Potential implications of minimum EP requirements from cost-optimal calculations, Concerted Action report

[3] Implementing the Energy Performance of Buildings Directive ; Concerted Action report , ADENE, 2013, October 2013

[4] It has not so far proved possible to make a comparable economic calculation.

The Directives are currently being reviewed. The review has identified two key issues that hamper the full energy savings potential of this policy to be captured. First, a lack of sufficient market surveillance means that non-compliant products remain on the market and consumers may be misled when buying energy labelled products. This undermines the internal market, a level playing field for industry and the trust that consumers have in the energy label. Second, the A+, A++ and A+++ energy labelling scales that were introduced during the last revision of the energy labelling Directive have been shown to negatively affect consumers' willingness to choose more energy efficient products.

3. ENERGY GENERATION, TRANSMISSION AND DISTRIBUTION

Energy efficiency in supply was first covered by EU legislation in the Cogeneration Directive (2004/8/EC), which focused on the promotion of high-efficiency cogeneration, i.e. cogeneration achieving at least a 10% primary energy saving (PES) compared to separate heat and electricity production. The Directive set common calculation methodologies for the efficiency of cogeneration, established grid system rules on a par with electricity from renewable sources and required the creation of guarantees of origin systems for electricity from high-efficiency cogeneration.

The Directive did not prove to be effective in promoting cogeneration. The share of electricity from cogeneration in Europe remained unchanged at around 10-11% despite an identified economic potential of 21% share in EU.

The Energy Efficiency Directive incorporates all the mandatory parts of the Cogeneration Directive and enlarges its scope. It covers heating and cooling in general. It strengthens grid system and authorisation rules for cogeneration. It requires Member States to prepare a comprehensive assessment of the potential for high-efficiency cogeneration and efficient district heating and cooling based on cost-benefit analysis covering the national territory. Member States must take adequate measures to realise the economic potential for high-efficiency cogeneration and efficient district heating and cooling. New or substantially refurbished power generation and industrial installations above 20 MW must be subject to a cost-benefit analysis on the possibility of using cogeneration and/or district heating/cooling. The outcome of the country-level and installation level cost-benefit analyses must be reflected in authorizations or permits.

The EED also includes provisions linked to the management of the grid. Electricity regulators must provide incentives for TSOs and DSOs to make available to energy retailers and customers system services permitting them to take advantage of the energy efficiency potential of smart grids. They must also not prevent DSOs, , TSOs and energy retailers from offering, as system services, in "organised electricity markets" measures to: shift customers' demand from peak to off-peak (taking into account the availability of renewable energy, energy from cogeneration and distributed generation); induce them to reduce demand; store energy; or connect or dispatch electricity from distributed generators. Optimisation of demand will be also driven by provisions on appropriate metering and billing of end-users' energy consumption.

4. TRANSPORT

Energy efficiency in the transport sector is addressed through energy efficiency improvements in the transport modes themselves (e.g. minimum requirements, labelling), integration of transport modes and the internalisation of externalities in the cost of transport.

Following the recent revision of EU regulations on CO_2 emission standards for passenger cars and light commercial vehicles, the fleet average to be achieved for new passenger cars is 130 grams of CO_2 per kilometre (g/km) by 2015 and 95g/km by 2021. This compares to an average of 160g/km in 2007. The Vans Regulation limits CO_2 emissions from new vans to a fleet average of 175 95g/km by 2017 and 147 g/km by 2020. This compares to an average of 203g/km in 2007. A strategy for reducing Heavy Duty Vehicles' fuel consumption and CO_2 emissions has been recently adopted[5].

Fuel efficiency standards are complemented by CO_2 labelling of vehicles and tyre labelling. The tyre labelling regulation has already led to 80% of tyres sold on the European market showing their performance levels to consumers in a transparent manner.

Specifications on the provision of EU-wide multimodal travel information services and of real-time traffic information services are in preparation and are expected to be adopted by the Commission by the end of 2014. Work is ongoing on the standardisation of ICT to support the interoperability of cooperative systems for intelligent transport.

The Commission proposal of April 2011 for a revised Energy Taxation Directive aims at encouraging an energy efficient and environmentally-friendly use of fuels by making a link between tax rates and the fuels' energy and CO_2 characteristics. The proposal is under discussion in the Council.

Since the beginning of 2012, emissions from aviation have been included in the ETS. The amendments to MARPOL Annex VI Regulations for the prevention of air pollution from ships entered into force on 1 January 2013, adding a new chapter on energy efficiency for ships to make mandatory the Energy Efficiency Design Index (EEDI), for new ships, and the Ship Energy Efficiency Management Plan (SEEMP) for all ships. Recent international agreements targeting reduced GHG emissions in the maritime and aviation sectors will also improve these modes' efficiency. In October 2013 the ICAO Assembly agreed to develop by 2016 a global MBM to apply it by 2020. On maritime emissions, the Commission presented a strategy to integrate the sector in the EU’s greenhouse gas reduction policies and will work with International Maritime Organisation on a global approach to achieve the necessary emissions reductions through the most appropriate measures[6].

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[5] COM(2014) 285 final

[6] COM (2013) 479

5. FINANCING, TECHNICAL SUPPORT AND CAPACITY BUILDING

Energy efficiency investment worldwide has been growing, reaching $300 bn in 2011[7]. This has been driven by more favourable regulatory environments[8] and by evidence of the business case for such investments[9].

Under the previous Multiannual Financial Framework (2007-2013), the European Union has provided increasing financial support for energy efficiency measures and investments through a wide range of programmes and funding instruments, including the EU Cohesion Policy fundings, the European Energy Efficiency Fund (EEE F) and the Intelligent Energy Europe Programme II as indicated in Table below.

Table 23: Funding for energy efficiency under the previous Multiannual Financial Framework (2007-2013)

Funding Source	Instruments/mechanisms	Total funding available	Funding for EE
Cohesion Policy funding	Operational Programmes incl. financial instruments	€ 10.6 billion for sustainable energy (RES & EE)	€ 6.1 billion for EE, co-generation and energy management
Research Funding	FP 7 (e.g. Concerto, E2B PPP, Smart Cities)	€ 2.35 billion for Energy research	€ 290 million for energy efficiency
Enlargement Policy Funding	IFI facilities (SMEFF, MFF, EEFF)	€ 552,3 million (381,5 +117,8 +53 respectively)	About one third of total funding for projects in industry and buildings
Programme for European Energy Recovery (EEPR)	European Energy Efficiency Fund (EEE F)	€ 265 million	70% of funding to be dedicated to energy efficiency
Competitiveness and Innovation Funding (CIP)	Intelligent Energy Europe Programme (including ELENA) Information and Communication	Approximately € 730 million for each programme	About 50% of the funding was dedicated to energy efficiency in all sectors

[7] IEA (2013), Energy efficiency market report 2013

[8] Regulatory requirements concerning the energy efficiency of buildings are being tightened in a number of countries, with the EU leading the way. These requirements push the average performance of buildings upward. Buildings with low performance are losing value as the benchmark moves up and may be difficult to sell since they will require upgrades to meet legal requirements.

[9] For example in the US, buildings with an Energy Star label have stronger financial performance than similar unlabelled buildings: 13.5 per cent higher market values, 10 per cent lower utility costs, 5.9 per cent higher net income per square foot, 4.8 per cent higher rents and 1 per cent higher occupancy rates. In the EU an analysis of developments in several Member States concluded that a one grade increase on the scale of a building Energy Performance Certificate corresponded to an approximately 4% increase in its values

	Technologies Policy Support Programme (ICT PSP)		

Under the EU Cohesion Policy funding 2007-2013, EUR 12.5 billion of programme funding was channelled through 870 specific Financial Instruments, out of which EUR 444 million through 16 Financial Instruments in eight Member States for energy efficiency and renewable energy. So far (2012 data), of the latter amount, EUR 90 million was disbursed to final recipients through 13 392 loans.

Under the Intelligent Energy Europe Programme, EUR 148 million has been earmarked for project development assistance under the ELENA Facility (implemented through the EIB, KfW, EBRD and CEB) and the "Mobilising Local Energy Investments" strand of the IEE Programme (implemented via EACI/EASME). The grant support is provided to public authorities to develop and launch sustainable energy investments, with a minimum leverage (EU grant to total investment launched) of 1:20 and 1:15, respectively. So far, EUR 81.2 million has been provided to 56 projects, expected to lead to investment worth EUR 4.032 billion.

Under the European Programme for Economic Recovery, the Commission together with participating Financial Institutions has piloted the set-up and operation of the dedicated European Energy Efficiency Fund (EEE F), where EU contribution of EUR 125 million has been matched by additional EUR 140 million provided by the European Investment Bank, Cassa Depositi e Prestiti and Deutsche Bank, under the Fund management by the latter. As of end March 2014, EUR 217 million has been allocated to 13 investment projects.

An initial assessment of these instruments suggests that (a) there has been some success in addressing the market failures that hamper the uptake of energy-efficient solutions; (b) EU level instruments like EEE F help providing long term innovative financing models and replication but have more difficulty to overcome market fragmentation; (c) differences in national circumstances, cultures and financial systems mean that a single European solution, such as an EU-wide equivalent to Germany's KfW, is not the answer, and what might be needed instead is a robust framework enabling better understanding, knowledge, transparency, performance measurement and de-risking at the EU level, accompanied by tailored Financial Instruments at the appropriate level, closer to final beneficiaries.

EU funding has been complemented at the Member state level, where prevailing public finance support has been provided through grants and subsidies, followed by soft loans. Only few Member States experimented with tax incentives and market based instruments (such as white certificates) so far.

Table 24: Energy efficiency support provided in the EU Member States[10]

	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HU	HR
Grants/subsidies	■	■	■	■	■	■		■	■	■	■	■	■	■
Loans		■	■		■	■		■	■		■	■	■	■
Tax incentives		■					■			■	■			
EEO/WC		■					■				■			

	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK
Grants/subsidies	■	■	■	■	■	■	■	■	■	■		■	■	
Loans			■				■	■		■			■	■
Tax incentives		■					■							
EEO/WC		■												■

Hand in hand with the evolving policy framework, as well as with the realisation that the main problem to address is potentially not the lack of funding but rather its accessibility and affordability, the provided EU financial support has extended its nature from pure grants towards more sophisticated and investment-linked support, addressing the issues related to capacity (to structure bankable investments) and sub-optimal investment levels (caused by the risk-aversion attitude of investors and lenders or affordability for borrowers, among other issues). It became increasingly clear that public finance should be rather used as a trigger for the private capital participation, through various forms of financial Instruments (such as risk-sharing or credit enhancement mechanisms).

The experience gained so far has been reflected in the design of the new Multiannual Financial Framework for the years 2014 – 2020. The regulations for the new set of EU Programmes bring a different understanding of the role of public funds in the area of energy efficiency.

Table 25: Energy efficiency funding allocation under the Multiannual Financial Framework for the years 2014-2020

Funding Source	Instruments/mechanisms	Total funding available	Funding for EE
European Structural and Investment Funds	Operational Programmes incl. financial instruments (e.g. off -the-shelf instruments etc)	Minimum € 27 billion for low-carbon economy investments including energy efficiency	to be defined in the Operational Programmes
Research Funding	Horizon 2020 (e.g. Energy Efficiency, E2B PPP, SPIRE PPP,	€ 5.6 billion for the whole energy challenge	ca € 840 million for energy efficiency

[10] JRC (2014): Draft report on financing of energy efficiency in buildings

	Smart Cities)		including the ELENA Facility not including the funding for EeB PPP and SPIRE PPP
Programme for European Energy Recovery (EEPR)	European Energy Efficiency Fund (EEE F)	€ 48 million (under first closing) plus expected further capital after second closing	70% of funding to be dedicated to energy efficiency
LIFE +	EIB guarantee facility for retail banking sector for EE lending	€80 million (launch phase 2014 – 2017)	full allocation

The implementation principles for the European Structural and Investment Funds (stress that public funding should complement private investments, leveraging it and not crowding it out; call on Member States to consider creating value for energy savings through market mechanisms before public funding (energy saving obligations, energy service companies (ESCOs)…); highlight that financial instruments should be used where potential for private revenue or cost savings is sufficient and remind that grants should be used primarily for social objectives, to support innovative technologies and investments going beyond minimum energy requirements, thus making sure that energy savings achieved with the public funding support are above those that would be achieved at the "business as usual" level (without the public support).

The European Structural and Investment Funds for the first time ring-fence[11] a significant EUR 27 billion (estimated minimum) specifically for low carbon economy investments including energy efficiency. Managing Authorities are particularly encouraged to set up financial instruments using their allocation to leverage additional private capital participation while providing market based support instruments (such as tailored loans or guarantees). To ease and speed-up the application of Financial instruments, "off-the-shelf" instruments are being designed by the Commission, to set the framework upon which faster replication of financial instruments can be enabled. In the area of energy efficiency, the "Renovation Loan" off-the-shelf instrument is under preparation, based on a risk-sharing loan model.

The new EU Programme for Research and Innovation, Horizon 2020, addresses the innovation challenges of the EU and incorporates elements of the previous research and innovation programmes, FP7 and Competitiveness and Innovation Programme (Intelligent Energy Europe). The Horizon 2020 earmarks EUR 5.6 billion for energy, out of which at least EUR 840 million is planned to be allocated for energy efficiency part of the

[11] A minimum 12%, 15% or 20% of the ERDF allocation has to be invested into the "shift to low-carbon economy" investments in less developed, transition and more developed regions of the EU, respectively.

programme, addressing both technology-related and non-technology-related innovation challenges. It also continues to provide specific support for development and launch of innovative investments, expanding its scope to private sector operators. Elena Facility continues under the programme.
Further, the LIFE + Work programme 2014-2017 has earmarked EUR 80m for a new EU risk-sharing (guarantee) facility with the EIB - "Private Finance for Energy Efficiency" Instrument, dedicated to extend the provision and enhance the affordability/attractiveness of debt financing for energy efficiency investments at the retail lending level.

Finally, the European Energy Efficiency Fund (EEE F), still remains operational, investing into sustainable energy projects, with (as of 31/3/2014) EUR 48 million still available and expected second closing which would bring additional investors to achieve its target size of EUR 600 million.

Annex III - Decomposition analysis of energy consumption trends at EU and Member State level.

1. METHODOLOGY

The decomposition analysis is based on the LMDI (Logarithmic Mean Divisia Index) method[12]. This method has two main advantages[13]:

- In difference to other methods used, for example the simple Laspeyre factorization method**Error! Bookmark not defined.**, the LMDI does not generate residuals which cannot be explained

- The method is easily applied to a larger number of factors which is not the case for other decomposition methods which generate quite complex formulae in such cases.

The analysis of primary energy consumption is carried out at two levels:

- First the energy conversion sector is analysed as a whole by distinguishing three energy sector branches: electricity, heat and other sectors (which comprises solid fuels, petroleum products, gas, renewable and wastes not used for electricity or heat generation) (Level 1, see Figure 6).

- Second the developments in the electricity and heat sector are analysed in greater detail (level 2, see Figure 2).

Level 1 analysis takes into account:

- Changes in energy available for final consumption[14], excluding non-energy uses
- Changes in the distribution losses across all energy sector branches
- Changes in the energy sector consumption
- Changes in the structure of the energy sector (mainly the influence from the increasing penetration of the electricity sector, which has a lower conversion efficiency as compared to the other branches of the energy sector).
- Changes in the efficiency of the electricity and heat sector (which is mainly driven by the structural change within the electricity sector, in particular by the penetration of renewable, see below).

[12] See for example http://www.ise.nus.edu.sg/staff/angbw/pdf/A_Simple_Guide_to_LMDI.pdf. We use the LMDI-I method. A more complex LMDI-II method has also been developed.

[13] See for example B.W. Ang: The LMDI approach to decomposition analysis: a practical guide, Energy Policy Volume 33, Issue 7, May 2005, Pages 867–871

[14] This differs from final energy consumption in a minor manner through the inclusion of statistical differences.

Figure 6: Structure for the Level-1-Analysis of changes in Primary Energy Consumption

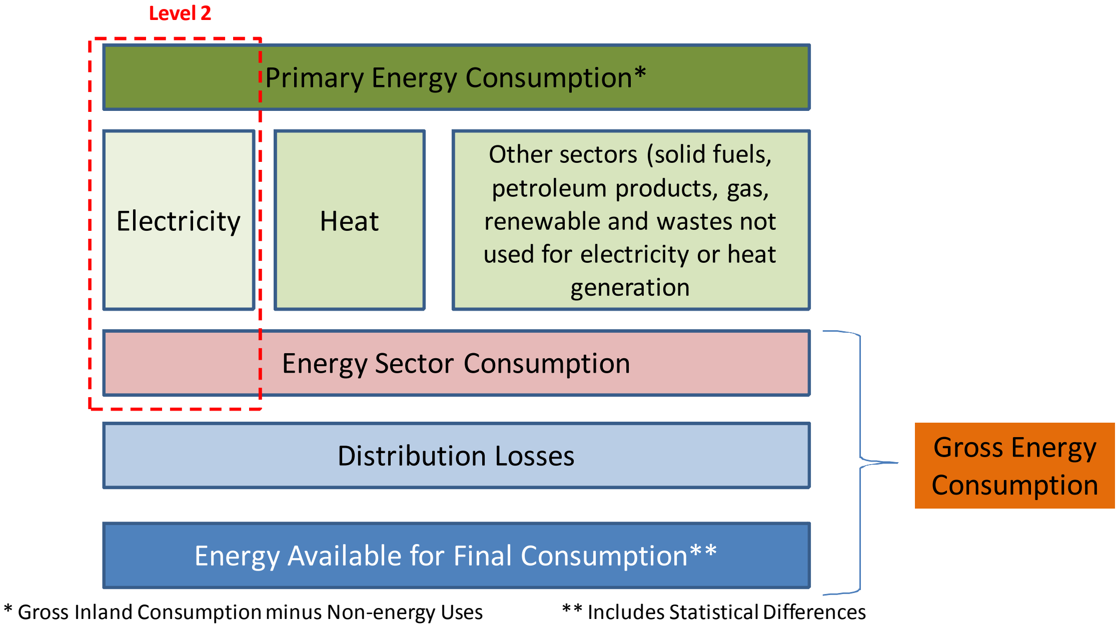
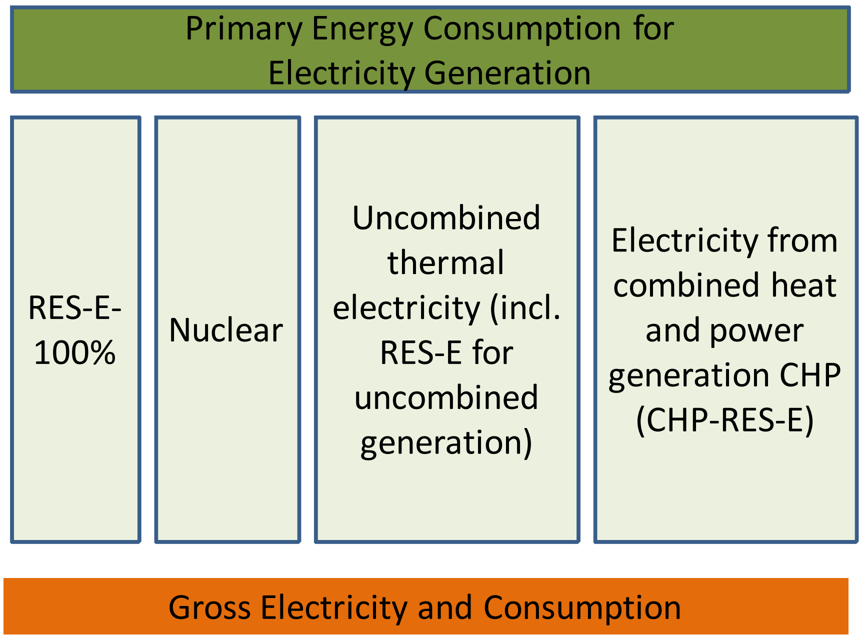


Figure 7: Structure for the Level-2-Analysis of changes in Primary Energy Consumption (impact of electricity sector)



Level 2 analysis with a focus on the electricity sector (**Error! Reference source not found.**) takes into account:

- The change in Gross Electricity Consumption (which includes distribution losses and electricity consumption of the energy sector

- The penetration of "100% efficiency renewables" (RES-E-100%), that is wind energy, solar PV, hydro power, wave/ocean/tidal energy[15].
- The decrease in the share of nuclear (with a nominal conversion efficiency of 33%) due to the phase-our strategies in some Member States
- The penetration of electricity from Combined Heat and Power generation CHP
- The efficiency improvement in uncombined thermal electricity generation (including renewable/wastes for uncombined generation.

2. RESULTS EU LEVEL

Figure 8: Decomposition analysis of changes in primary energy consumption 2008-2012 (Level 1)

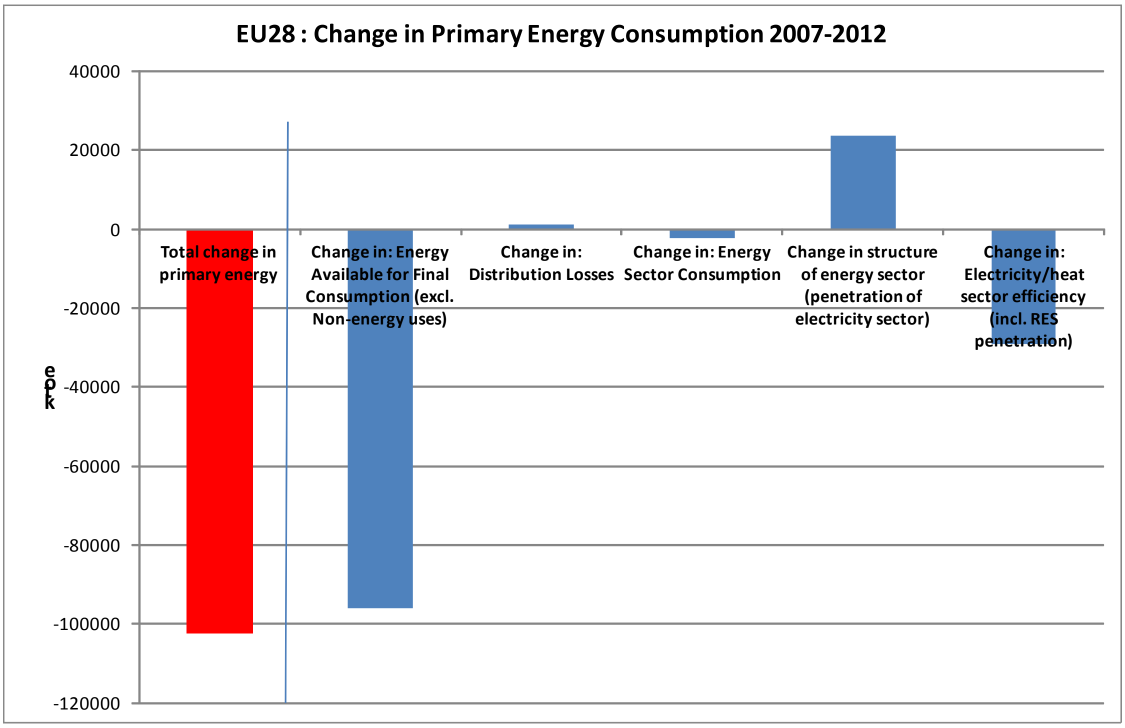


Figure 8 shows the Level-1 analysis of Primary Energy Consumption:

- The total change in Primary Energy Consumption in the period 2008-2012[16] was -100 Mtoe.[17]

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[15] Note that solar thermal (both Concentrated Solar Power CSP and solar thermal for heat provision) are not accounted for in the same manner in Eurostat balances as are the other RES100%. These are directly accounted for in Gross Inland Consumption and are passed through to the electricity sector as Interproduct Returns. Solar Thermal (CSP) enters the transformation inputs as the solar heat is converted to steam.

[16] Starting year of the factor analysis is 2007 as the last year before the period 2008-2012 under consideration

[17] All graphs and figures in this annex are primarily based on input data from Eurostat

- The main reason for the decrease was the decrease in final energy which amounted to -70 Mtoe from 2008 to 2012 but which in primary energy terms translates to -96 Mtoe.
- Distribution losses (+1.3 Mtoe, possibly due to a penetration of distributed renewables) and Energy Sector Consumption (-2.3 Mtoe) had smaller influence on the changes in primary energy consumption.
- A comparatively large increase in primary energy with +24 Mtoe came from the further penetration of the electricity sector in the structure of the energy sector branches.
- This was more than counterbalanced with -29 Mtoe by an improvement in the electricity sector efficiency, which in fact comprises different factors of influence, among others the penetration of RES-E-100%, see the analysis at Level-2.

Figure 9: Decomposition analysis of changes in primary energy consumption 2000-2012 (Level 1)

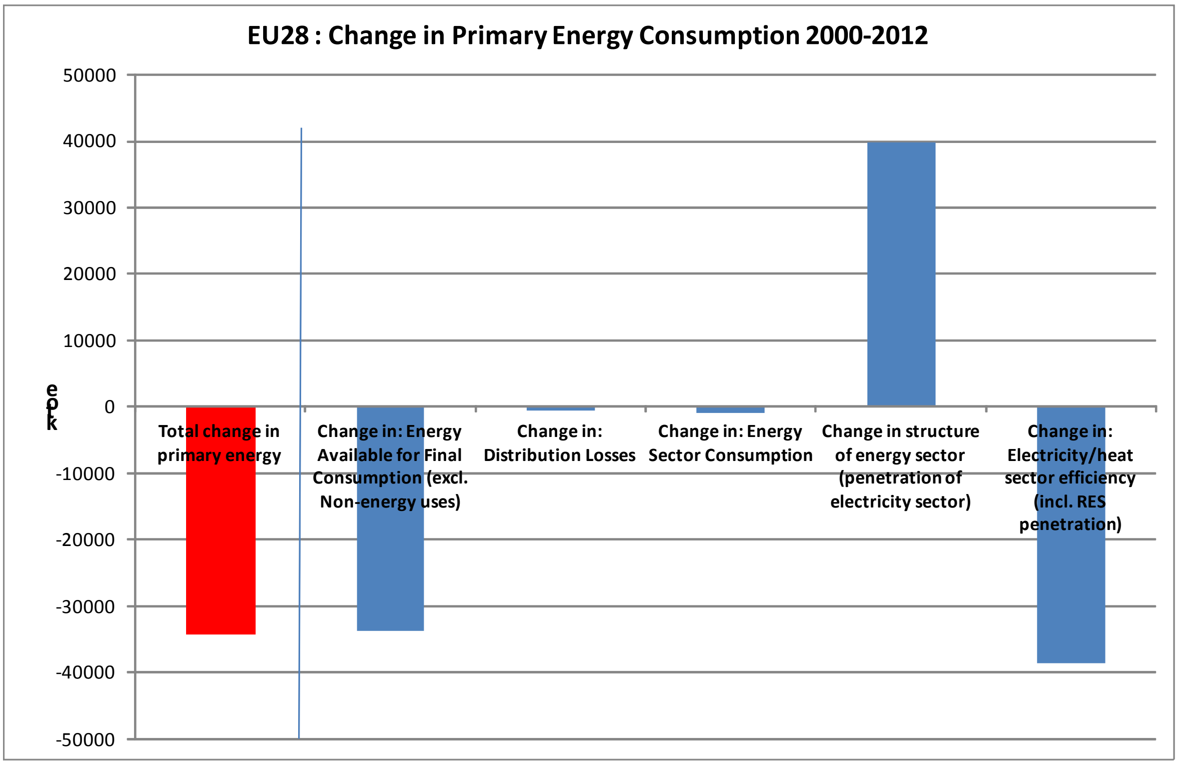


Figure 9 shows for comparison purposes the decomposition analysis for the longer time period 2000-2012. The main differences with the analysis for the period 2008 to 2012 is that primary energy is decreasing less (-34 Mtoe), that the penetration of the electricity sector was more pronounced (+40 Mtoe) but which was also nearly totally counterbalanced by the developments in electricity sector efficiency (-39 Mtoe).

Level-2 analysis shows the details of what happened in the electricity conversion from primary energy consumption to gross electricity consumption (Figure 10):

- The total change in primary energy consumption due to electricity generation was -34 Mtoe in the period 2008-2012. This was the combined effect of a decrease in gross electricity consumption (impact -15 Mtoe in primary energy terms), a change in the structure of electricity generation which induced a reduction of 29 Mtoe in primary energy, a worsening in thermal electricity generation which induced an increase in primary energy consumption of 10 Mtoe (possibly due to partly low capacity use of part of the thermal power plants).
- The structural effects were due to four individual components:
    - The increasing penetration of RES-E-100 and CHP electricity increased Primary Energy Consumption by 18 Mtoe and 0.4 Mtoe respectively.
    - However, this was by far overcompensated by the decrease in nuclear (-5 Mtoe primary energy) and uncombined thermal power generation (-42 Mtoe) with their much lower efficiencies.

For comparison Figure 11 shows the same analysis for the longer period from 2000 to 2012. The main difference is that the electricity sector still increased primary energy consumption by 11 Mtoe, especially to the still strong increase in gross electricity demand (+46 Mtoe in primary energy terms), the counterbalancing effect of the structure changes in electricity generation (-49 Mtoe)

Figure 10: Decomposition analysis of changes in primary energy consumption due to electricity generation 2008-2012 (Level 2)

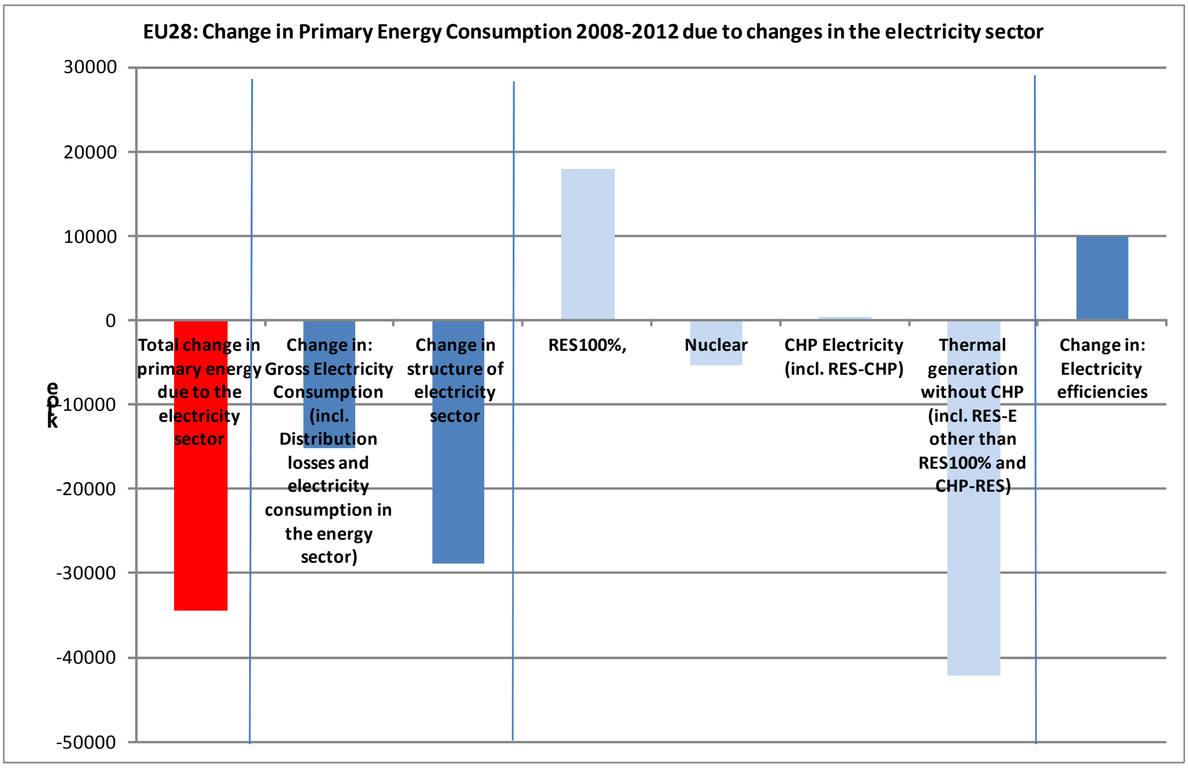
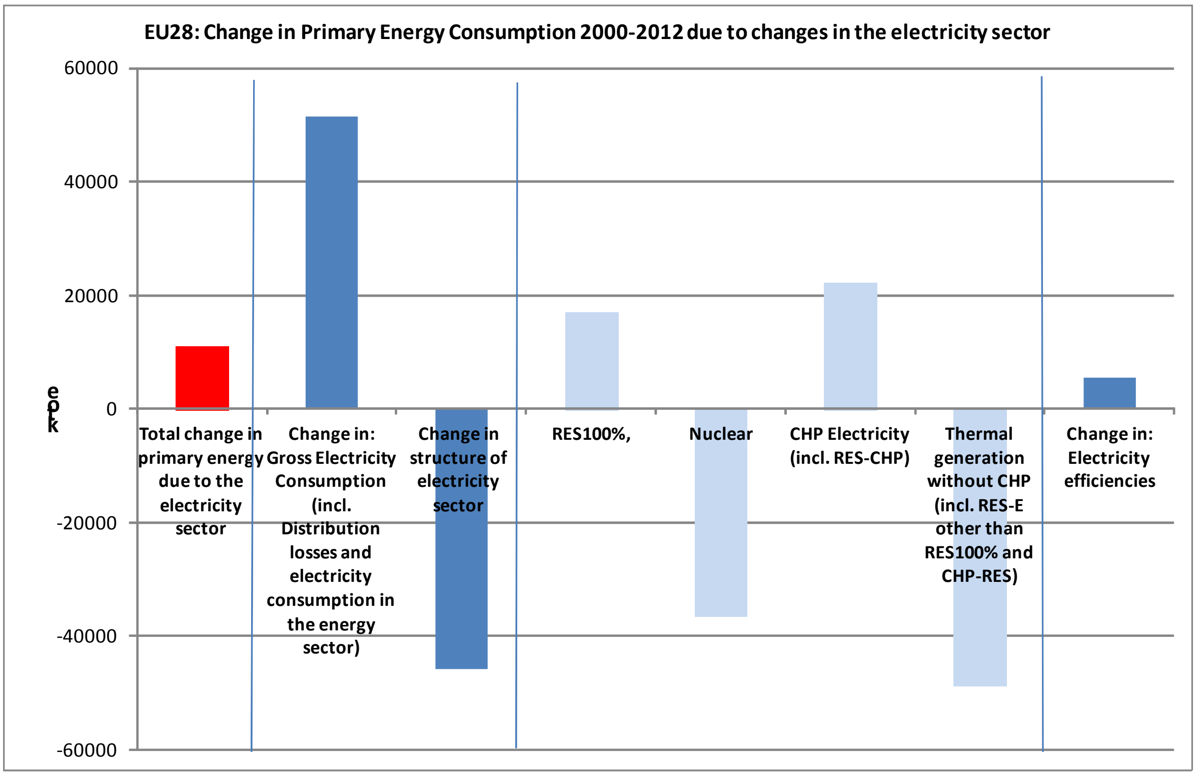


Figure 11: Decomposition analysis of changes in primary energy consumption due to electricity generation 2000-2012 (Level 2)



2.1. Decomposition analysis of final energy consumption

In the previous section we identified as the main driver for the decrease in primary energy consumption from 2008 to 2012 the decrease in final energy which amounted to -67.1 Mtoe but which in primary energy terms translated to -96 Mtoe. In this section we will analyse the details of the different final demand sector to the change of -67.1 Mtoe. An overview is provided by Figure 12. This change is due to changes in activity levels in the different sectors with nearly -33 Mtoe, further counter balancing impacts of structural changes in industry, modal shift in transport as well as comfort and social factors, climatic differences between the beginning and the end of the period, and finally an important contribution of energy efficiency with a reduction of nearly 53 Mtoe in the historic period 2008-2012 (around 10.5 Mtoe or 1.0% annually compared to the overall final energy demand in 2012). More sectoral details can be found in the following section. This comprises both the impacts of autonomous energy savings and the impacts of energy efficiency measures.

Figure 12: Decomposition analysis of changes in final energy consumption 2008-2012

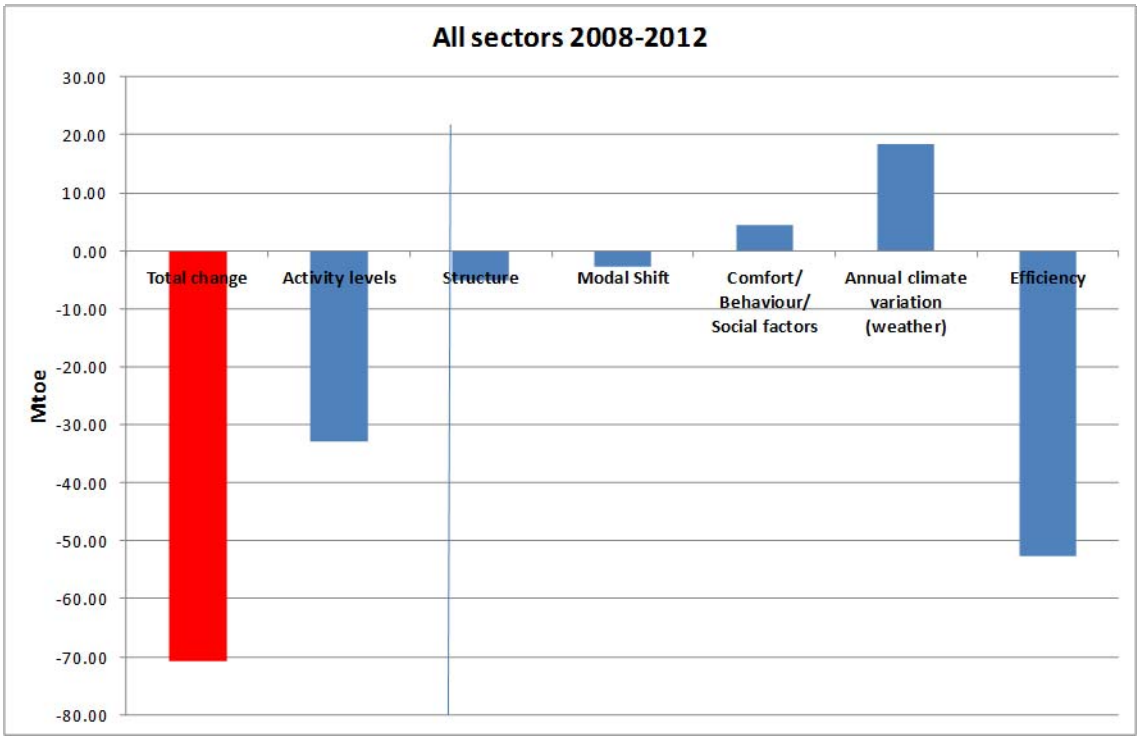


Figure 13: Decomposition analysis of changes in final energy consumption 2000-2012

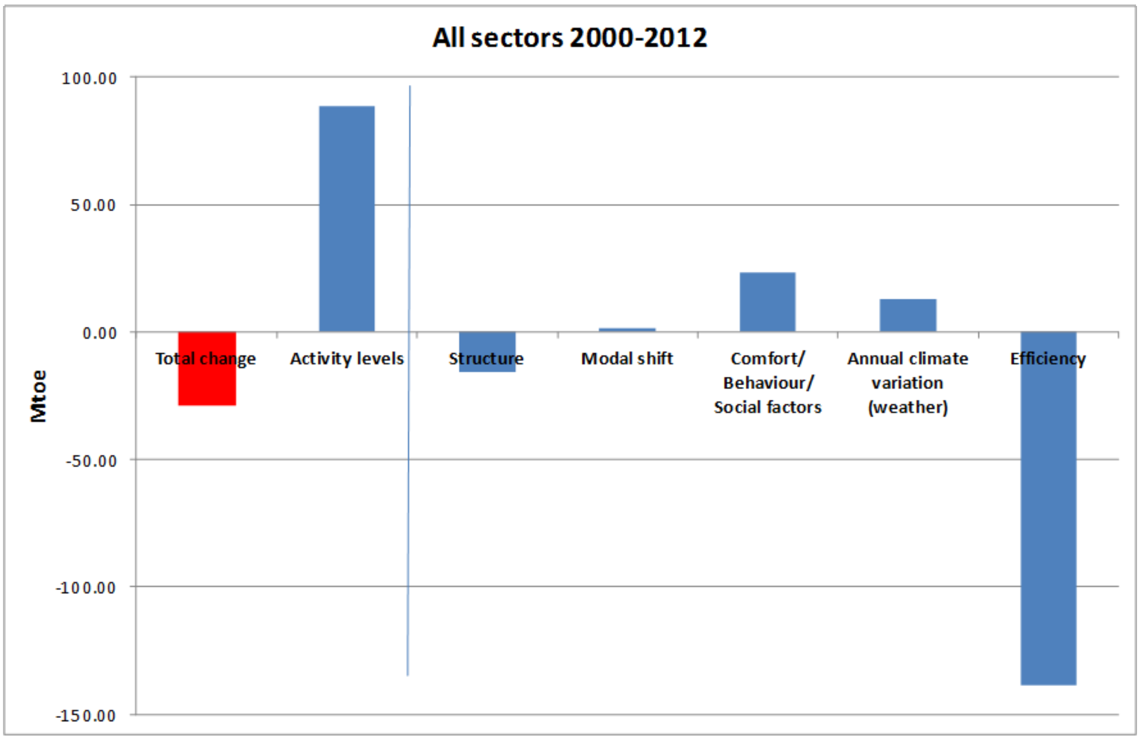


Figure 13 provides the same information for the longer period 2000 to 2012. The main difference with the period 2008 to 2012 is that activity changes were contributing to an increase in final energy consumption, as well as comfort factors, while energy efficiency improved more strongly with 11.5 Mtoe annual savings or 1.05% of final energy consumption of 2012. As an overall result final energy decreased since 2000 only by around 28 Mtoe, as up to 2005 final energy demand was still increasing.

2.2. Sectoral results of the decomposition analysis of final energy consumption

Figure 14 shows that industry and transport reduced most final energy consumption in 2008-2012 while in 2000-2012 mainly industry contributed while services strongly increased final energy consumption in the longer period. However the reasons for this development were quite different from sector to sector:

- The **residential sector** (Figure 15) had quite important contributions to energy efficiency in 2008 to 2012 with 1.3% of energy consumption saved annually. However this was compensated by the increase in activity (population), social factors (less persons in dwellings, hence more dwellings), comfort/behavior (e.g. more heated surfaces in homes) and by climatic influences (as 2012 was a cold year as compared to the reference year 2007 for this period).

- For **industry** (Figure 16) activity effects (impact of the economic crisis), structural effects as well as efficiency effects all contributed to reduce energy consumption in the period 2008-2012, while in the longer period 2000-2012 the activity effect was positive. However, the savings rate has slowed down to below 0.96% annual savings in the period 2008 to 2012 as compared to 1.40% over the longer period 2000-2012.

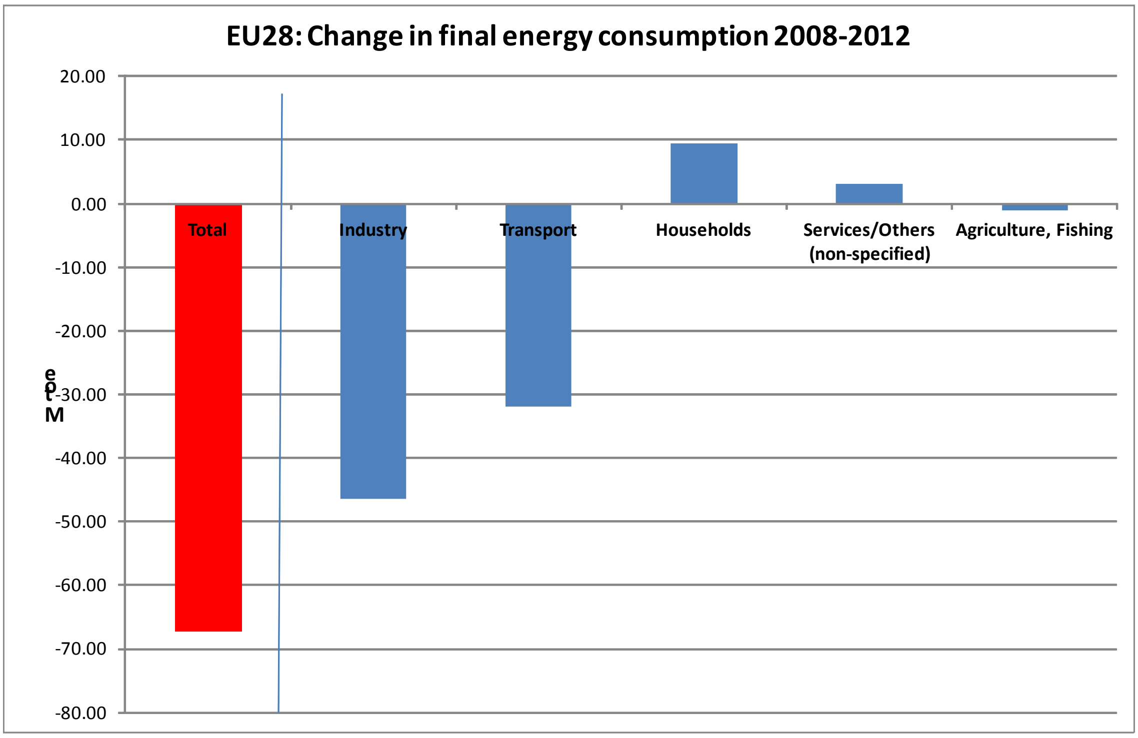
- For **passenger transport** (Figure 17) efficiency effects (CO_2 standards) strongly contributed to the reduction in energy consumption while activity effects were modest compared to the longer period 2000-2012. As passenger transport is less influenced by the impacts of economic down-turn, this is also a sign of saturation effects in transport. The annual savings rate is with 2.2% per year quite high.

- **Goods transport** (Figure 18) is like industry strongly impacted by the economic development, hence a negative activity effect from 2008 to 2012. The efficiency effect is reversed (annual increase 0.1% per year between 2008 and 2012.

- In **Services** efficiency effects cannot be separated from structural effects at the level of the EU as a whole but only for some MS.

- **Agriculture, fishing and other sectors** (Figure 19) is mainly dominated by efficiency changes which may also contain nevertheless some structural changes.

Figure 14: Sectoral decomposition of changes in final energy consumption 2008-2012 and 2000-2012



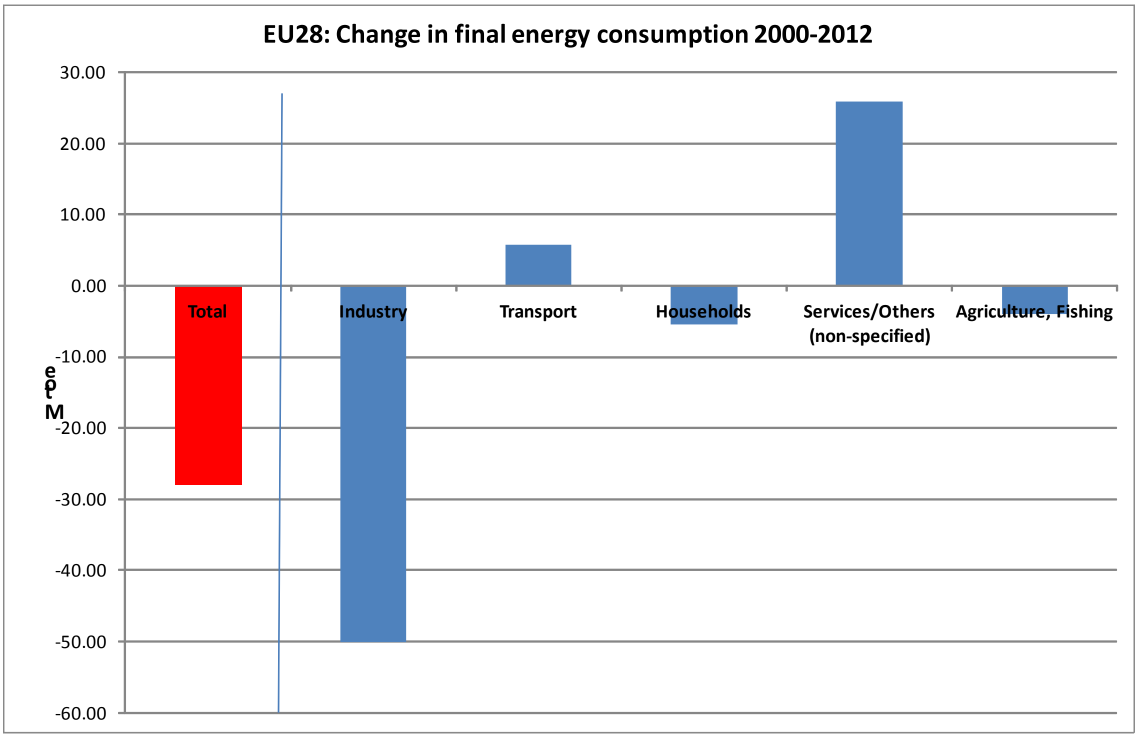
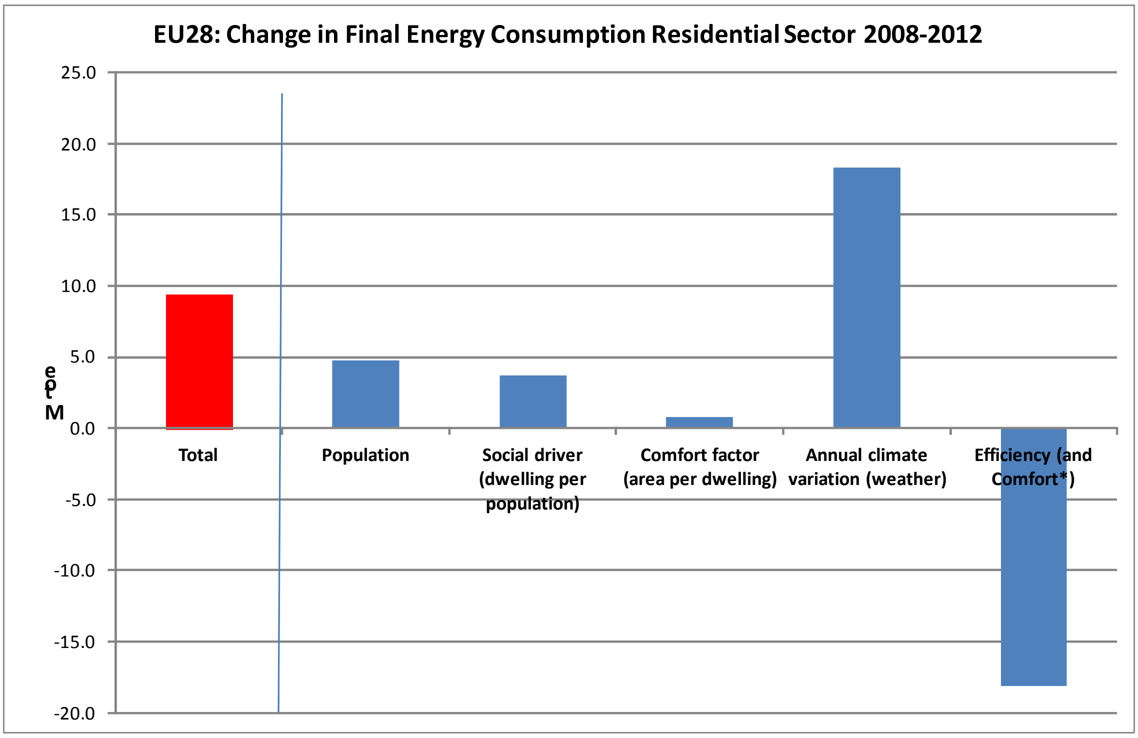
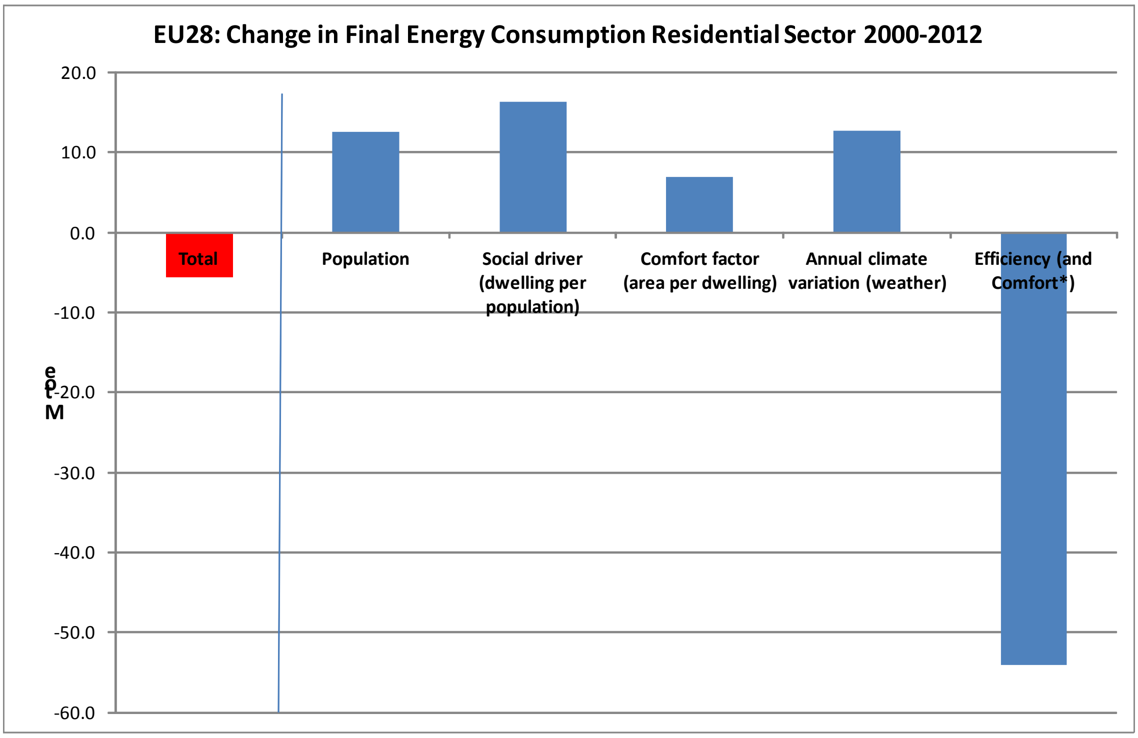


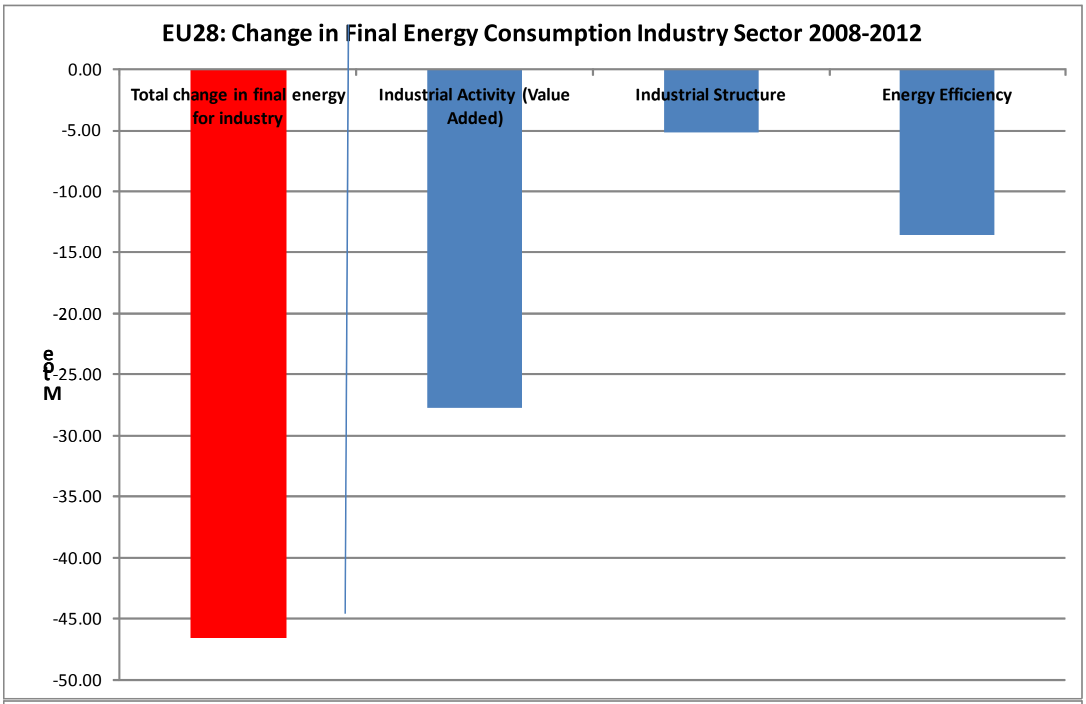
Figure 15: Sectoral decomposition analysis (residential sector) of changes in final energy consumption 2008-2012 and 2000-2012

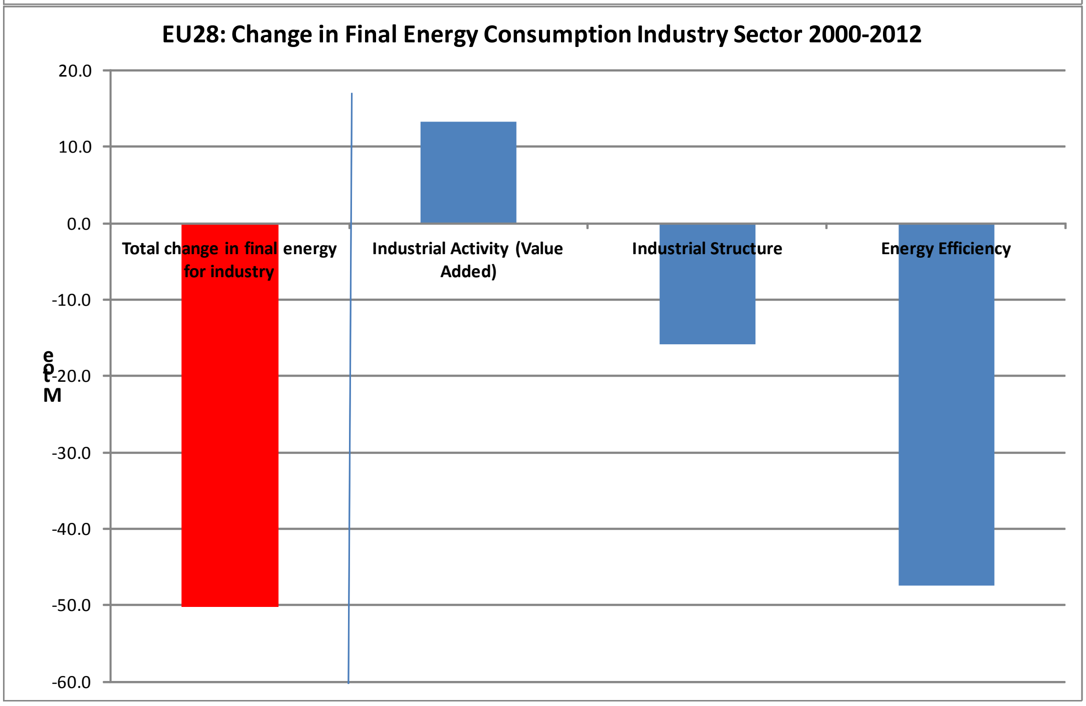




Note: The sector is broken down to the applications space heating, sanitary water heating, cooking and electric appliances/lighting. Some comfort factors in the trend towards more smaller electric appliances per dwelling could not be separated from efficiency effects for data reasons.

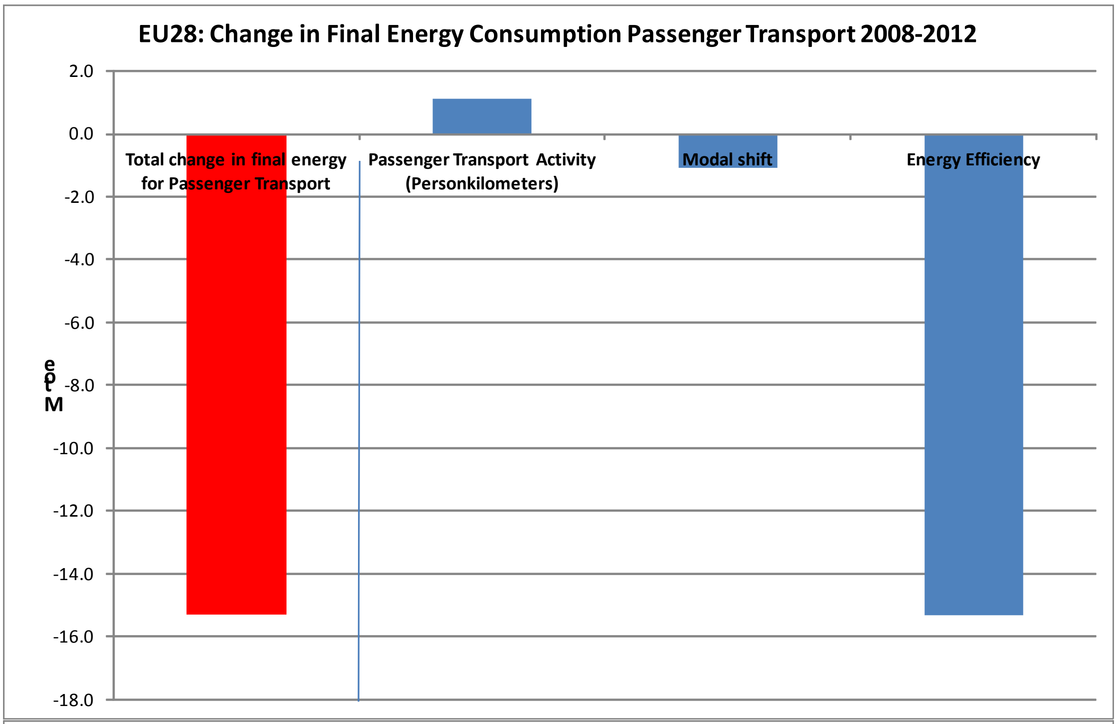
Figure 16: Sectoral decomposition analysis (industry sector) of changes in final energy consumption 2008-2012 and 2000-2012 (lower figure)

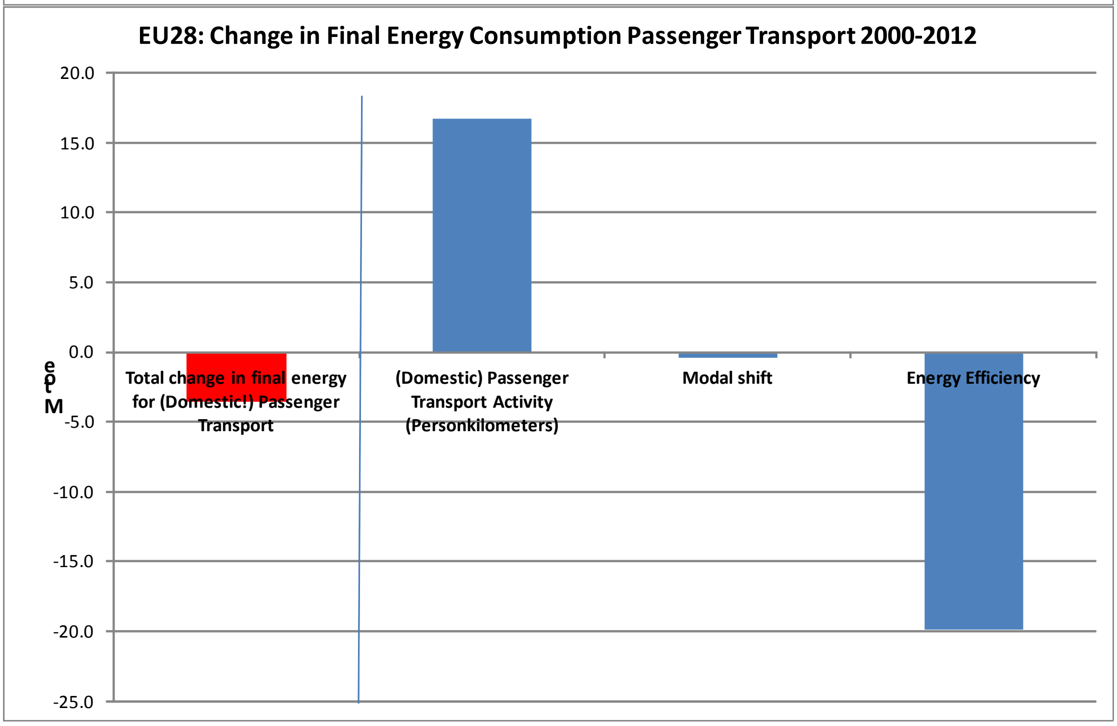




Note: the impacts of the industrial structure are based on the NACE-2 decomposition as used in the energy balance. Further structural changes at lower levels are small.

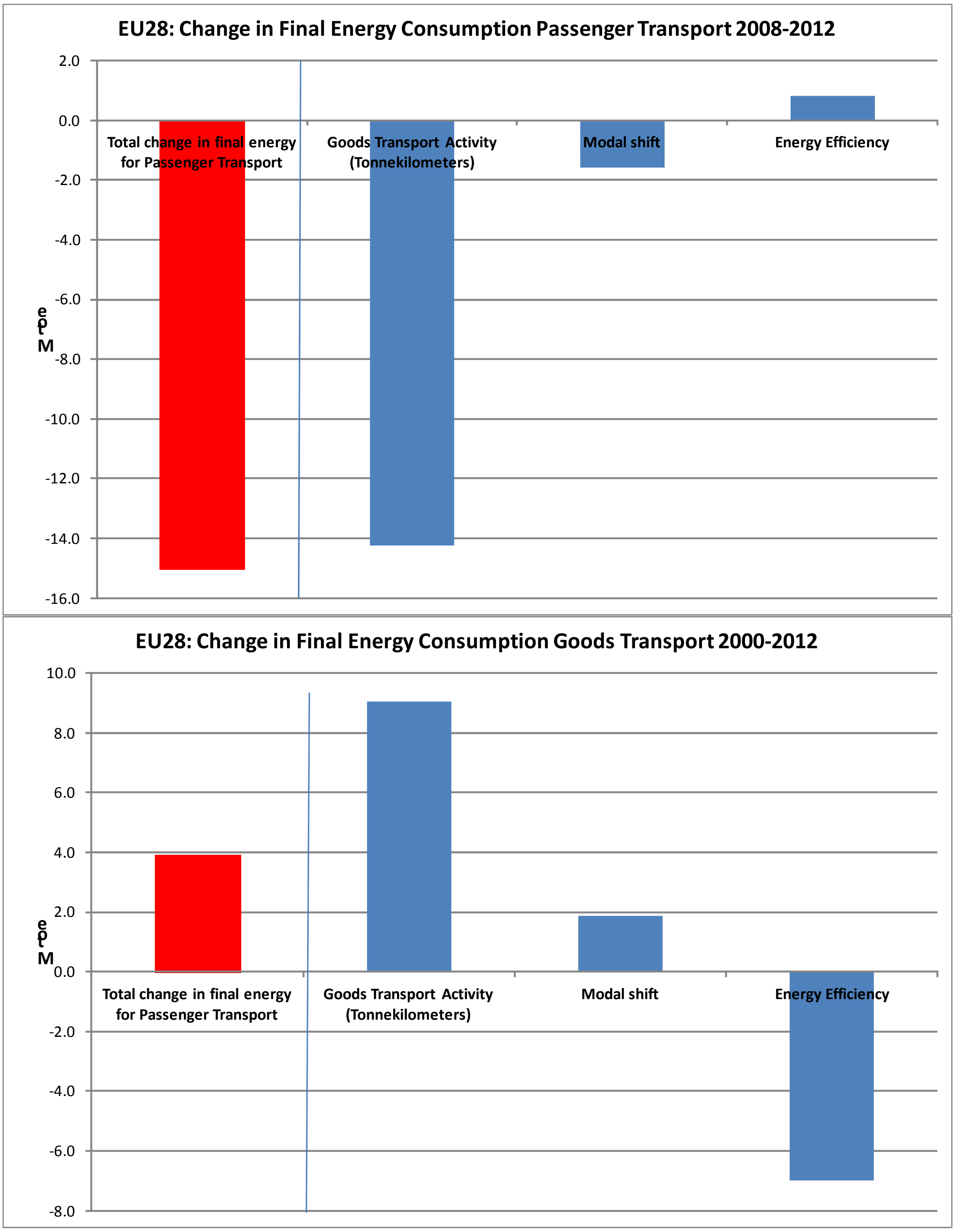
Figure 17: Sectoral decomposition analysis (passenger transport sector) of changes in final energy consumption 2008-2012 (upper figures) and 2000-2012 (lower figure)





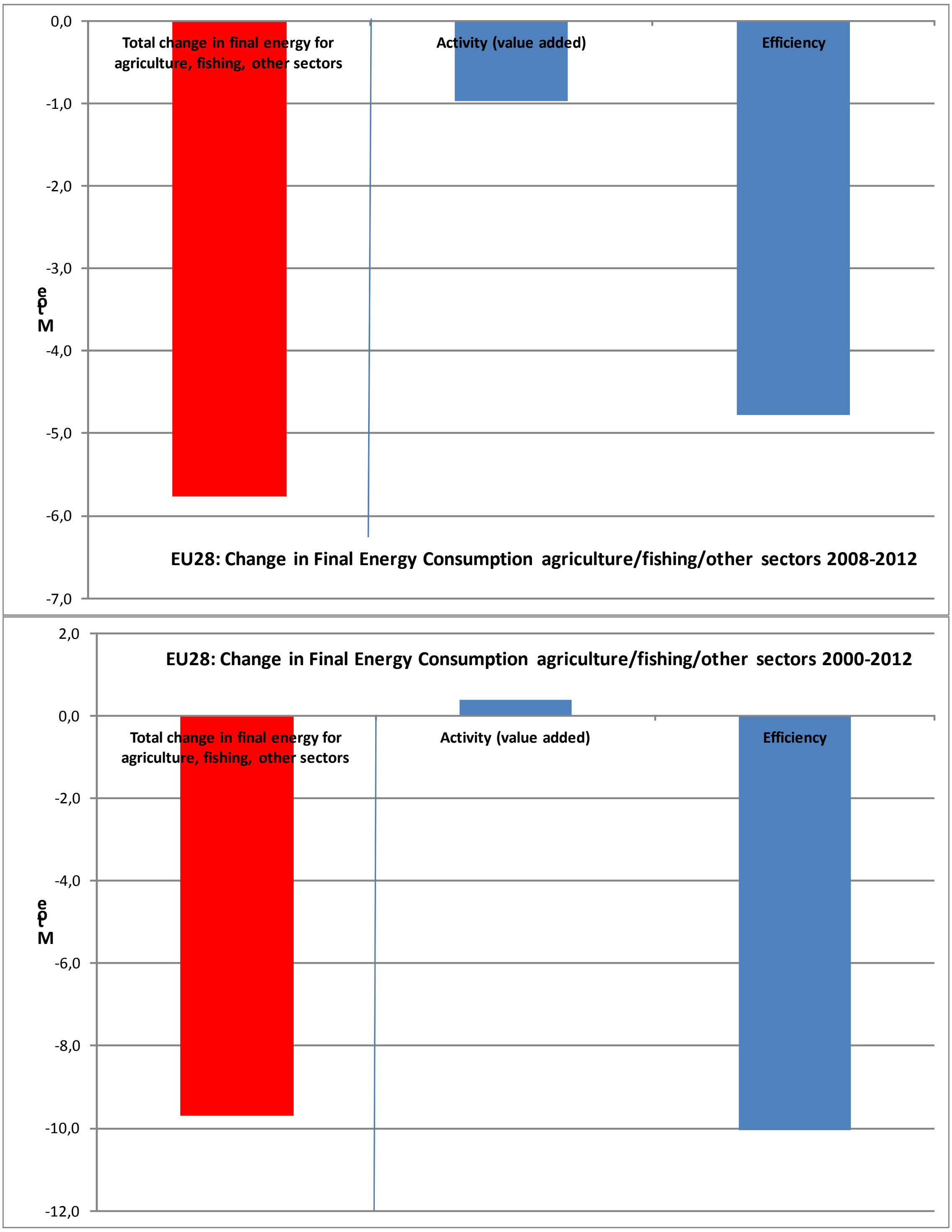
Note: Passenger transport is broken down to the modes road, rail, and domestic air transport. International air traffic is considered separately as it is not in competition with other modes for modal shift. Further details can be provided from the database.

Figure 18: Sectoral decomposition analysis (goods transport sector) of changes in final energy consumption 2008-2012 (upper figures) and 2000-2012 (lower figure)



Note: Goods transport is broken down to the modes road, rail, inland water ways and pipelines. Further details can be provided from the database.

Figure 19: Sectoral decomposition analysis (agriculture sector) of changes in final energy consumption 2008-2012 (upper figures) and 2000-2012 (lower figure)



Note: Agriculture, fishing and other sectors is broken down into an activity effect and energy efficiency effect only as no further details are available.

3. COUNTRY-SPECIFIC ANALYSIS

In this section key selected country comparisons for the decomposition analysis. Are shown. For comparison purpose the changes in the different factors are provided on an annual basis and normalized to the final or primary energy consumption of 2012 for the country (change in percent of final/primary energy per year). The main observations are as follows:

Final energy (Figure 20 and Figure 21)

- While the annual total changes in final energy was still increasing in a number of countries in the period 2000-2012, especially in eastern Member States, it was decreasing in nearly all Member States in the period 2008-2012.
- This was largely due to the impact of the financial and economic crisis as seen by the activity component, which was still largely contributing to the increase in final energy in the period 2000-2012, while it was reducing final consumption since 2008.
- The structural component was also contributing to the reduction in final energy on average in both periods but the changes were mixed across the countries.
- Comfort/behaviour and social factors were contributing in both periods to the increase in energy consumption though less in the period since 2008
- The impact of annual climate variations (weather impact) was to increase final consumption due to the fact that the end year 2012 was colder than both 2000 and 2007 (the base year for the 2008-2012 analysis) which in the period 2000-2012 appeared as rather warm years.
- The energy efficiency factor contributed to reduce final energy consumption by around 1% per year in both periods but it slowed down in the shorter period 2008-2012 due to impacts of the economic crisis which for example in industry or goods transport has a negative impact on energy consumption due to lower capacity uses.

Primary energy (Figure 22 and Figure 23):

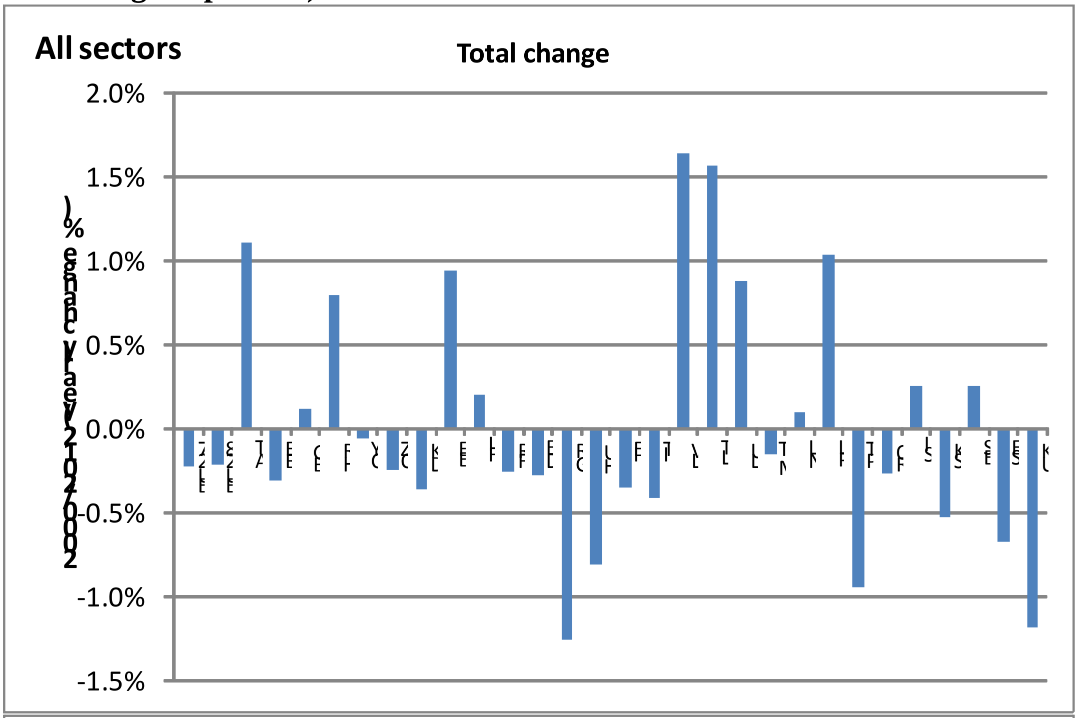
- Primary energy reflects partly the changes in final energy consumption and the changes in the conversion sector. Hence, the total change in primary energy is differing across countries and is influenced by different factors. Overall, primary energy consumption decreased since 2008.

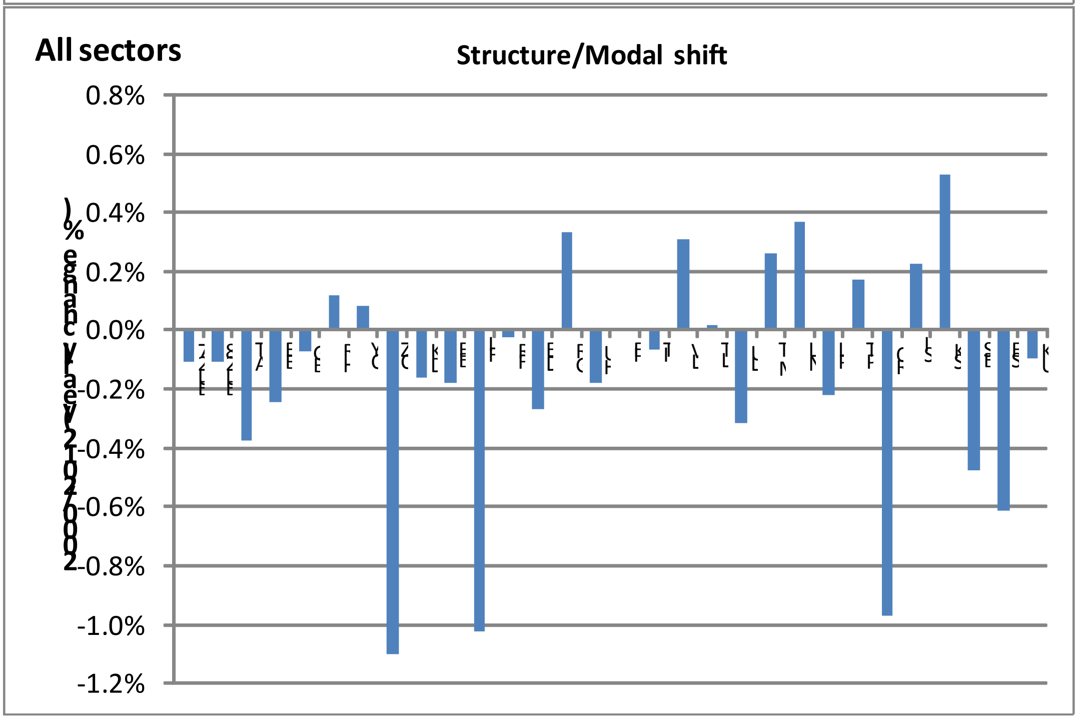
- Activities (demand for energy available for final demand) drove the primary energy demand up in the total period 2000-2012 but contributed to an increase since 2008. This is due to the combined impact of the different factors impacting on final energy and discussed in the previous section.
- Both distribution losses and own consumption in the energy sector overall contributed to reduce primary energy consumption but comparatively little in comparison with other factors.
- Structural change in the energy conversion sector was impacting negatively the consumption of primary energy with the penetration of the electricity sector which as a lower efficiency than the other parts of the conversion sector. The impact was, however, less pronounced in the period since 2008.
- Energy efficiency in the transformation sector contributed strongly to mitigate the impacts of the structural change. This was in particular due to the electricity sector itself (see the next section), which changing shares in renewable energy sources and CHP.

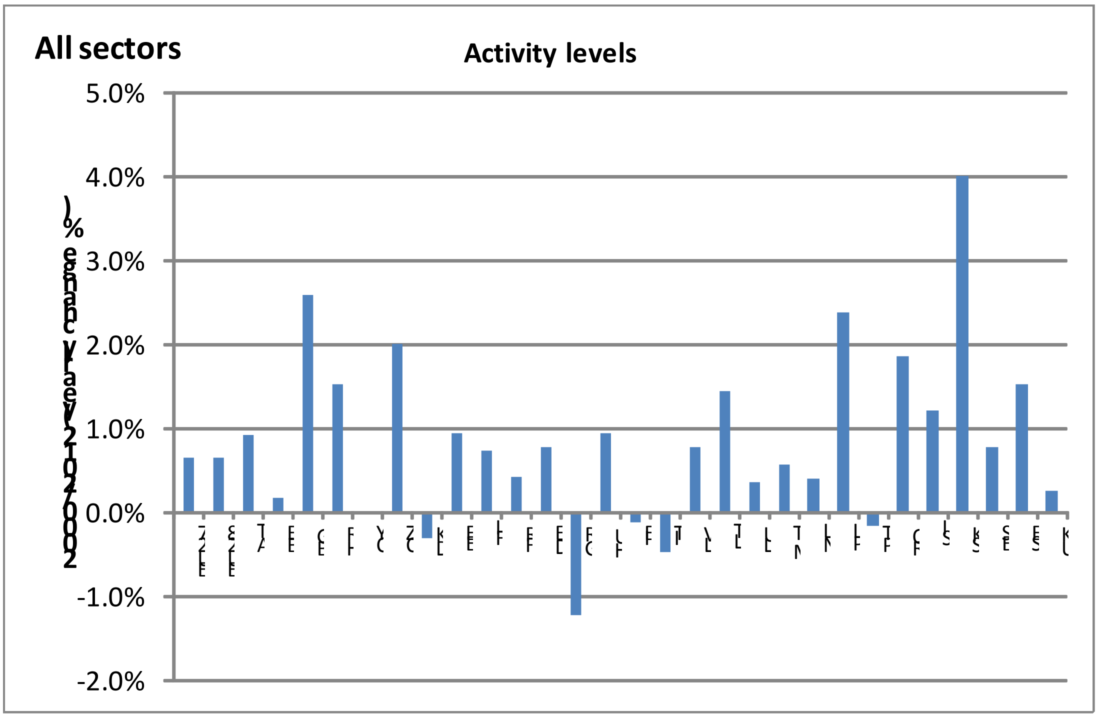
Changes in primary energy due to electricity generation (Figure 24 and Figure 25)

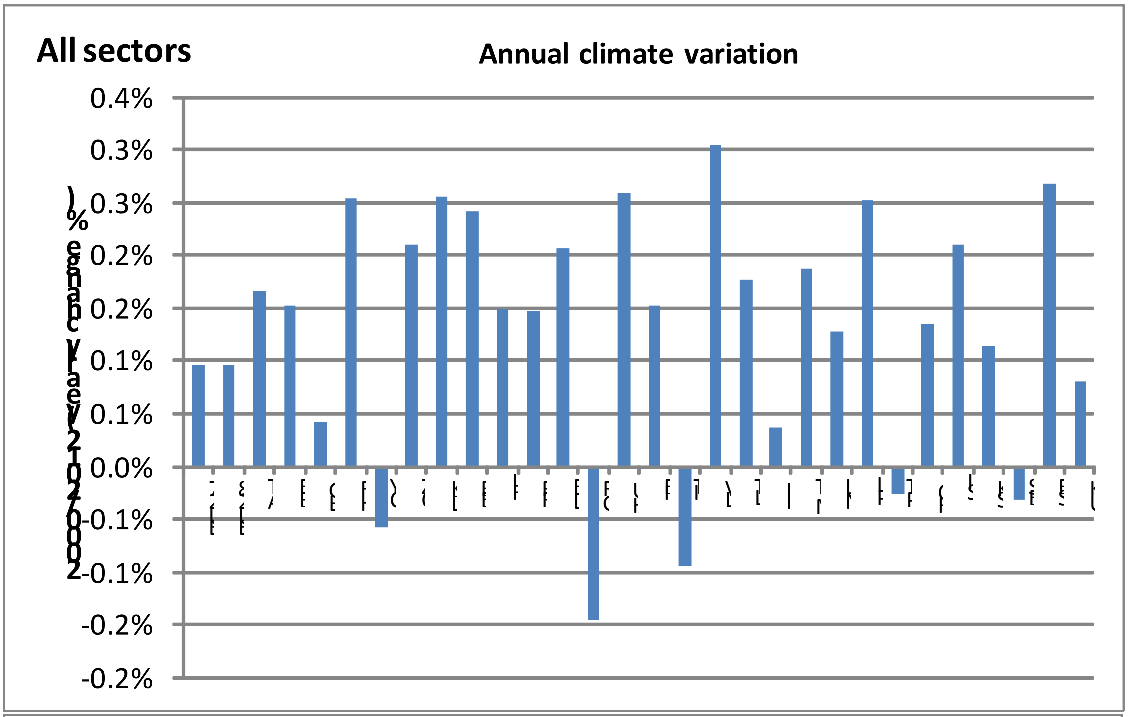
- The electricity sector was strongly contributing to the different changes in primary energy as discussed in the previous section. In the period 2000-2012 primary energy was increasing due the strong increase in gross final electricity demand in all countries (activity effect). This effect slowed down and even reversed in the period since 2008 that is less demand for gross electricity demand contributed to reduce primary energy demand for electricity generation
- A large impact came from structural change in the electricity generation, away from thermal power generation and nuclear towards more renewable (with 100% nominal efficiency) and CHP in some countries.
- The efficiency of (thermal) power plants contributed to an increase in primary energy consumption in the period since 2008, possibly due to lower capacities uses of thermal power plants (under the combined impacts of the penetration of renewable and the lowered demand for electricity since 2008).

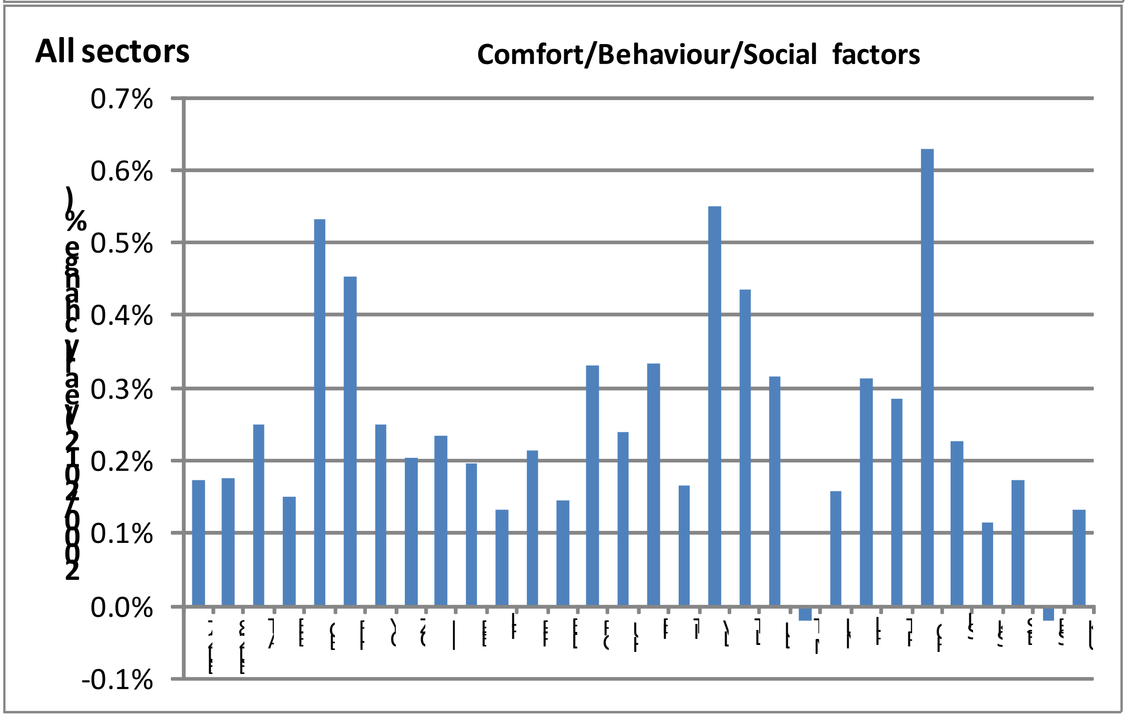
Figure 20: Total change in final energy consumption and different factors 2000-2012 (annual change in percent)






All sectors
Activity levels
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
-1.0%
-2.0%


All sectors
Annual climate variation
0.4%
0.3%
0.3%
0.2%
0.2%
0.1%
0.1%
0.0%
-0.1%
-0.1%
-0.2%
-0.2%


All sectors
Comfort/Behaviour/Social factors
0.7%
0.6%
0.5%
0.4%
0.3%
0.2%
0.1%
0.0%
-0.1%

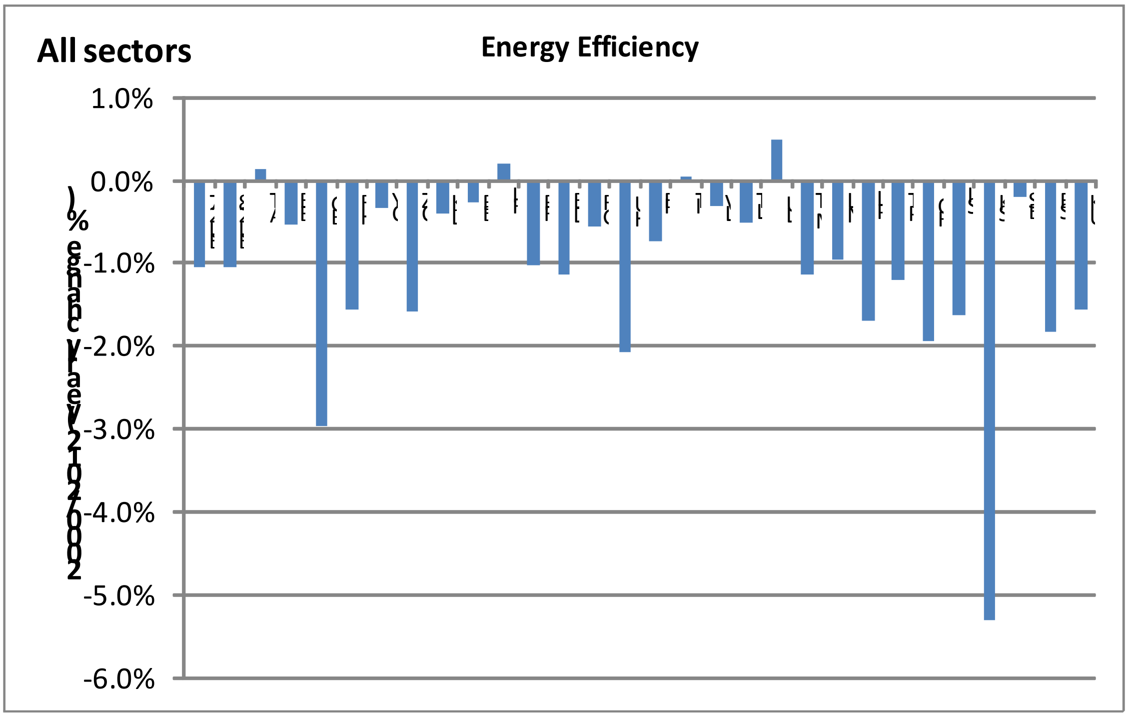
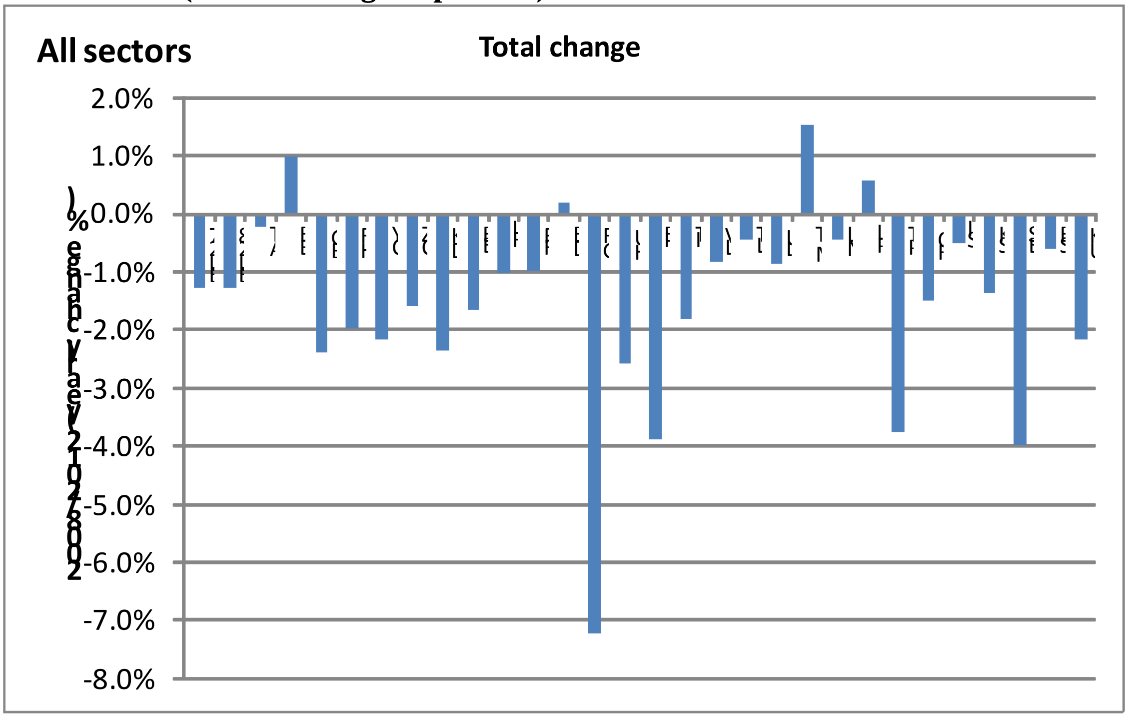
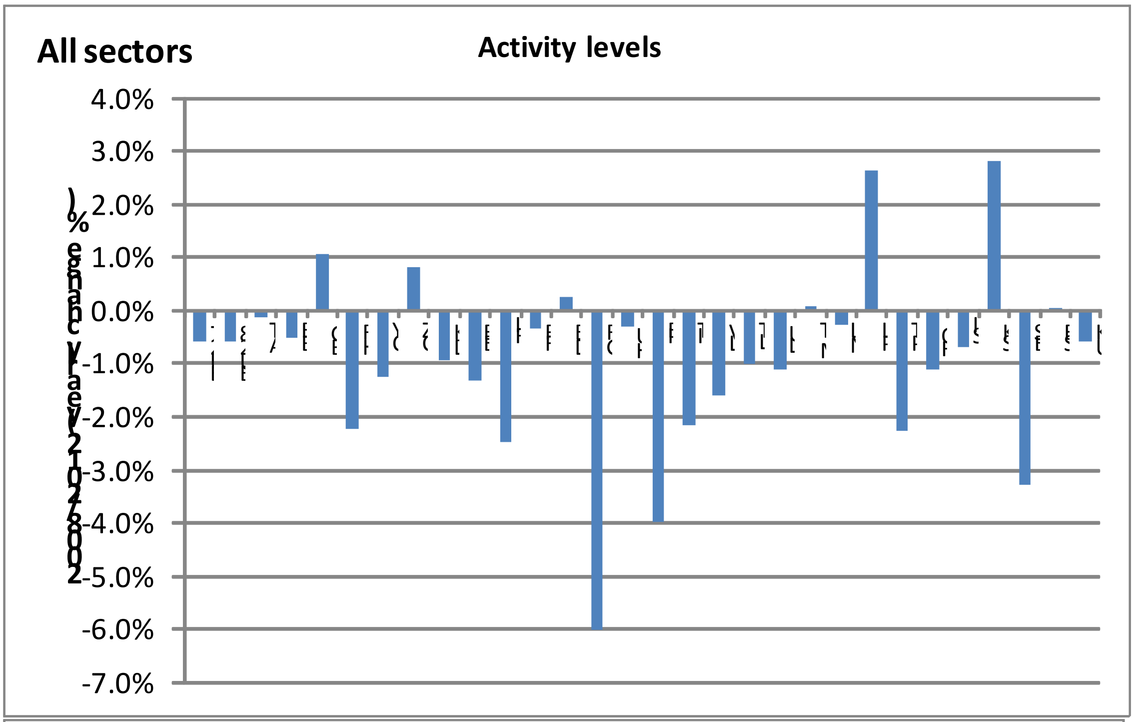
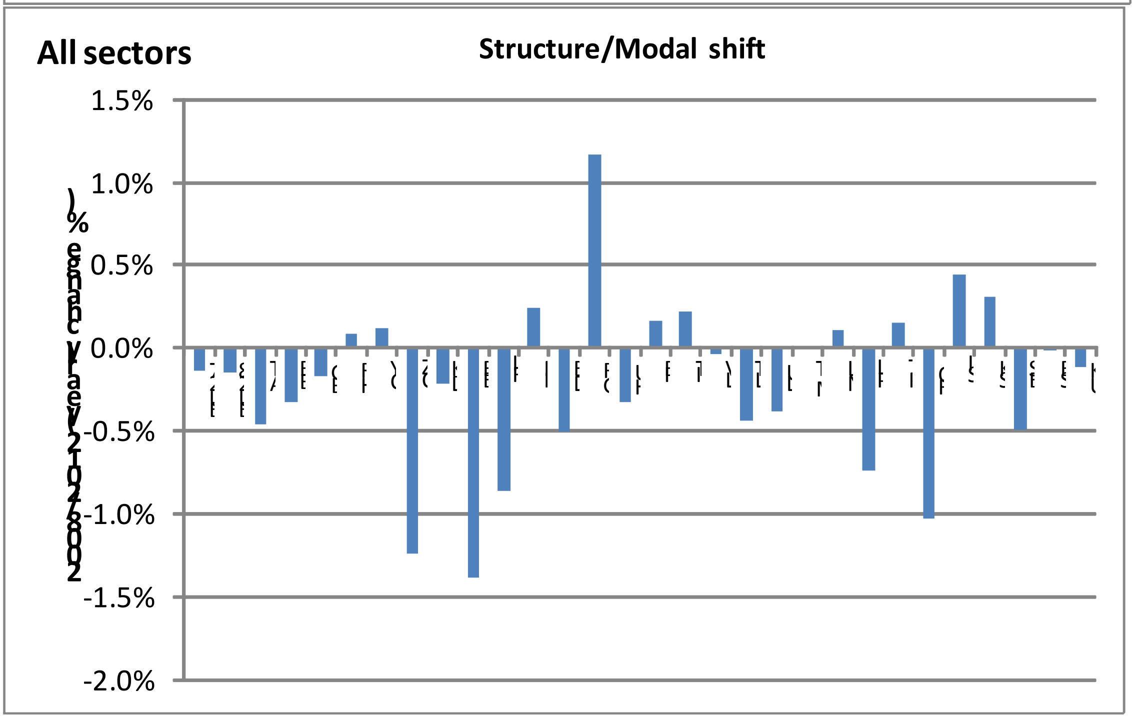
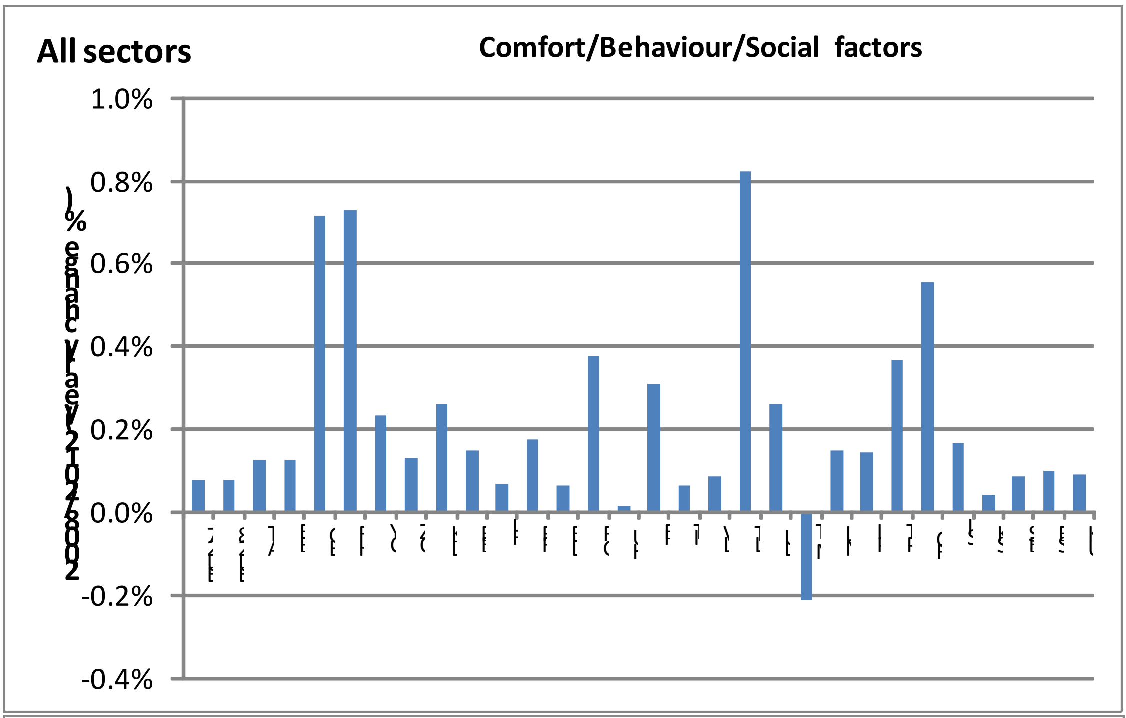


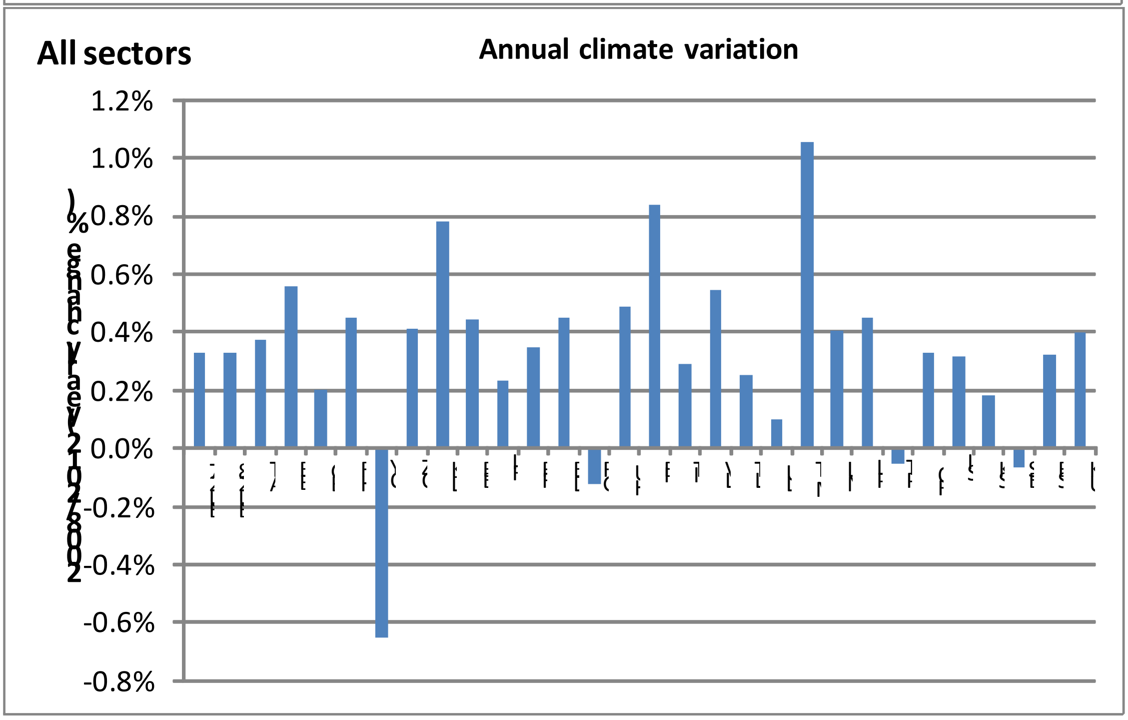
Figure 21: Total change in final energy consumption and different factors 2008 (incl.)-2012 (annual change in percent)




All sectors
Activity levels
4.0%
3.0%
2.0%
1.0%
0.0%
-1.0%
-2.0%
-3.0%
-4.0%
-5.0%
-6.0%
-7.0%


All sectors
Structure/Modal shift
1.5%
1.0%
0.5%
0.0%
-0.5%
-1.0%
-1.5%
-2.0%


All sectors
Comfort/Behaviour/Social factors
1.0%
0.8%
0.6%
0.4%
0.2%
0.0%
-0.2%
-0.4%


All sectors
Annual climate variation
1.2%
1.0%
0.8%
0.6%
0.4%
0.2%
0.0%
-0.2%
-0.4%
-0.6%
-0.8%

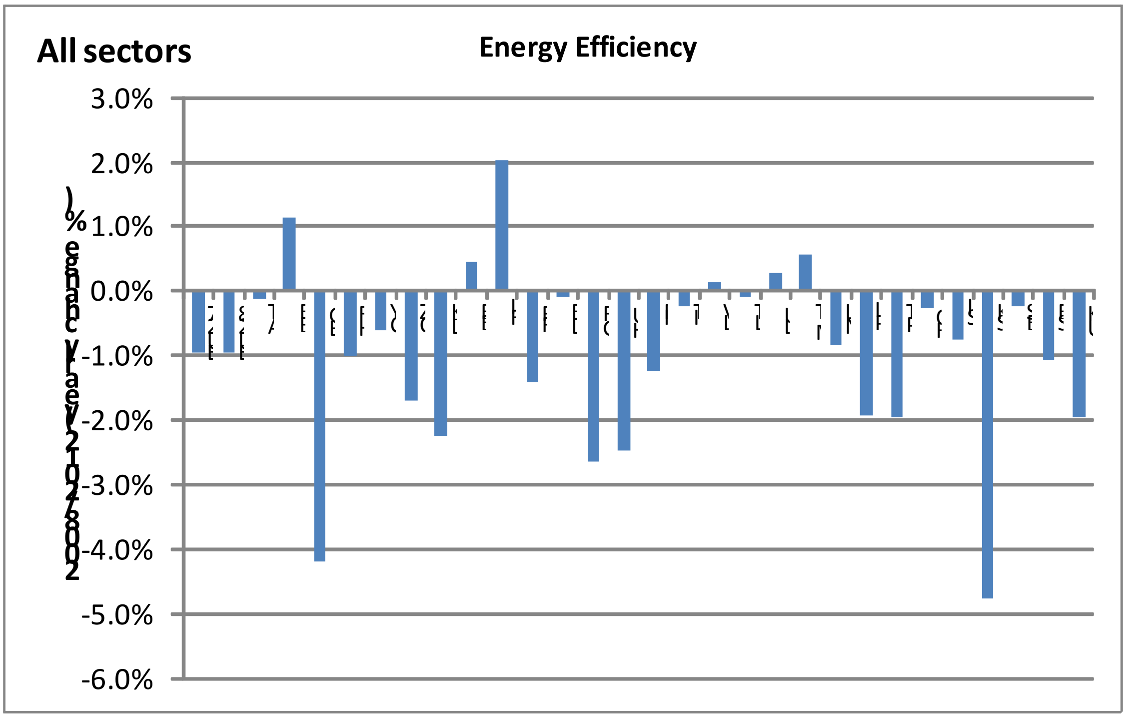
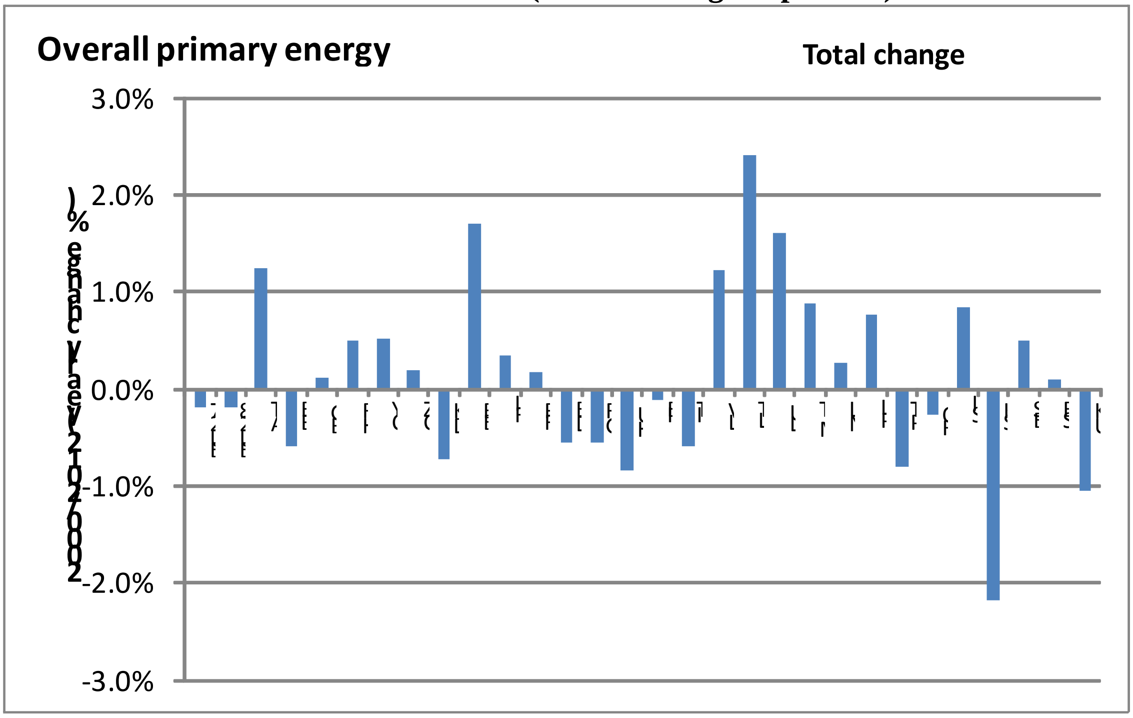
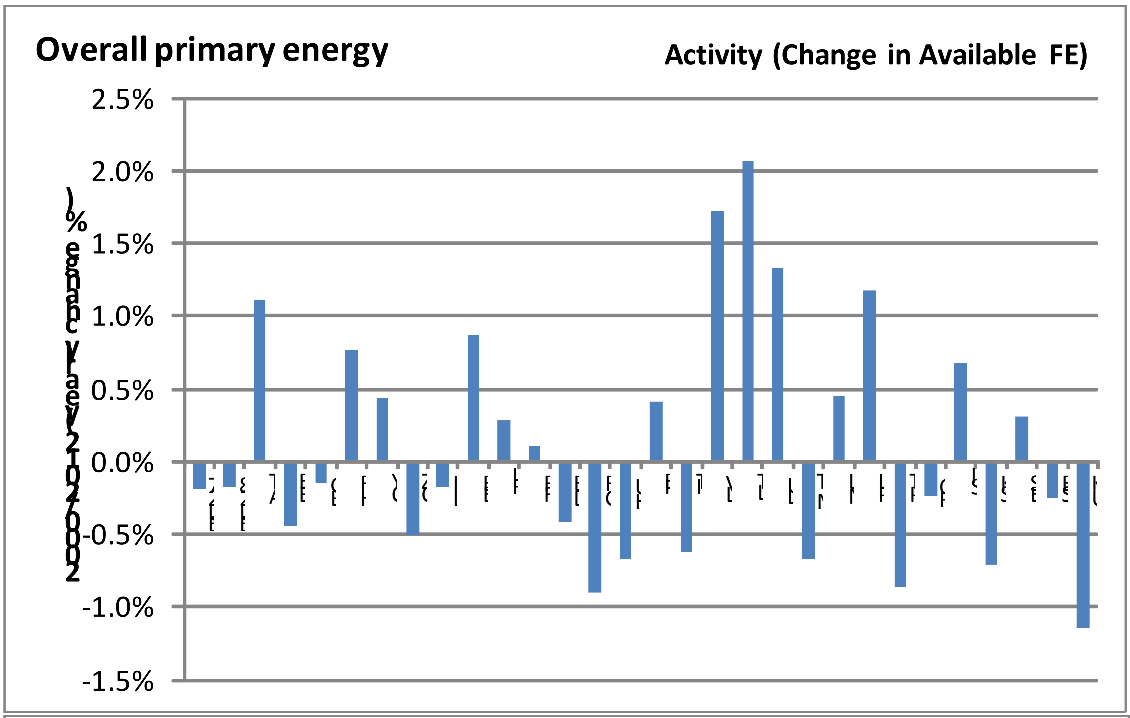
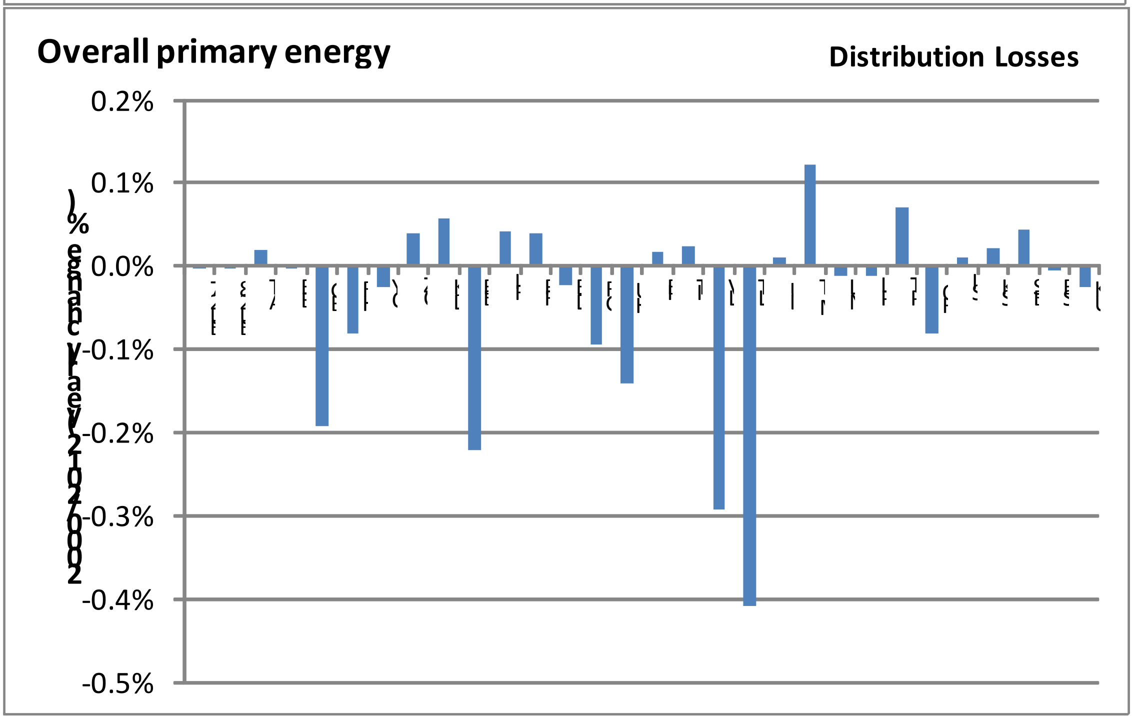
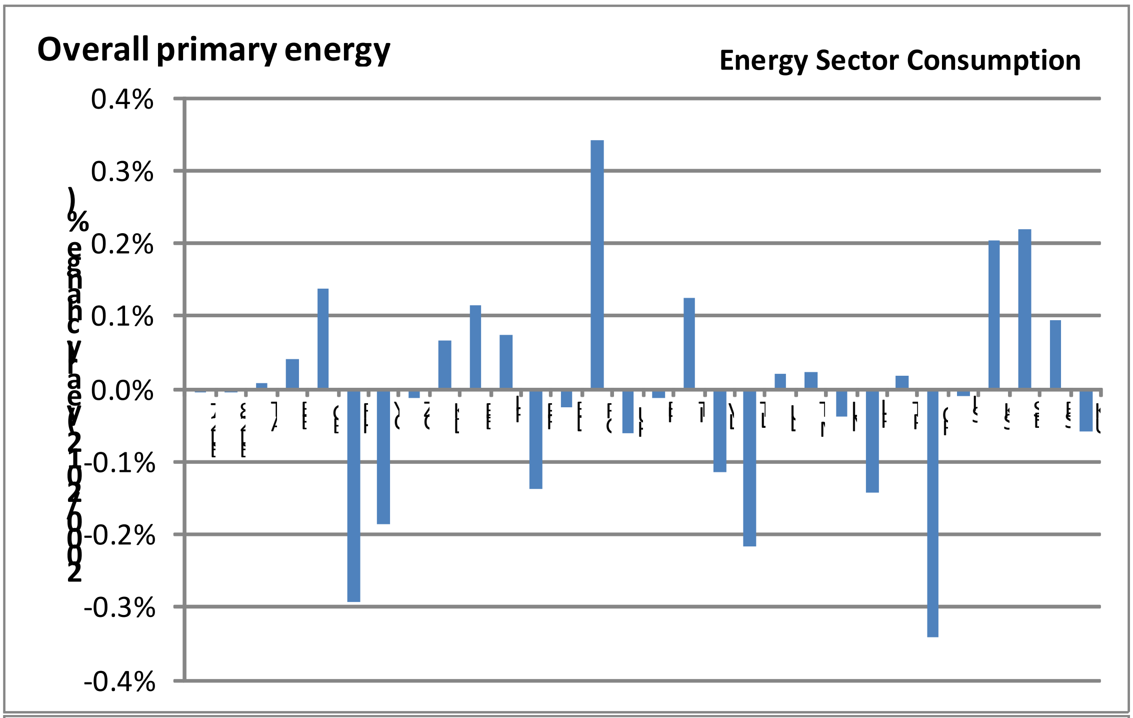


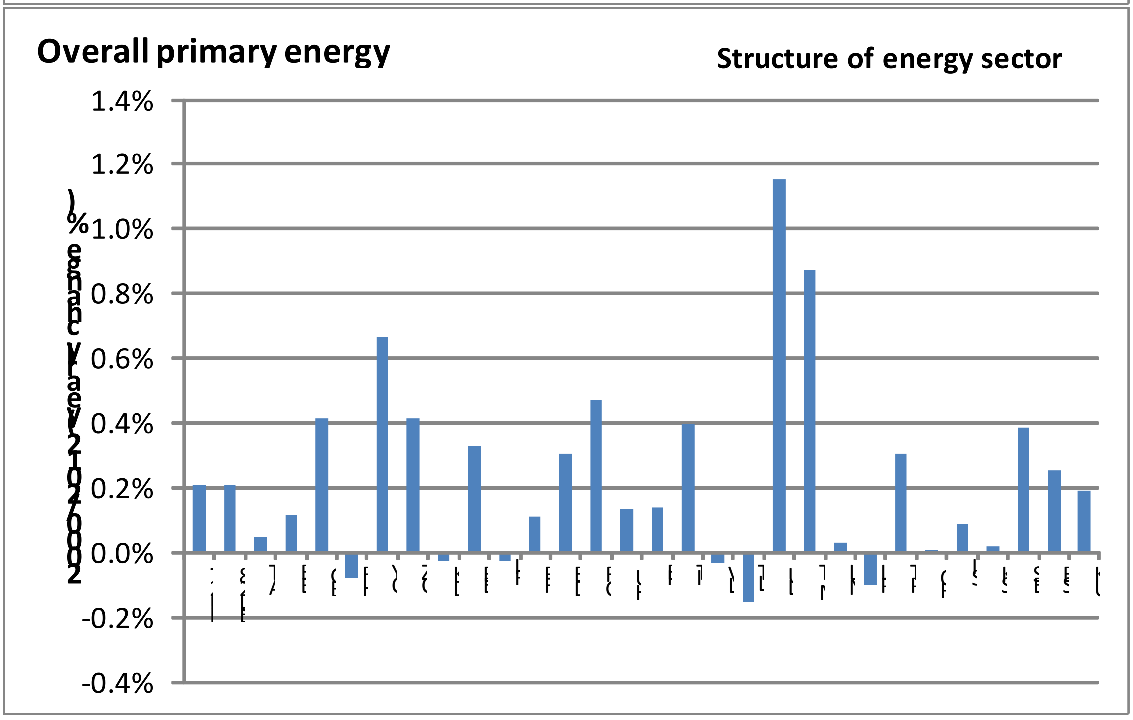
Figure 22: Total change in primary energy consumption (excl. non-energy uses) and different factors 2000-2012 (annual change in percent)




Overall primary energy
Activity (Change in Available FE)
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
-0.5%
-1.0%
-1.5%


Overall primary energy
Distribution Losses
0.2%
0.1%
0.0%
-0.1%
-0.2%
-0.3%
-0.4%
-0.5%


Overall primary energy
Energy Sector Consumption
0.4%
0.3%
0.2%
0.1%
0.0%
-0.1%
-0.2%
-0.3%
-0.4%


Overall primary energy
Structure of energy sector
1.4%
1.2%
1.0%
0.8%
0.6%
0.4%
0.2%
0.0%
-0.2%
-0.4%

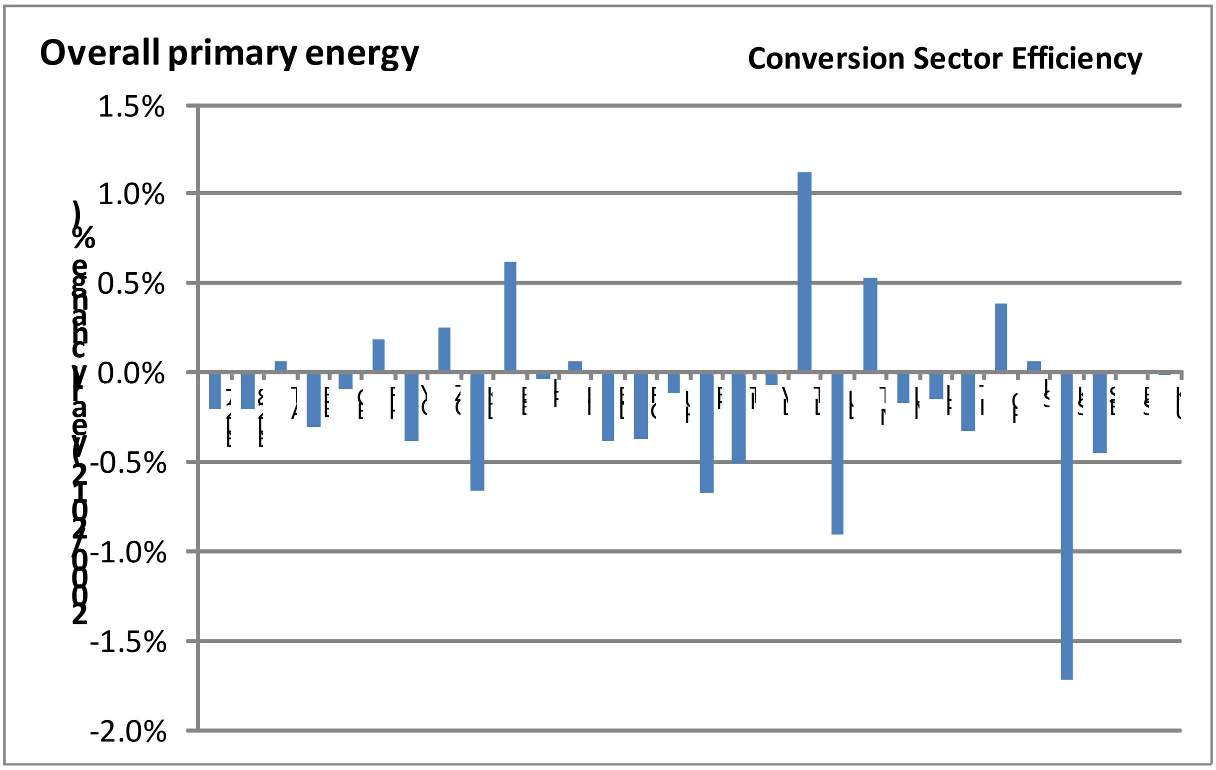
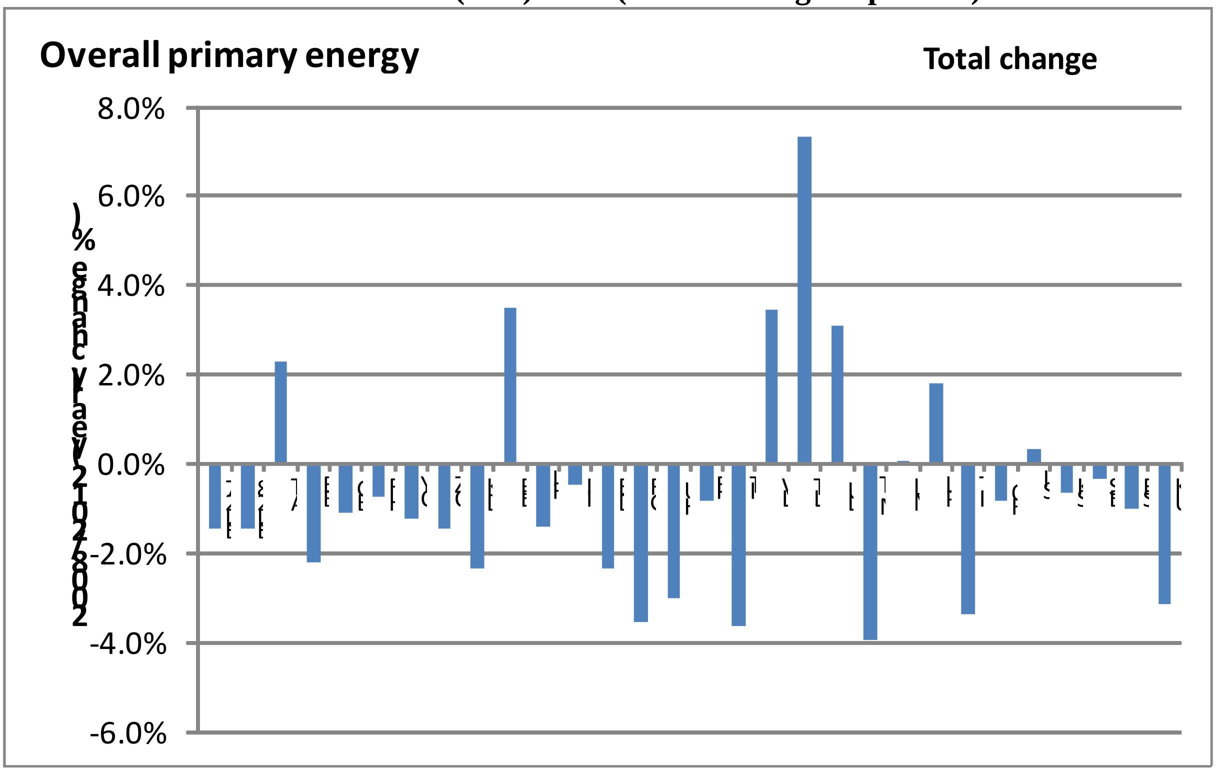
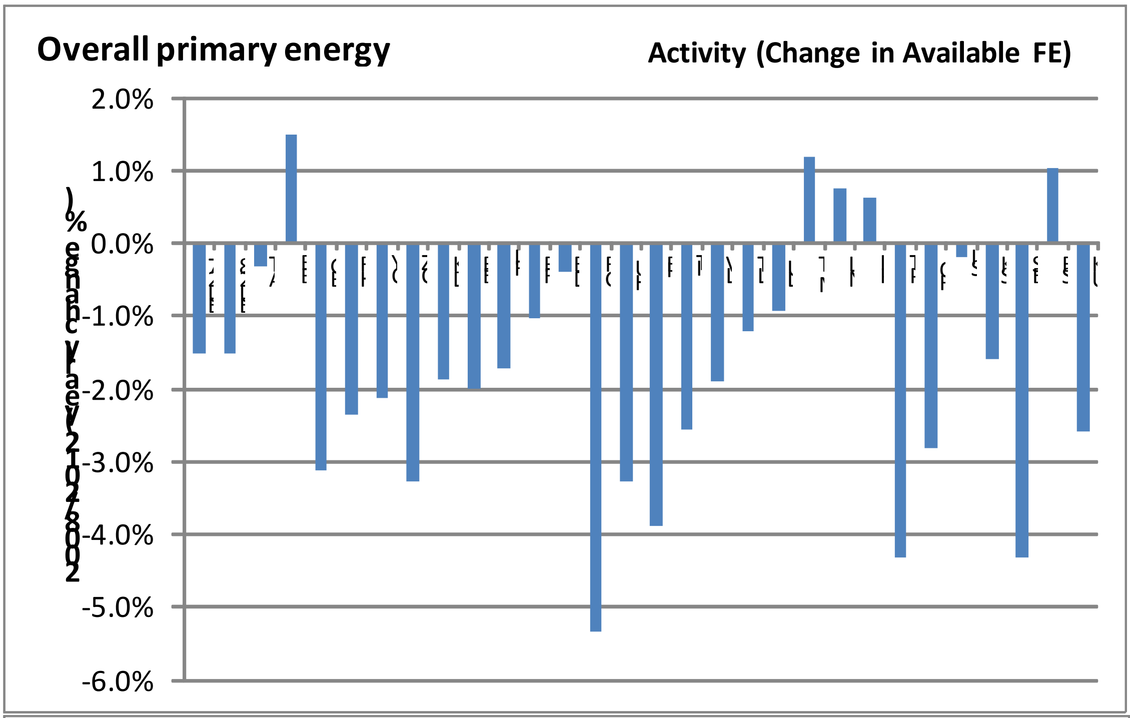
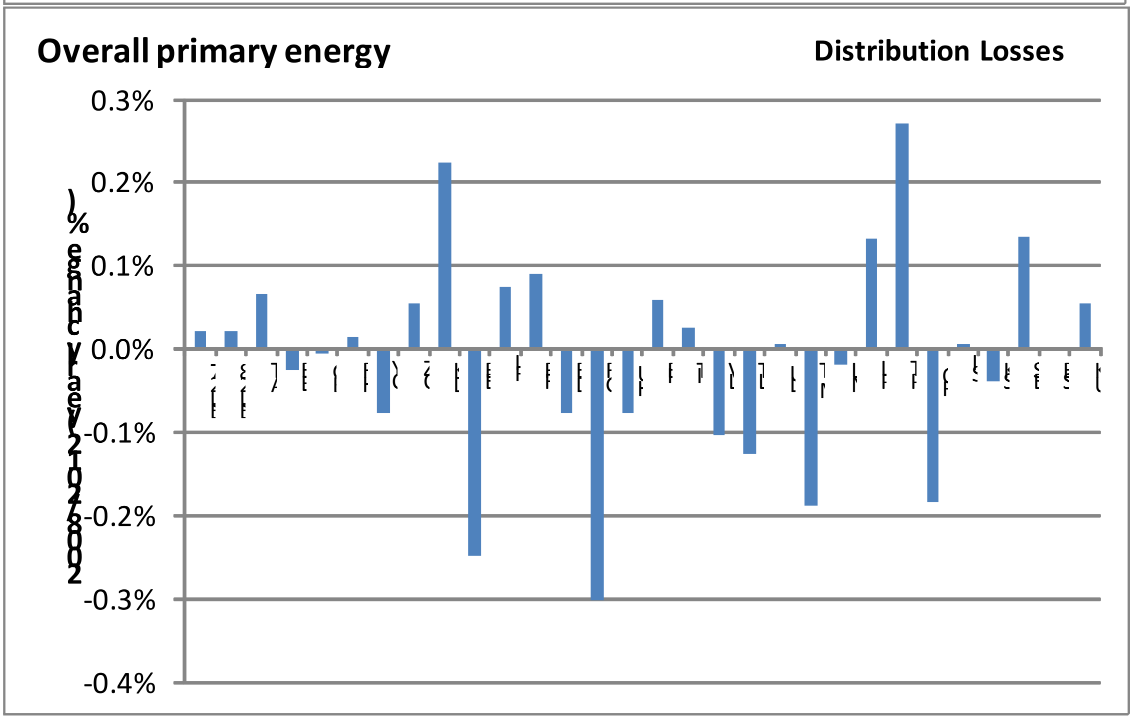
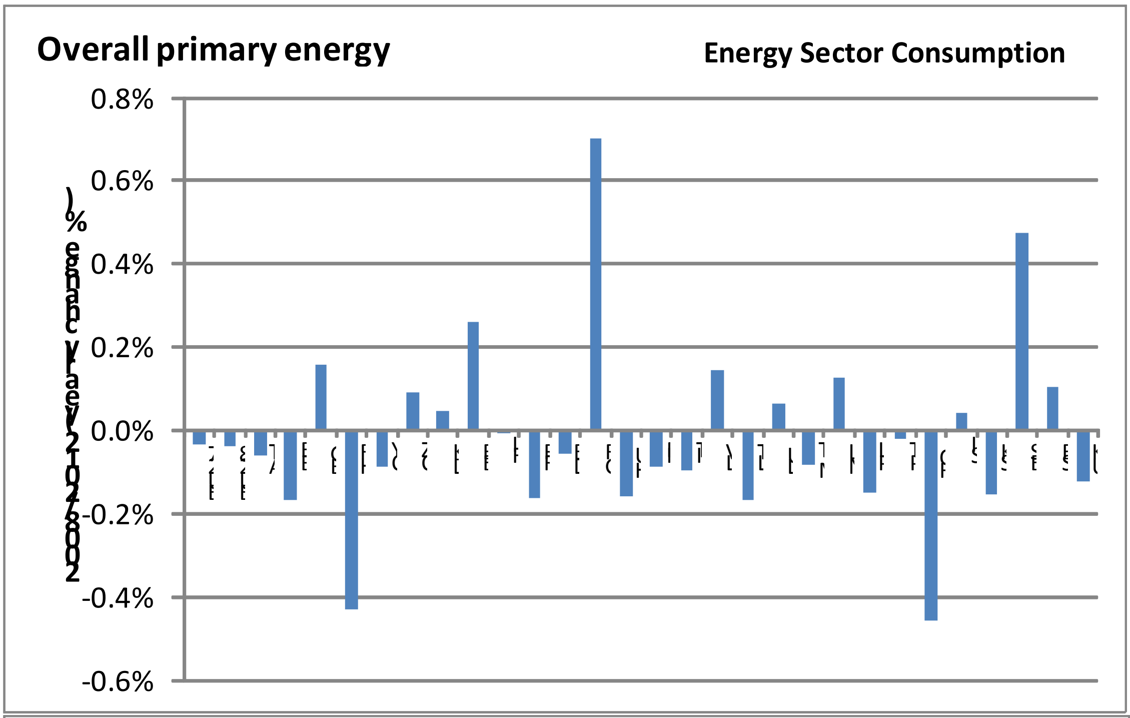


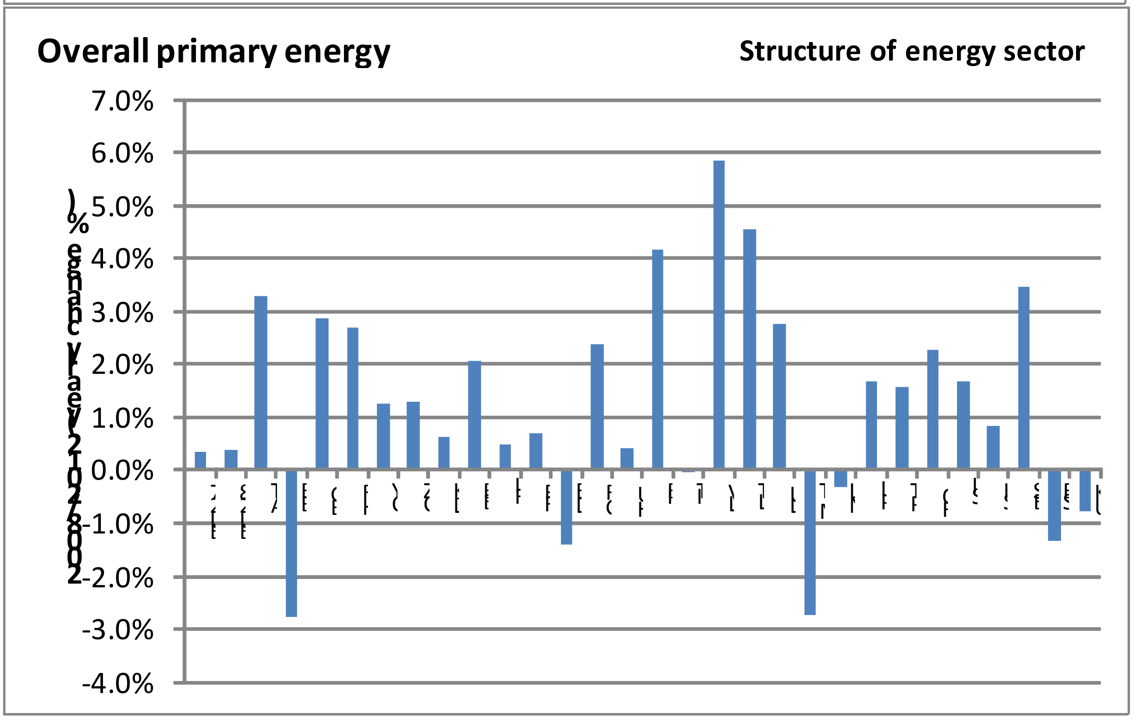
Figure 23: Total change in primary energy consumption (excl. non-energy uses) and different factors 2008 (incl.)-2012 (annual change in percent)




Overall primary energy
Activity (Change in Available FE)
2.0%
1.0%
0.0%
-1.0%
-2.0%
-3.0%
-4.0%
-5.0%
-6.0%


Overall primary energy
Distribution Losses
0.3%
0.2%
0.1%
0.0%
-0.1%
-0.2%
-0.3%
-0.4%


Overall primary energy
Energy Sector Consumption
0.8%
0.6%
0.4%
0.2%
0.0%
-0.2%
-0.4%
-0.6%


Overall primary energy
Structure of energy sector
7.0%
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
-1.0%
-2.0%
-3.0%
-4.0%

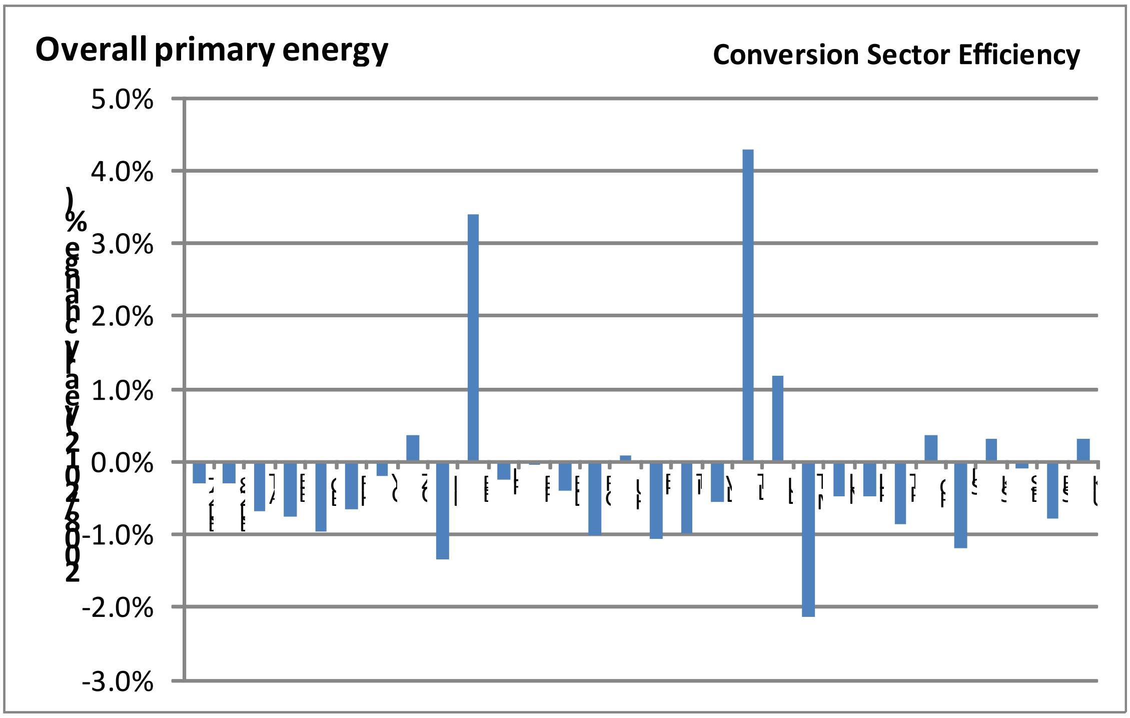
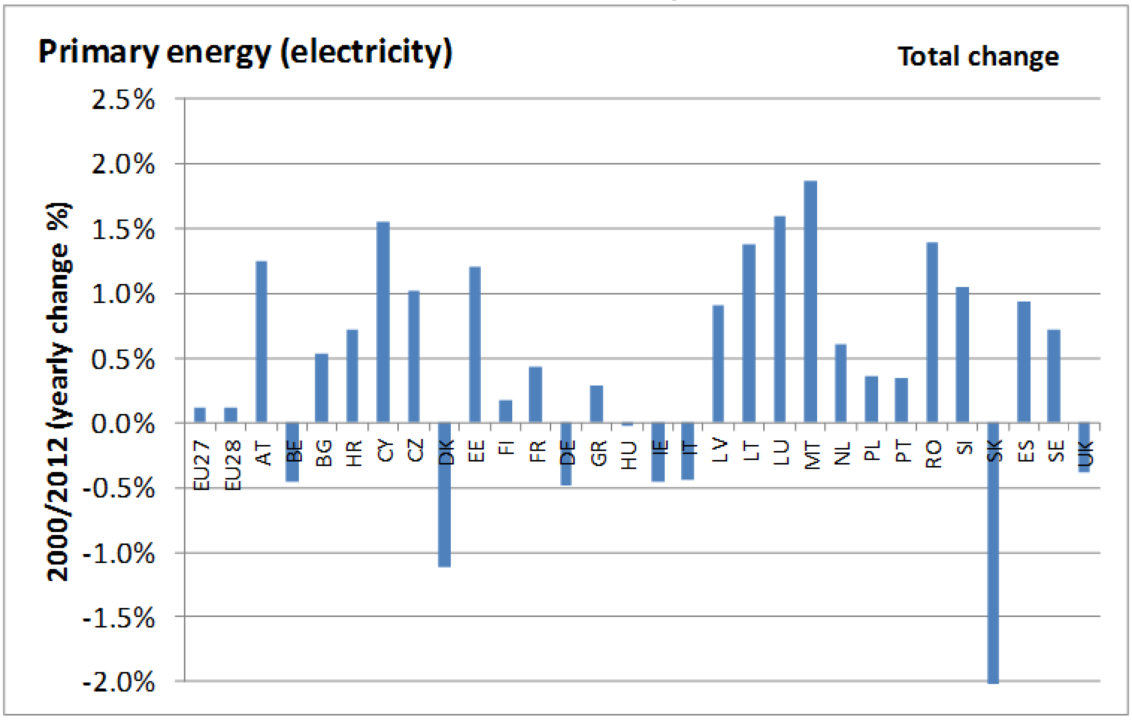
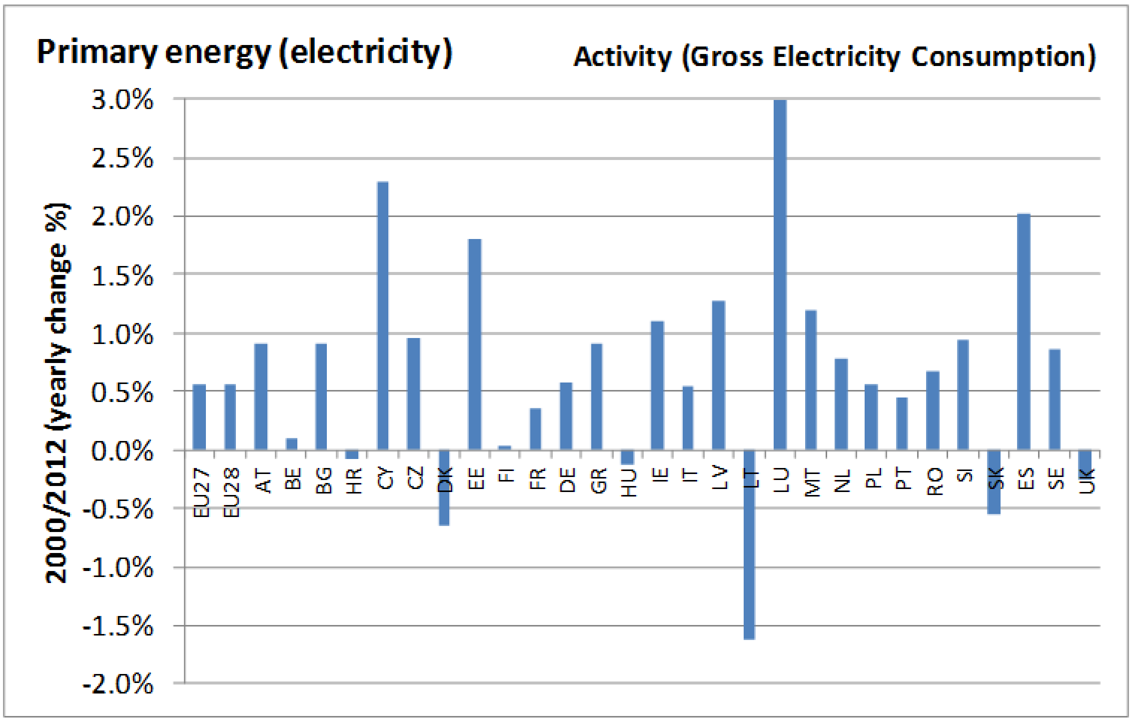
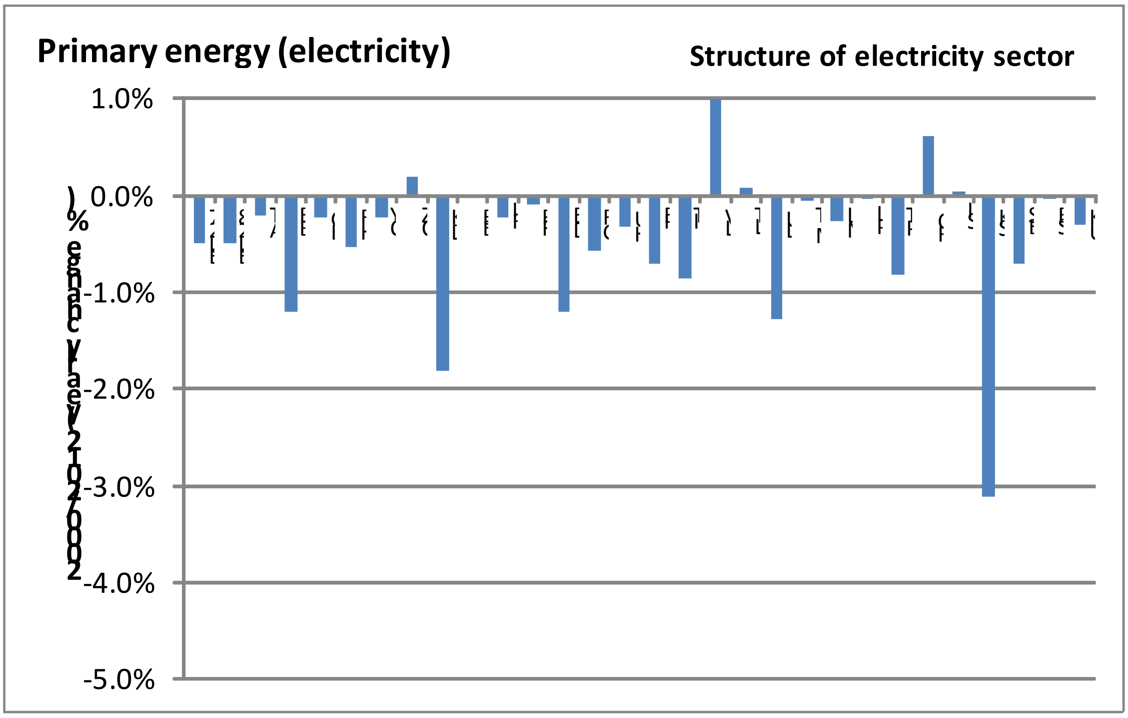


Figure 24: Total change in primary energy consumption for electricity generation and different factors 2000-2012 (annual change in percent)




Primary energy (electricity)
Activity (Gross Electricity Consumption)
2000/2012 (yearly change %)
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
-0.5%
-1.0%
-1.5%
-2.0%
EU27
EU28
AT
BE
BG
HR
CY
CZ
DK
EE
FI
FR
DE
GR
HU
IE
IT
LV
LT
LU
MT
NL
PL
PT
RO
SI
SK
ES
SE
UK


Primary energy (electricity)
Structure of electricity sector
1.0%
0.0%
-1.0%
-2.0%
-3.0%
-4.0%
-5.0%

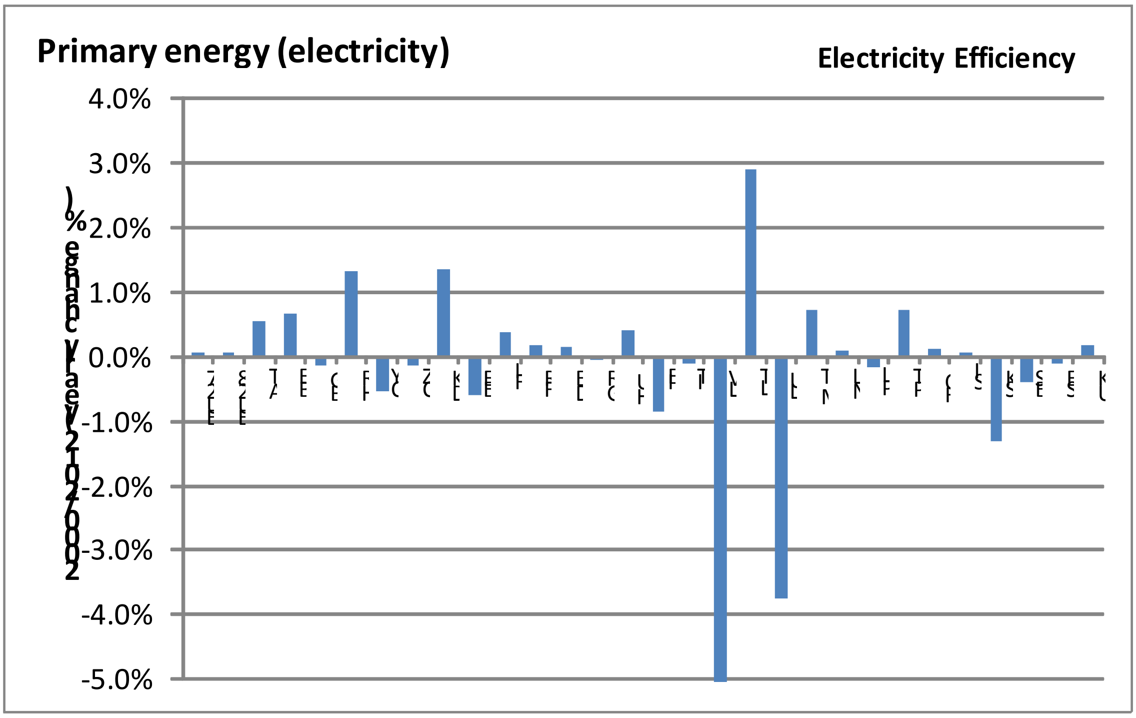
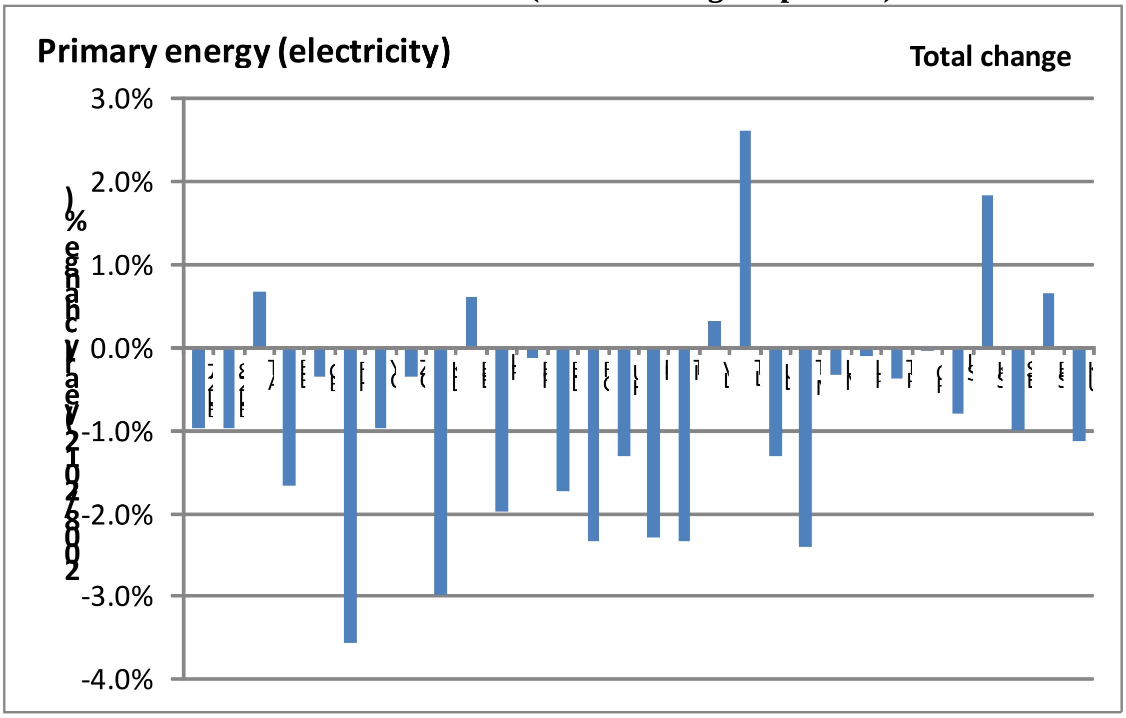
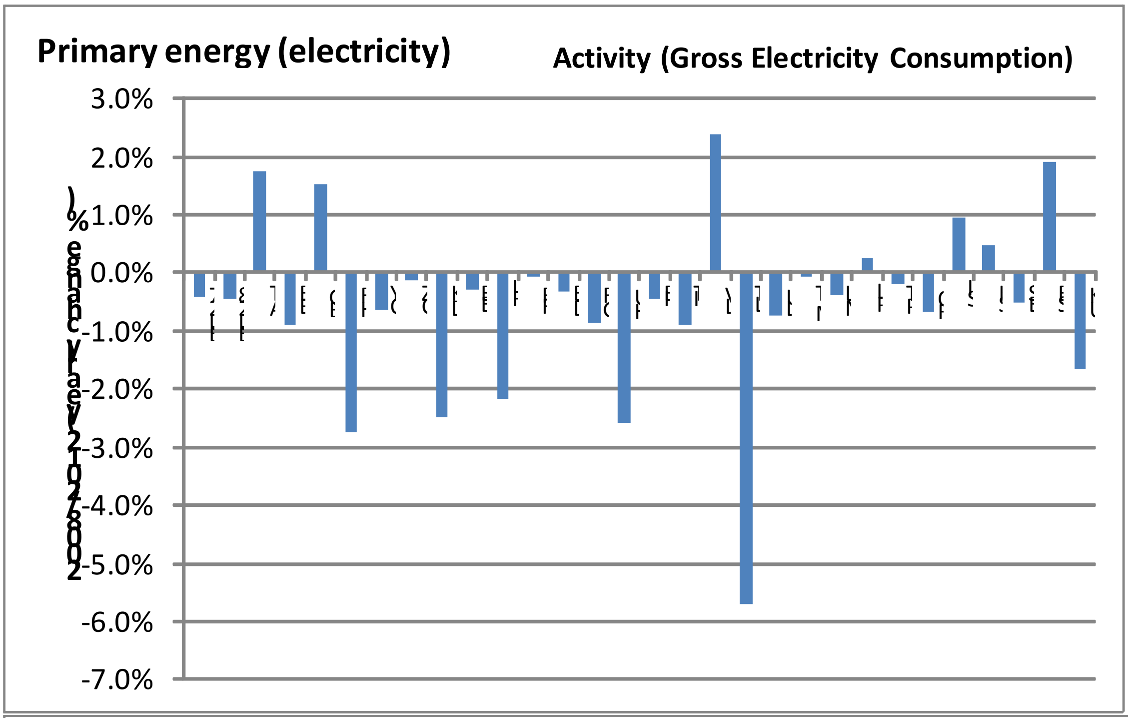
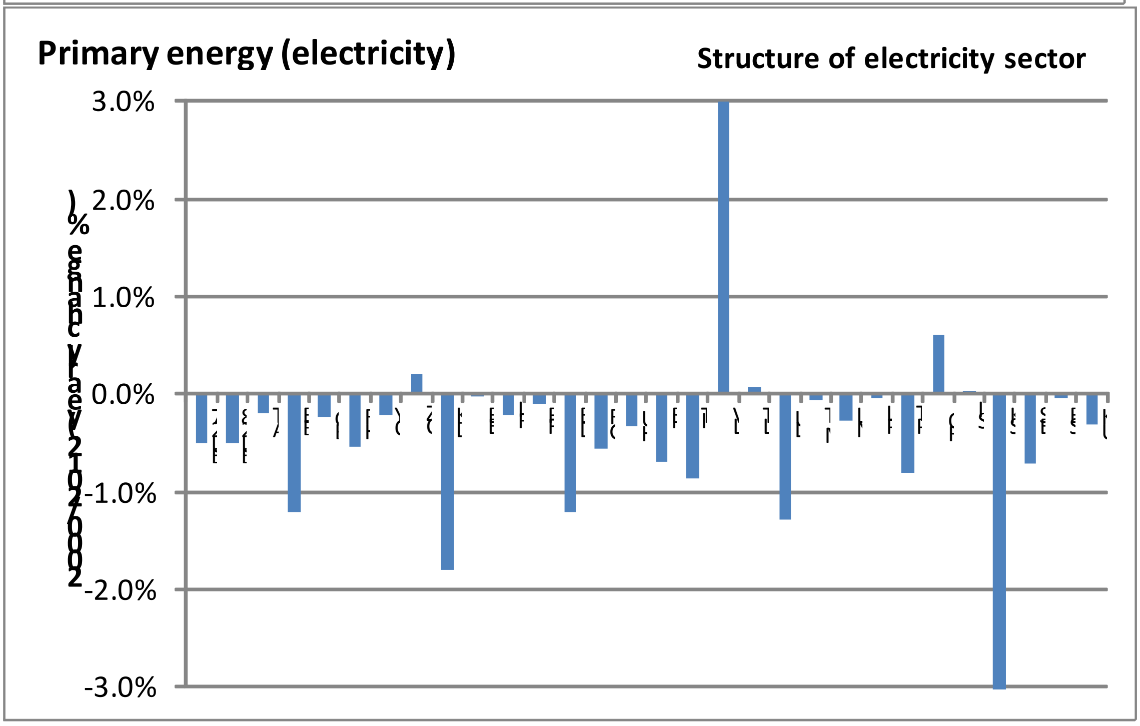
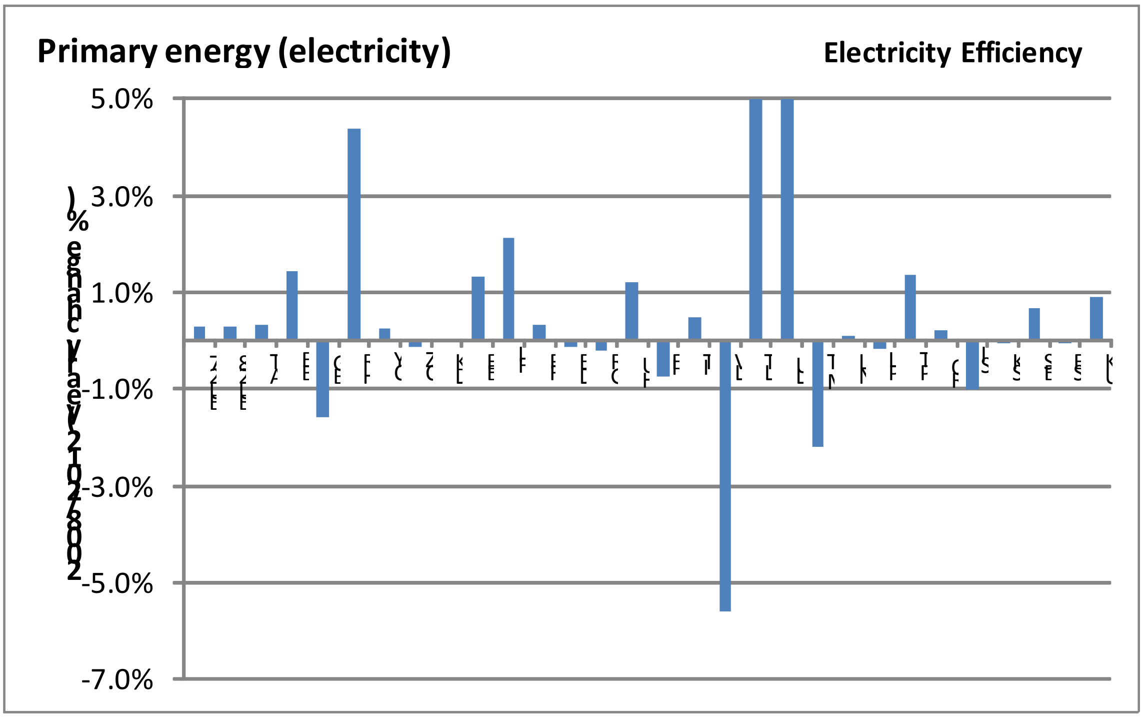


Figure 25: Total change in primary energy consumption for electricity generation and different factors 2000-2012 (annual change in percent)




Primary energy (electricity)
Activity (Gross Electricity Consumption)
3.0%
2.0%
1.0%
0.0%
-1.0%
-2.0%
-3.0%
-4.0%
-5.0%
-6.0%
-7.0%


Primary energy (electricity)
Structure of electricity sector
3.0%
2.0%
1.0%
0.0%
-1.0%
-2.0%
-3.0%


Primary energy (electricity)
Electricity Efficiency
5.0%
3.0%
1.0%
-1.0%
-3.0%
-5.0%
-7.0%

Annex IV. Analysis of sectoral correlations between changes in GDP and final energy consumption

1. Correlation analysis

An analysis of the linear correlation of change in GDP (ΔGDP) to the change in final energy consumption within all sectors has been performed. In the figures the change in energy consumption is plotted against ΔGDP for the period from 2000 to 2011 (to 2010 for transport due to lack of 2011 data), each data point representing a member state. A linear fit was performed and the R^2 value of the fit was computed (a broken line is added to indicate the hypothetical perfect linear dependency with an inclination of one). While the residential and tertiary sectors are uncorrelated to ΔGDP, the industry sector shows signs of correlation and the transport sector is strongly linear correlated to ΔGDP.

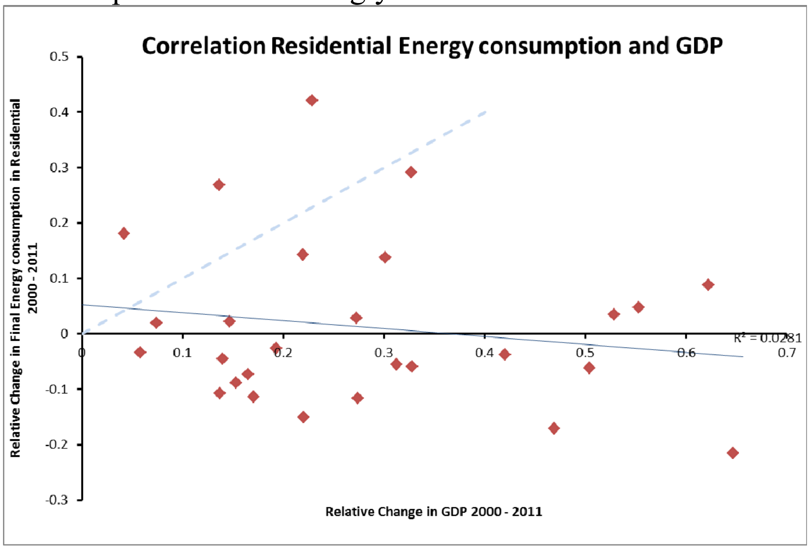


Figure 26: Correlation between energy consumption in the residential sector and ΔGDP

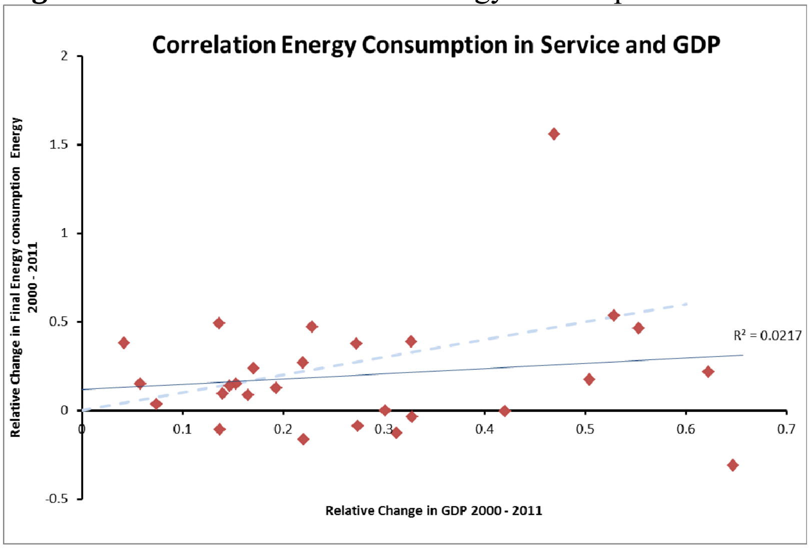


Figure 27: Correlation between energy consumption in the tertiary sector and ΔGDP

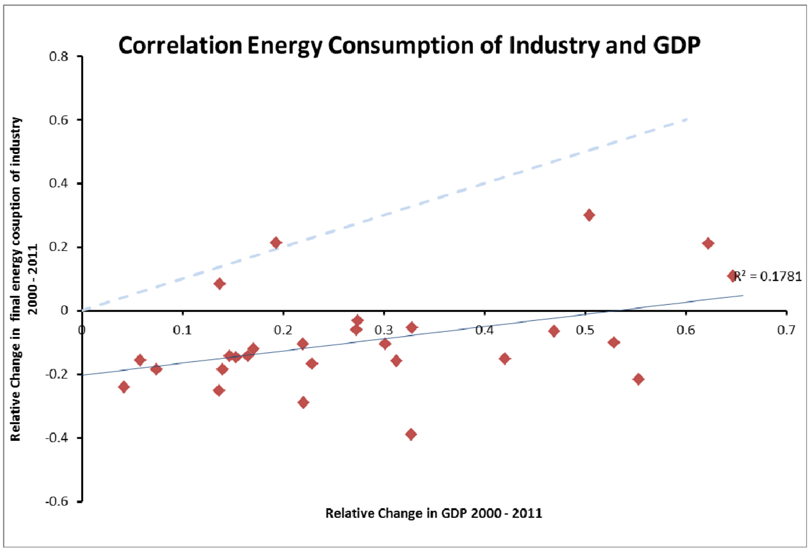


Figure 28: Correlation between energy consumption in the industrial sector and ΔGDP

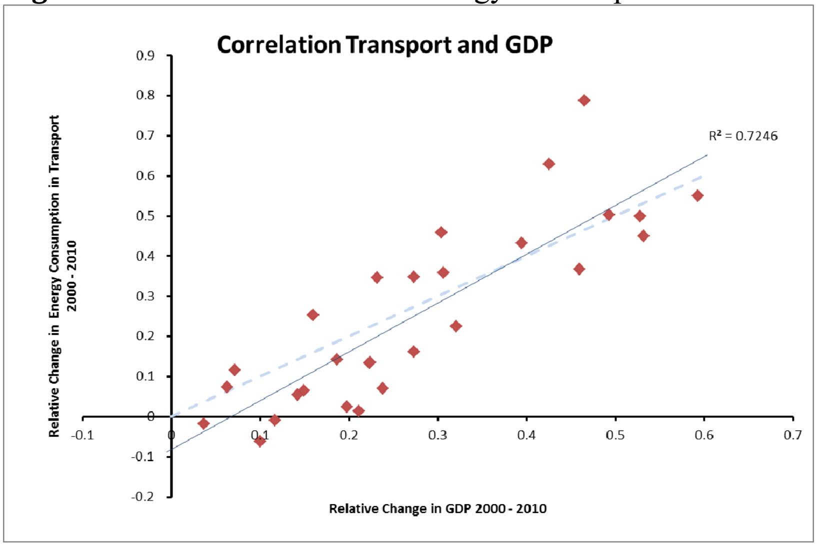


Figure 29: Correlation between energy consumption in the transport sector and ΔGDP

Annex V: PRIMES Methodology and modelling assumptions

1. PRIMES model

PRIMES which is a partial-equilibrium model of the energy system, was used for setting the EU 2020 targets (including energy efficiency), the Low Carbon Economy and Energy 2050 Roadmaps as well as the 2030 policy framework for climate and energy. The PRIMES model is suitable for analysing the impacts of different sets of energy efficiency policies on the energy system as a whole, notably on the fuel mix, GHG emissions, investment needs and energy purchases as well as overall system costs. It is also suitable for analysing the interaction of policies promoting energy efficiency with policies driving the GHG abatement and promotion of RES.

Modelling with PRIMES was therefore used to create the scenarios that illustrate different policy options presented in this IA (in terms of different levels of energy efficiency ambition) and to compare their impacts on

- Energy system with strong focus on security of supply
- Competitiveness
- Sustainability

2. Coherence with the 2030 Communication and its underlying Impact Assessment

The focus in the modelling exercise that underpins this IA is on energy efficiency, investigating different levels of ambition of energy efficiency policies, as the impacts of GHG and RES policies were already analysed in detail in the 2030 IA.

The PRIMES modelling results underpinning the 2030 IA were used as a starting point to make the two modelling exercises consistent. In particular, the proposals of the 2030 framework regarding binding targets for GHG emission reductions and RES share in final energy consumption by 2030 were reflected in this modelling exercise. Both exercises also focused on decarbonisation perspective in 2050..

3. Reference scenarios

This analysis is based on the PRIMES Reference Scenario 2013 "EU Energy, Transport and GHG Emissions – Trends to 2050"[18] ("Reference"), which was also used in the 2030 Impact Assessment (PRIMES model and data version of 2012-2013). In general, the purpose of a reference scenario in the IA context is to serve as a basis projection to which policy scenarios can be compared and thus their net effect assessed. In defining the Reference, a statistical update has been performed around end of 2012, when year 2010 statistics were fully available. Projection of exogenous variables to PRIMES, such as world fossil fuel prices,

[18] http://ec.europa.eu/energy/observatory/trends_2030/doc/trends_to_2050_update_2013.pdf

GDP, population and production by sector of activity, has taken place via dedicated modelling exercises, in the last quarter of 2012, reflecting views and data available at that time. Similarly, the assumptions about future evolution of costs and performance of various energy demand and supply technologies have been consolidated in the beginning of 2013. A reference scenario follows the logic of including only policy measures which have been adopted until a certain cut-off date, without including new policies not yet officially adopted. In the Reference, which has been published in December 2013, the cut-off date was spring 2012 (the EED was therefore included although with fairly conservative assumptions).

In order to have the most accurate review the effects of possible new energy efficiency measures and their overall level of ambition and to measure precisely how close is the EU to achieve the 20% energy efficiency target in 2020, it was necessary to update this Reference Scenario 2013 with regard to recently adopted and proposed policies with regard to energy consumption. The update of the Reference is called the Reference Plus Scenario ("Reference+") and in addition to all assumptions of the Reference, it also features the policies that were adopted (and in addition some relevant acts proposed by the Commission) between spring 2012 and January 2014, namely:

- In transport sector: additional initiatives in the field of transport proposed by the Commission: new EU rules for safer and more environmental lorries; Clean Power for Transport package concerning the infrastructure for alternative fuels; Forth railways package; Single European Sky) and several measures at MS level (road charging for Hungary, Belgium and UK and a bonus system for silent wagons for rail freight in the Netherlands and Denmark).

- New eco-design and labelling legislation together with updated evaluation of potential savings from existing legislation.

- The recently agreed revision of the F-gas regulation, adopted in March 2014. The additional F-gas emissions reduction in 2030 has been estimated for every MS based on GAINS marginal abatement cost curves and for simplicity kept constant afterwards. For 2025 it is assumed that half of the 2030 effect occurs.

- In addition, most up-to-date information on transposition of EED is included, which leads to small revisions of assumptions on the implementation of the national obligation schemes and alternative measures that the Member States notified under art. 7 of the EED[19], as follows:
  - Sweden does not exclude the energy consumption of the transport sector while calculating the energy savings for 2014 – 2020.
  - Denmark does not use the 25% exception and even goes beyond the obligations of art. 7 EED.
  - France has well developed plans for implementing fully the 75% of the 10.5%

[19] In general, in PRIMES a conservative approach is taken. It is assumed that the MS do not fully implement the obligations laid down in the EED, including with regard to art. 7 EED.

Commission's proposals which do not have a clear timeline for adoption and where the content of the final agreements is rather uncertain have not been included in the Reference+. Two important cases omitted from the Reference+ are the Energy Taxation Directive proposal and the proposal for the structural reform of ETS ("Market Stability Reserve") which were not included for this reason.

Also the Commissions regulation (EU) No 176/2014 to determine the volumes of greenhouse gas emission allowances to be auctioned in 2013-2020 was not taken into account. As the focus for this analysis until 2020 is on the progress regarding energy savings the backloading of allowances within 2013-2020 is of less importance and the analysis beyond 2020 is not affected by this structural measure.

The resulting changes from the Reference projection are very small on the EU level. In comparison to the Reference, the Reference+ scenario mainly shows small reduction of energy demand (more specifically, there is a slightly lower demand in transport, notably in aviation, and slightly lower demand in non-ETS sectors including for electricity). Regarding the ratio of energy savings as percentage of 2010 consumption, the Reference+ achieves 5.1% by 2020 which is a little above the 5.0% shown in the Reference 2013 projection. In terms of the rate of savings in primary energy consumption relative to PRIMES 2007 projection, the Reference+ projection achieves 17% in 2020 and 21% in 2030, which are virtually unchanged to the 16.8% in 2020 and 21% in 2030 ratios projected in the Reference.

In terms of the RES share in the final consumption, the Reference+ achieves 20.96% by 2020, which is virtually equal to the 20.88% achieved by Reference. The impacts on the ETS sector are also small and the modelling found no justification to modify the equilibrium ETS prices which are maintained as in Reference.

The inclusion of the F-gas regulation in the Reference+ leads to higher reduction of non-CO2 emissions post 2020 relative to the Reference. In particular, in 2030 the non-CO2 emissions reduction in the Reference+ is 42% relative to 1990, with the respective figure being 38% in the Reference. The difference in total GHG emissions reduction is however small (33% reduction in comparison to 1990 instead of 32% in 2030), as non-CO2 emissions constitute a small percentage of overall emissions.

To sum up, Reference+ is a projection very similar to the Reference; the only noticeable differences are a very small reduction of energy demand in 2020, which is a consequence of updated assumptions regarding the implementation of the energy efficiency legislation and also of a few additional policies considered for the transport sector, and the reduction of non-CO2 emissions due to the implementation of the revised F-gas regulation.

The described updates above were the only changes made regarding the Reference. All other PRIMES assumptions for instance regarding the GDP projections and the population growth, imported fossil fuel prices and technology costs are the same as in the Reference.

While Reference+ has an important role in identifying the exact progress in reaching the 2020 target, for reasons of comparability with the 2030 IA all the results of the energy efficiency scenarios are compared against the Reference.

4. Assumptions used in Energy efficiency scenarios

The aim of this PRIMES modelling exercise regarding the 2020 time horizon is to assess the progress towards the 2020 target on energy efficiency. With regard to the 2030 time horizon, the aim is to find the optimal level of energy efficiency ambition and identify, broadly, measures to deliver it, which combined with the targets proposed in the 2030 Communication, will improve Europe's security of supply, competitiveness and sustainability. The mix of energy efficiency policies is not altered among the scenarios (it always follows the logic of current legislation) and only the overall level of ambition intensifies.

Six scenarios were thus quantified, assuming a stepwise increase in the intensity of energy efficiency efforts after 2020 in all final energy demand sectors, which are targeted by the current policy measures. These scenarios achieve energy savings in 2030 (relative to PRIMES 2007 projections for 2030) of 27.4% (EE27 scenario), 28.3% (EE28), 29.3% (EE29) 30.7% (EE30), 35.0% (EE35) and 39.8% (EE40).

As described above, the overall level of ambition of different energy efficiency policies is progressively increased. The policy mix on energy efficiency - includes the following measures:

- Increasing energy efficiency of houses and buildings by means of a continued energy savings obligation.
- Elimination of market failures and imperfections (e.g. ESCOs, labelling, information campaigns, addressing landlord-tenant problems) reflected in the reduction of discount rates.
- Increased uptake of advanced technologies by stricter Ecodesign standards and improved labelling.
- Increased uptake of BAT in industry through energy efficiency policies in this sector (e.g. voluntary agreements).
- Higher penetration of district heating and CHP through promotion of investments in CHP and in distributed steam and heat networks.
- Measures limiting grid losses.
- Measures reducing energy consumption in transport, notably stricter CO2 standards for light duty vehicles (passenger cars and light commercial vehicles).
- Measures leading to improvements in the fuel efficiency of heavy duty vehicles (HDVs), ambitious vehicle taxation reforms to shift to CO2 based taxation, internalisation of external costs, wide deployment of intelligent transport systems, development of infrastructure for alternative power-trains and other soft measures like fuel labelling and eco-driving in line with the measures put forward in the 2011 White Paper on Transport. Importantly, intensity of these measures is not intensified across the scenarios.

The modelling assumptions used to drive energy savings are summarized below:

a) Energy Efficiency Obligations for Houses and Buildings:
Increasing energy efficiency obligations related to thermal integrity of dwellings is simulated by varying the energy efficiency values[20,] which apply by country and also for the EU as a whole. Energy efficiency values increase by scenario and in time and drive a faster pace of investments in renovations, as well as increasing deepness of renovations from an energy perspective. New buildings codes are common under all scenarios, however demolishment rate and enforcement of building codes slightly vary by EE scenario. National policies towards stronger renovation (mirrored by the efficiency values at national scale) increase gradually across the EE scenarios, and are more harmonized across the EU in the ambitious cases. The energy efficiency values act in the model only in the sectors of residential and office buildings and exert effects on energy efficiency investment and behaviour as shadow prices associated to a virtual energy saving obligation. This process is equivalent of having an estimation about the degree of achievement of the obligation under Article 7 of the Energy Efficiency Directive by country and over time, assuming that EED is implemented and enhanced beyond 2020; this estimation is then mirrored in the model projections by varying the energy efficiency values. Because the largest part of energy consumption in these sectors is taking place for heating/cooling purposes, the energy efficiency values and the ensuing investment to improve thermal integrity constitute is by far the main driver of increasing energy saving performance measured according to Article 7.

The degree of renovation per year (as % of stock) is historically of the order of 1% but the energy-related part of the renovation works is not necessarily high in the absence of energy-oriented incentives. In other words it matters for energy savings how deep the renovation goes in insulations and other interventions which improve thermal integrity of houses and buildings. Apart from renovation pace and its deepness, energy efficiency progress is also influenced by the energy-related strictness of the building codes which concern new constructions and by the rate of demolishment. The rates of demolishment and of new construction are, however, small in the EU and are driven by demographics and economic growth which evolve slowly in Europe. The building codes are already today very strict in

[20] Efficiency values are a key modelling instrument used to simulate energy saving obligations in the sectors of houses and office buildings. The efficiency value is measured in EUR/toe-saved and can be seen as a threshold which indicate as profitable all portions of energy saving investment which have an annual marginal energy saving cost equal or below the threshold value. The efficiency value is the additional amount that has to be borne annually for a limited period of time incurring as a unit cost above average fuel price in order to economize over fuel payments for an unlimited period of time due to the energy saving investment.

In the model, the efficiency value is perceived by the demand actors as a virtual marginal value stemming from energy savings: it makes profitable all portions of the cost-potential curve (with increasing slope) of energy saving investment possibilities which are positioned below that value and thus the corresponding energy saving investments are selected and deliver energy savings over subsequent periods of time.

The logic of setting the levels of efficiency values in a scenario context is to iterate until a certain pre-determined energy saving amount is obtained from scenario results. In this sense, the efficiency values are not policy instruments, but the ensuing energy saving amounts can be considered as targets or obligations and so they are policy instruments. The PRIMES model does not cover the details of policies which enforce such a target or obligation. Nonetheless, considerations of accompanying policies which aim at enabling more effective implementation of the target/obligation can be mirrored in the model assumptions, as for example the change in discount rates related to the assumption of implementing the targets as obligations on utilities (see below for more details).

most EU countries regarding the thermal integrity of new houses and buildings, thanks to national policies and the revised EPBD. It is assumed in the projections, already in the Reference Scenario, that the building code standards become very strict in all countries to a horizon of 2020 and a few years later, and remain at very strict levels until 2050. But because the rate of new constructions is small, achieving significant energy savings in the short/medium term cannot be obtained only through the new constructions. It is mainly renovation rhythm and its deepness that matter for that purpose.

Please see in Annex VII projections of renovation rates.

b) **Reduced discount rates due to policy implementation**:

Individuals perceive a series of risk factors, lack information and have limited access to funding when considering energy saving investment in their premises. The risk factors are technical, administrative and institutional. Lack of information is important concerning the future performance and robustness of interventions when e.g. renovating a house. Barriers also stem from the different interests and competences between owners and tenants of houses. One of the most important barriers is the limited access that individuals have to capital markets. Access to funding and cash flows depends on individual's income and is particularly difficult for the majority of individuals which have income below a threshold. Using individual savings for energy saving renovations is hardly possible in most cases as individuals associate very high opportunity costs (shadow interest rate) to savings and in general to the drawing of funding. According to the empirical literature, all the above barriers but most of all the lack of access to funding, explain why individuals use very high values of subjective discount rates when assessing costs and benefits of energy saving investments.

Subjective discount rates are used in PRIMES to model the higher costs of consumers due to the above described market failures in the decision making. Without any policies to remove these market failures the sectoral discount rates in the second column of the figure below were used for the decision making in PRIMES. Because of the implementation of the EED by June 2014, it is assumed in the Reference that a widespread penetration of ESCOs or similar institutions and mainly the legislative provisions that savings obligations apply on utilities which have to make sure efficiency investment at their consumer premises will change the environment for decision making in the tertiary sector and for households on energy saving investments. To reflect the removal of market barriers in the Reference due to the EED, the sectoral discount rates were lowered in the two sectors from 2015 on and mainly from 2020 onwards (see column three and four of the figure below). For instance, the involvement of utilities and ESCOs implies removal of risk factors regarding technical, administrative and institutional issues, and also implies lower interest rates as these large organizations collectively bargain with banks the funding of energy investment projects and also collectively manage the individual project risks. As a result, the subjective discount rates which prevail in capital-budgeting decisions when such decisions are taken solely by individuals are reduced, moving closer to business interest rates.

Figure 30: Discount rates used in PRIMES assumed in the Reference Scenario 2013

Discount rates (in real terms)	Standard discount rates of PRIMES	Modified discount rates due to EED	
		2015	2020 - 2050
Power generation	9%	9%	9%
Industry	12%	12%	12%
Tertiary	12%	11%	10%
Public transport	8%	8%	8%
Trucks and inland navigation	12%	12%	12%
Private cars	17.5%	17.5%	17.5%
Households	17.5%	14.75%	12%

Source: Primes

Already in the 2030IA, it is assumed for some scenarios (notably GHG40/EE and GHG40/EE/RES30) that the energy efficiency policies continue and intensify after 2020.

Consequently, discount rates for these scenarios with more ambitious EE post 2020 have been further lowered compared to the Reference. This reflects that economic actors become more familiar with EE and market failures are being tackled successfully through the implementation of energy efficiency policies. Wide deployment of energy performance contracting (EPC) and stronger penetration of ESCOs is mirrored by a further reduction of discount rates for households and services as presented in the Table below. In addition, strengthening of European or national policies with regard to energy efficiency financing and awareness rising of energy efficiency will lower the discount rates for customers.

The discount rates is this IA were not lowered below levels that were included in the 2030 IA, even for the most ambitious energy efficiency scenarios. It has to be also borne in mind that the more ambitious scenarios are in terms of energy efficiency, the higher the level of investments, resulting in more restricted lending conditions (due to higher exposure of banks to this specific sector and higher competition for capital as the EE investments increase).

Table 26: Discount rates in the energy efficiency policies scenarios

Discount Rates of the Residential Sector (%)	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	2030 IA*
Reference	17.5	17.5	14.75	12	12	12	12	12	12	12	
EE 27	17.5	17.5	14.75	12	11.7	10.5	10.2	10.2	10.2	10.2	GHG35/EE®
EE 28	17.5	17.5	14.75	12	11.7	10.5	10.2	10.2	10.2	10.2	GHG35/EE®
EE 29	17.5	17.5	14.75	12	11.7	10.5	10.2	10.2	10.2	10.2	GHG35/EE®
EE 30	17.5	17.5	14.75	12	11	10	9.5	9	9	9	GHG40/EE GHG45/EE/RES35
EE 35 EE 40	17.5	17.5	14.75	12	10	10	9	9	9	9	

<table>
<tr><th>Discount Rates of the Tertiary sector (%)</th><th>2005</th><th>2010</th><th>2015</th><th>2020</th><th>2025</th><th>2030</th><th>2035</th><th>2040</th><th>2045</th><th>2050</th><th>2030 IA*</th></tr>
<tr><td>Reference</td><td>12</td><td>12</td><td>11</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td></td></tr>
<tr><td>EE 27</td><td>12</td><td>12</td><td>11</td><td>10</td><td>9.7</td><td>9.2</td><td>9</td><td>9</td><td>9</td><td>9</td><td>GHG35/EE®</td></tr>
<tr><td>EE 28</td><td>12</td><td>12</td><td>11</td><td>10</td><td>9.7</td><td>9.2</td><td>9</td><td>9</td><td>9</td><td>9</td><td>GHG35/EE®</td></tr>
<tr><td>EE 29</td><td>12</td><td>12</td><td>11</td><td>10</td><td>9.7</td><td>9.2</td><td>9</td><td>9</td><td>9</td><td>9</td><td>GHG35/EE®</td></tr>
<tr><td rowspan="2">EE 30</td><td rowspan="2">12</td><td rowspan="2">12</td><td rowspan="2">11</td><td rowspan="2">10</td><td rowspan="2">9.5</td><td rowspan="2">9</td><td rowspan="2">8.5</td><td rowspan="2">8.5</td><td rowspan="2">8.5</td><td rowspan="2">8.5</td><td>GHG40/EE</td></tr>
<tr><td>GHG45/EE/RES35</td></tr>
<tr><td>EE 35</td><td rowspan="2">12</td><td rowspan="2">12</td><td rowspan="2">11</td><td rowspan="2">10</td><td rowspan="2">9</td><td rowspan="2">9</td><td rowspan="2">8.5</td><td rowspan="2">8.5</td><td rowspan="2">8.5</td><td rowspan="2">8.5</td><td rowspan="2"></td></tr>
<tr><td>EE 40</td></tr>
</table>

(*) discount rates used are exactly the same as in 2030 IA scenarios listed in this column
Source: PRIMES

The discount rates assumed for the transport sector are differentiated between decision making for private car choice, business transport choice and decision making for the choice of transport means in public transport. For the latter the model uses low discount rates reflecting either business practices (12% e.g. private trucks and aviation) or policies in sectors regulated by the state (8% e.g. rail, busses). For private cars the model assumes high discount rates (17.5%) which reflect perception of risks by individuals and eventual limited access to cash flow. The high discount rates in car choices have consequences for market penetration of electric vehicles which have significantly higher upfront costs but much lower operating costs than conventional cars.

The discount rates for the transport sector are kept unchanged from 2030 IA in the energy efficiency scenarios.

For the industrial and energy supply sectors the discount rates assumed in the reference scenario are in line with business practices and range between 7 and 9% (the lower end applies to infrastructure subject to state regulation). A WACC at that level is reasonable and can be seen as a weighted sum of an interest rate applied on equity and a bank lending rate, the latter being lower than the former.

The industrial WACC values are also kept unchanged from 2030 IA in the energy efficiency scenarios for industry and energy supply sectors.

c) Anticipation of enforcement of eco-design regulations

The eco-design policy aims at reducing energy consumption of energy-using equipment and appliances by promoting product varieties which embed higher energy efficiency. Depending on implementing measures and voluntary agreements, the eco-design regulations certify specific energy consumption by product variety and eventually provides for mandatory requirements for certain products. The requirements impose a minimum bound on energy performance of products. The bounds are set for the next two to five years. This implies that the menu of technologies for consumer choices in the future is restricted to product varieties which have performances exceeding the minimum threshold value. Obviously the menu of choice will allow selecting technologies which perform above minimum threshold value; the choice will depend on relative costs, perception of technical risks and the policy context. The eco-design regulations, combined with the labelling directive, are playing an important role to remove uncertainties regarding technical risks and those stemming from lack of information.

The model represents a generic set of technologies (ordinary, improved, advanced, future, etc.) by product type. The technologies have increasingly higher energy efficiency performance at higher upfront cost. Choice of technology by product type is simulated within the economic optimization problem which drives actors' decision making. Technology costs are perceived to be higher than under conditions of market maturity, so as to reflect learning, scale return and subjective risk factors. All these elements improve under active efficiency policies implying that advanced technologies are adopted earlier than under reference conditions and that learning is accelerated. The technical characteristics of projected technologies are modified in a scenario if they are inferior to eco-design regulations as assumed in this scenario.

The reference scenario is assumed to include the currently adopted eco-design regulations to a horizon of 2020. This implies that technologies until 2020 comply with the regulations and that beyond 2020 all projected technologies perform equally or better than the regulations. The menu of choice obviously includes technologies that perform above the regulations' thresholds. As mentioned their uptake by consumers depend on economic conditions.

For the energy efficiency scenarios, it is assumed that beyond 2020 the eco-design regulations increase the performance requirements and also that the policy context, including the beneficial effects from labelling, is such that the consumers increasingly trust in advanced technology and perceive lower costs by neglecting risk factors. This mechanism is numerically escalated in a range from Reference to the most ambitious energy efficiency scenario. The resulting early uptake of advanced technology is modelled to induce acceleration of learning making them cheaper and more efficient as they are getting towards commercial maturity. So, the dynamic uptake of advanced technologies by consumers has subsequently effects on the progress of these technologies. As higher volumes of advanced technologies are chosen by consumers, production of such technologies moves further on the learning curve; thus efficiency improvements occur faster. At the same time, with increasing efficiency performance the cost of investment in these technologies is increasing. Modelling parameters that represent these two aspects of technology performance (increased efficiency and increased investment cost) of the available technologies are modified accordingly.

Overall, the effect of the eco-design regulation and other measures can be summarized in increased uptake of efficient technologies due to removal of barriers in respect to consumer information (reduction of perception cost) and in increased rate of improvements of the technical characteristics of technologies due to learning effects. Therefore, the average efficiency of equipment used by the residential and household sectors is improving both because more efficient technologies penetrate the market and because the technologies themselves are becoming more efficient faster. These benefits are partly offset by rebound effects which are inherent in the modelling and are of course limited by technical potential of performance improvement by type of product. So in very ambitious energy efficiency scenarios, the projections show some degree of saturation in the rate of improvement of performance of energy using equipment and appliances.

It should be noted that the eco-design policy was already included in the reference scenario EE-policies package, with considerable effects on the uptake of more efficient technologies and the technology progress. In the EE scenarios the intensity of eco-design policy is assumed to increase after 2020 which adds effects on the modelling of a context with intense energy efficiency measures, which induce further uptake of advanced technologies. Therefore, as mentioned, across the EE scenarios the perception of the cost is reduced and techno-economic characteristics are improved.

To the 2030 horizon, the effects of eco-design are simulated to intensify relative to the reference scenario and across the EE scenarios. Moving from 2030 to 2050, the effects are simulated to intensify further relative to the 2020-2030 period and approach technical potential in the very ambitious cases. The learning effects are modelled to be relatively lower until 2030 than after 2030.

Please see in Annex VII projections on rates of improvement of energy using equipment in residential sector.

d) <u>Anticipation of enforcement of best available techniques (BAT) in Industry</u>

Energy efficiency progress in the industrial sector in the energy efficiency scenarios occurs through the deployment of BAT (best available techniques), both vertically and horizontally; vertically refers to technologies associated with the equipment used for specific industrial process; horizontally, refers to systems that affect all industrial processes, such as energy control systems and heat recovery systems.

Regarding the technologies at the level of equipment, the menu of candidate for investment BATs is the same in all energy efficiency scenarios. What varies among scenarios is their uptake, depending on the intensity of energy efficiency policies assumed. Similar to what has been described in the previous section for the technologies in the residential and tertiary sectors, anticipation of increased energy efficiency savings results in moderation of the perception of risk associated with advanced technologies, and in acceleration of their maturity and uptake. This effect is represented in the energy efficiency scenarios through modifying the parameters that reflect the perception of cost. The risk associated to anticipation does not refer to technical risk or lack of information but rather refers to regulatory risk: in the context of strong efficiency policy, as also in the context of strong emission reduction policies, industry anticipates that enforcement is likely to become more stringent in the future and so in order to avoid locking-in inferior technologies increases the uptake of advance, hence more efficient technologies.

Regarding the horizontal BAT, their deployment leads to energy savings at all process levels. These horizontal technologies are not the same as the technologies for the equipment associated to the various processes. Such horizontal possibilities mainly include energy control systems and heat recovery systems. They also follow BAT specifications. The model database includes engineering estimations of potential amounts of energy savings due to deployment of horizontal BAT, such as control systems and heat recovery. The degree of exploitation of this potential depends on relative costs and prices and also on exogenous model parameters which reflect the degree of anticipation of future emission cutting commitments, the degree of enforcement of BAT promoting policies and generally the intensity of the policy context enabling such savings. The values of the parameters controlling the pace of uptake of BAT technologies in industry for horizontal energy saving purposes is escalating across the EE scenarios, so as to mirror the assumptions about increasing energy efficiency ambition across the scenarios. The model considers a maximum potential for energy savings from horizontal BAT adoption, which is different by sector and by country. The energy efficiency scenarios are designed to exploit partly the maximum potential at a degree reflecting the intensity of energy efficiency ambition by scenario. Therefore the uptake of horizontal BAT increases by scenario but is limited by potential. Moreover, each scenario is assumed to follow a different path towards achieving this potential.

Overall, the uptake of BAT (vertical and horizontal) in industry contributes to decreasing energy intensity of the sector. This leads to higher reduction of energy consumption per unit of industrial output in the more ambitious scenarios than in the policy scenario with a lower level of energy efficiency.

Please see in Annex VII projections on industry savings potential.

e) **DH and CHP**:

Energy efficiency policies induce efficiency improvements on the supply side through the promotion of investments in CHP and in distributed steam and heat networks. These investments are combined with incentives on the consumer side to shift towards heating through district heating, both in the residential and the tertiary sectors. This results in a larger number of dwellings in the residential sector having access to distributed heat networks, which in turn allows for further participation of CHP in heat/steam supply.

To simulate this effect, a parameter is utilized that controls the substitution of heating through individual (non-central) heating equipment with district heating. The choice of shifting to district heating is endogenous and depends on its economic viability; what the model is controlling is the availability of district heating in the menu of candidate technologies for space heating, which in the EE-scenarios is increasing. As a result, the number of households that are connected to district heating is increasing in the EE scenarios. In parallel the share of CHP in heat/steam supply is increasing. Both are necessary to increase overall efficiency in primary energy trends, because district heating alone, without CHP, can have lower efficiency performance, overall, than other configurations based on individually operating equipment for heating.

This is not to imply that the only factor resulting in increasing CHP in steam generation is the penetration of district heating. In a context with intense energy efficiency policies CHP penetrates both steam and electricity generation as a result of a combination of factors, including the CHP promotion policies and the increased requirements for energy efficiency in general. In the modelling exercise for the EE policies scenarios, CHP penetration was not facilitated through the modification of relevant parameters, as is the case for district heating penetration. The level of facilitation is similar to the reference scenarios, which already assumes considerable penetration of CHP. Further penetration in the EE policies scenarios is thus the result of the increasing use of district heating and of increased requirements of the supply side for energy savings. But CHP penetration depends also on economics which are influenced by scale parameters: the larger the volume of heat/steam and electricity demand, the more economic CHP projects can be. Increasing energy efficiency reduces volumes of steam/heat and electricity demand which goes against the economics of CHP projects for reasons of lower return to scale. Variability of load also acts to the detriment of CHP. In the context of high emission reduction targets, clean power solutions such as nuclear and RES are economically and technically superior options than CHP which is obliged to use fossil fuels, at least to a certain degree, given the biomass resources are limited and clean hydrogen is not yet a mature option. So in the long term the projections show limited increase in CHP and further limitations are shown in the context of the highly ambitious scenario.

Please see in Annex VII projections on % of households connected to district heating networks and in Chapter 5 the CHP indicator.

f) More efficiency grids

Modification of specific parameters has been used as an approach to represent the improvement of the rate of grid losses due to smother load factor in electricity demand enabled by smart metering and generally demand response measures. Energy efficiency implies lower demand for electricity and generally lower electrical charge in power grids thus lower losses. The rate of reduction of grid losses across scenarios is assumed to be small as the potential for reducing grid losses through smoothing the load curve is limited.

Please see in Chapter 5 projections on electricity grid losses.

g) Transport policies

Additional measures for transport could contribute to energy savings in a 2030 perspective. These measures included in the policy scenarios draw on the 2011 White Paper on Transport and imply that the scope of the EED (Art 7) remains unchanged in relation to transport. These measures are expected to mainly contribute beyond 2020.

The CO2 standards for cars and vans are key assumption leading to reduction of energy consumption. The standards are tightened progressively within the energy efficiency scenarios according to the table below.

Table 27: Assumptions on CO2 standards (g/km) for cars and light commercial vehicles (vans) across scenarios

cars							
	2020	2025	2030	2035	2040	2045	2050
EE27	95	85	76	64	37	32	26
EE28	95	85	75	63	37	32	26
EE29	95	85	74	62	36	31	26
EE30	95	85	72	60	35	30	25
EE35	95	85	70	50	25	18	17
EE40	95	85	70	50	25	18	17

vans							
	2020	2025	2030	2035	2040	2045	2050
all scenarios	147	130	110	90	70	65	60

Source: PRIMES

In addition, all energy efficiency scenarios assume in line with the IA accompanying the 2011 White Paper on Transport:

- Measures leading to improvements in specific fuel consumption of heavy duty vehicles of about 1.1% per year between years 2010 and 2030, as well as for the period 2030 to 2050.
- Full internalisation of the costs of infrastructure wear and tear, congestion, air pollution and noise in the pricing of transport for all modes by 2050. The charges are set at 100% of the values of the external costs from "Handbook on estimation of external costs in the transport sector"[21]).
- In each Member State that did not introduce a CO2-related element, at least 25% of the total tax revenue from registration and annual circulation taxes, respectively, would originate in the CO2 based element of each of these taxes starting with 2020. From 2025 at least 50% of the total tax revenue from both the annual circulation tax and the registration tax would originate in the CO2 based element of each of these taxes.
- The elimination of the favourable tax treatment of company cars (and of the corresponding fuel use) by changes in car ownership, vehicle size in the fleet and fuel consumption, based on the findings of a study commissioned by DG TAXUD[22].
- The wide deployment of intelligent transport systems in road and waterborne transport is gradually implemented starting from 2020.
- Measures concerning railways and aviation
- Development of infrastructure for alternative powertrains

These measures are not progressively intensified across the scenarios.

5. Modelling of non-ETS emission reductions

In this modelling exercise, the so called carbon values for the non-ETS sector which were used in the 2030 Impact Assessment were not applied. In the energy efficiency scenarios, the non-ETS sector is modelled with the above mentioned concrete energy efficiency policies. Therefore, the use of such a carbon value, which is the shadow price of the overall emissions reduction constraint was not necessary.

[21] Source: http://ec.europa.eu/transport/themes/sustainable/doc/2008_costs_handbook.pdf
[22] See page 44 of the TAXUD study: http://ec.europa.eu/taxation_customs/resources/documents/taxation/gen_info/economic_analysis/tax_papers/taxation_paper_22_en.pdf

Carbon values in the non-ETS sector do not directly affect emitters budget but they alter the relative costs of energy forms, because the use of fossil fuels would be perceived as including the carbon value. Due to carbon values, the consumption is reduced because emissions due to the use of fuels/technologies have a higher perceived price (substitution effect) but these are no carbon emission payments which would reduce emitters' budget (no income effect). This means that carbon values in the non-ETS sector would lead to fuel switching. In addition, carbon values also induce additional non-CO2 emission reductions in non-energy sectors. The carbon value mirrors a large variety of unknown policies needed to achieve the overall carbon constraint of all sectors. The overall emission reduction target should be allocated across sectors to minimise total abatement costs. Carbon values are used to achieve a cost-efficient split of abatement policies between the ETS and the non-ETS when implementing an overall emissions constraint. As in practice no market-based emission trading system is implemented for the non-ETS system, the optimal distribution of efforts regarding GHG emission reduction between the ETS and the non-ETS sector was modelled with the help of carbon values in the 2030 Impact Assessment.

In the modelling work for the 2030 Communication the overall GHG emission reduction constraint/target was specified for 2030. The volume of the ETS cap was determined in this modelling exercise. For sectors belonging to ETS, the emission abatement instruments were modelled in a way that they reflect the design of the ETS Directive. For the non-ETS sectors a carbon value which is equal to the ETS carbon price of the ETS sector was assumed since for the time being no specific policies or measures are in place for the non-ETS sector. The carbon value is used as a shadow value of an emission reduction target in the non-ETS sectors, which is not a priori known. For the non-ETS sector the results shows which fuel/technology switch is necessary and at which costs to meet the target.

The optimal level of overall GHG reduction in 2030 was calculated in the 2030 IA. For the ETS sector where a concrete policy – the ETS system – is in place, it was established in the 2030 Communication that the linear reduction factor should be reduced after 2020 from 1.74 % to 2.2%. As in the non-ETS sector no concrete policies to reduce emissions are in place carbon values were used to model the contribution in emission reductions of this sector. Beyond 2030, tighter CO2 standards for light duty vehicles were also assumed. In contrast, in this IA, the focus is on choosing the right policy instruments for the non-ETS sectors.

6. <u>Enabling settings</u>

In the context of the modelling exercise for the 2030 Communication, some of the scenario assumptions have been organized in two groups, one called reference settings and the other enabling settings. The former group assumes that actors in the energy sectors do not anticipate strong GHG emission reduction commitments in the time period after 2020 and decarbonisation in 2050 perspective and so they do not necessarily take all actions that are necessary to achieve optimal levels of infrastructure, technology learning and market coordination. In contrast, the enabling settings mean that because of good anticipation of future GHG emission reduction commitments, all conditions are met in infrastructure, technology learning, public acceptance and market coordination so as to enable the decarbonisation or in other words to maximize the effectiveness of policy instrument which aim at driving strong GHG emission cuts. Consequently, GHG emission cuts are more difficult, hence more costly, under reference settings compared to enabling settings.

In order to ensure that enabling settings do happen in reality, it necessary to put concrete policies in place, but by definition the actual policy instruments which are conceived for driving GHG emission cuts effectively are not included in the settings, which include only the background and basic actions (e.g. support for research, development and innovation, infrastructure development, etc.) which are meant to facilitate the actual drivers of GHG emission cuts. This means that it is assumed that enabling policies ensure the availability of necessary infrastructure, progress in R&D, broad social acceptance of technologies to reach the decarbonisation in 2050.

Box 1: Enabling conditions

Main enabling conditions include:

- Development at large scale of intelligent grids and metering as well as management systems for recharging of car batteries to facilitate demand response in power markets.
- Development of infrastructure to harvest decentralised as well as remote RES for power generation; this is produced by a streamlining of permitting procedures, higher investment, timely availability of technology and appropriate price signal by smart and net metering.
- Development of carbon transportation and storage infrastructure as well as public acceptance of the technology that leads to the faster development of CCS.
- Technological progress enabling mix of hydrogen and bio-gas in gas supply and possibility to use hydrogen-based storage.
- Development of electric vehicles battery technology combined with development of battery recharging infrastructure and public acceptance of electric vehicles leading to transport electrification.
- Accelerated innovation in biofuels in particular enabling strong emission reduction in transport activities for which electrification is not possible.

The underlying modelling of the 2030 Communication is based on an ambitious commitment to reduce greenhouse gas emissions in line with the 2050 roadmaps. In addition, the proposed EU-wide target of at least 27% RES share in final energy consumption was based on scenarios which assumed enabling settings.

For these reasons, in the modelling exercise presented in this IA enabling conditions were used in the PRIMES modelling as well - except for EE policies. With regard to EE the enabling settings were replaced by concrete policies which were intensified in the policy scenarios.

7. Modelling of ETS

For comparability purposes to the 2030 IA, the overall cumulative GHG emissions up to 2050 are equalized to the projections of the GHG40 scenario from 2030 IA, i.e. a scenario achieving 40% emission reductions in 2030 and 80% emission reductions in 2050 (mainly driven by uniform carbon prices and carbon values). Similarly as in the 2030 IA, the EU ETS is modelled in the energy efficiency scenarios via carbon prices. These are varied in the scenarios until the cumulative ETS emissions approximate the cumulative ETS emissions of GHG40.

8. Modelling of RES

In the 2030 Communication, a binding European target of at least 27% RES was proposed for 2030. In the PRIMES modelling conducted for this IA, this target was also set as a constraint and the RES values have been used in order to achieve this target. RES values are consequently increasing in comparison to the Reference scenario.

9. Modelling of non-CO2 emissions reductions

The modelling approach of not using carbon values implies that there is no incentive for additional non-CO2 emission reductions beyond those achieved in the Reference scenario. Moreover, the policies to reduce non-CO2 GHG emissions do not belong to the domain of the energy efficiency (mainly agriculture and waste treatment are concerned). On the other hand, for the consistency reasons with 2030 IA (notably reaching the 40% GHG target), some assumptions had to be made for these emissions.

Consequently, all scenarios feature assumptions on policies which reduce non-CO2 GHG emissions. The volume of reduction of these emissions as achieved by the GHG40 scenario from the 2030 IA has been used as a starting point. In the GHG40 a certain amount of non-CO2 GHG emissions reduction was necessary in order to reach 40% GHG reduction in 2030. Because of the higher level of energy savings in the EE policy scenario modelled in this IA the contribution of non-CO2 GHG emissions to achieve the 40% GHG target decreases (but is uniform across the policy scenarios in order to ensure comparability).

10. Modelling of EED implementation

Art. 7 of the EED requires Member States to establish policy measures – either energy efficiency obligation schemes – or alternative policy measures ((e.g. financing, fiscal, voluntary, and information measures) to reach certain amount of new, cumulative energy savings over 2014-2020 period.

In line with the provisions of the Directive, it is assumed that transport sector is excluded as the Directive stipulates that the transport sector can be partially or fully excluded (for Denmark and Sweden the transport sector has not been excluded). The possibility for exclusion of industrial activities covered by the ETS industries also exists, subject to a deliberate of choice of the MS concerned. In the Reference scenario, ETS industries have therefore not been included in the modelling of the energy savings obligation. However, this choice is part of the flexibility options within the on maximum 25% limit of the amount of energy savings referred to in paragraph 1 of Article 7.

Given the overlaps of article 7 with other requirements of the EED the expected saving obligations by country was specified as part of the policy assumptions. In implementing the

Directive, Member States will decide on which provisions and alternatives to use, reflecting their specific circumstances.

The table below illustrate the projected energy savings achieved by residential, tertiary and industries due to the EED implementation (mainly article 7 EED). The numbers expresses the difference as percentage of energy consumption in 2010.

Table 28: Reduction of final energy demand in industries, residential and tertiary due to the Energy Efficiency Directive (EED) – in comparison to 2010.

Indicator	Ref	Decarbonisation Scenarios					
		EE27	EE28	EE29	EE30	EE35	EE40
Reduction of final energy demand due to the EED in 2020 (Savings as % of 2010 consumption of scenario w/o EED)	-6.5%	-7.8%	-7.8%	-7.8%	-8.3%	-8.5%	-8.6%
Reduction of final energy demand due to the EED in 2030 (Savings as % of 2010 consumption of scenario w/o EED)	-7.7%	-16.8%	-19.8%	-22.3%	-25.1%	-33.9%	-43.6%

Source: Primes 2014

Annex VI. E3ME and GEM-E3 Methodology

The results on macro-economic impacts are based on the PRIMES results for the scenarios achieving respectively 25, 28, 30, 35 and 40% energy efficiency targets. The scenario with 25% energy savings has ambition similar to GHG40 scenario but is built on the PRIMES scenario that has concrete EE policies rather than carbon values - for better comparability with other scenarios. The macro-economic modelling building on EE27 and EE29 scenarios would likely have very similar outcome to results presented for EE28 and EE30, with little additional insight brought to the analysis – for practical reasons, smaller number of scenarios is therefore presented..

The five scenarios analysed in this IA have escalating levels of energy savings efforts after 2020, which are made possible by the significant investments in all final energy demand sectors. These investments are the key driver of the macro-economic impacts. In this IA, similarly to 2030 IA, two models have been applied to assess the macro-economic impacts representing different schools of economic thought and reflecting current uncertainty about the best way of assessing these impacts. Application of two different models enables not only to establish a range of possible impacts but also to identify the conditions necessary for maximising the positive impacts.

Theoretical background and assumptions

In this IA, the models E3ME and GEM-E3 have been applied to assess the impacts on GDP and employment of policy scenarios with escalating levels of energy savings efforts. Both models enable to assess complex interactions between different sectors of economy and to compare the results to respective baselines (please note that because of different assumption applied by the models also the baselines produced by each model are different).

The path and magnitude of investment in energy efficiency in each scenario together with other important drivers such as energy prices or overall energy balances are taken from projections made in PRIMES: the E3ME and GEM-E3 models are then calibrated to represent these changes in the energy system so that their economy-wide impacts can be modelled. The two macroeconomic models have many similarities. However, there are also important differences that arise from their underlying assumptions and respective structures. E3ME is a macro-econometric model, based on a post-Keynesian framework; GEM-E3 is a general equilibrium model that draws strongly on neoclassical economic theory and optimising behaviour of economic agents.

Due to these theoretical differences, the two models will in some cases lead to differing results. Any differences in results may be traced to the different model structures:

- A key difference between the two approaches is the modelling of supply and demand. In general equilibrium models (like GEM-E3), there is an assumption that markets will always clear because agents behave optimally. This is achieved through the full adjustment of prices which allow supply to equal demand and thus a ‘general’ equilibrium is reached and maintained throughout the system.

  In contrast, post-Keynesian econometric models do not adhere to the ‘general’ equilibrium rule; instead demand and supply only partly adjust due to persistent market imperfections and resulting imbalances may remain a long-run feature of the economy. The degree of adjustment is derived from econometric evidence of historical non-optimal behaviour. Therefore the level of output, which is a function of the level of demand, may continue to be less than potential supply or a scenario in which demand increases can also see an increase in output.

- Another important difference is that in GEM-E3, capital markets are assumed to operate in an optimal manner. Since output and savings cannot be boosted by higher demand, the requirement that investment must be funded from savings implies that crowding out of certain investment must take place due to the capital resource constraint which is imposed at a global level. Therefore additional investment requirement in energy efficiency projects implies lower capital availability for the remaining sectors, unless there is also an increase in savings (either domestically, through a reduction in consumption, or through international financial flows (see below)).
- In E3ME, investment in one particular sector does not automatically lead to a crowding out effect on investment in other sectors. This relates to the model's underlying approach, which does not assume optimisation in markets. If there is spare capacity in the baseline case, then it is possible for there to be an increase in investment in the scenarios without necessarily having a reduction in investment elsewhere: the national income identity that savings equals investment is met either by the higher savings associated with a higher level of output or by capital inflows from abroad (see below).[23] If the investment is financed externally, then, again, the treatment between the two modelling approaches differs. In GEM-E3, investment is usually made subject to a binding capital constraint, meaning that investment cannot be financed through larger current account deficits. Therefore, in order to maintain the current account size relative to GDP, the terms of trade need to deteriorate to bring about a shift in production towards exports.

  In contrast E3ME does not hold a capital constraint rule at country level and therefore additional funding from abroad is possible. This increases the current account deficit but there is no assumption that the terms of trade will deteriorate to close the deficit.
- Due to market clearing assumptions in general equilibrium models like GEM-E3 wages, like prices, adjust automatically so that the supply and demand of labour reach a state of equilibrium. The implication of this is that there is no involuntary unemployment in classical general equilibrium models. However, GEM-E3 does allow for labour market frictions, meaning that limited unemployment is a possible outcome. In E3ME, as in other non-equilibrium models, the response of wages to lower labour demand and the subsequent reaction of labour demand are estimated on the basis of historical experience: typically these responses are insufficient to prevent unemployment from rising when labour demand falls.

[23] This is an important distinction between the modelling, which should not, however, be overstated – in particular it is important to note that in these scenarios the direct investment in energy efficiency is funded through higher domestic savings rates that are imposed through taxation.

In both models, therefore, the impact on employment depends on the stock of available labour; if there are no spare labour resources available then boosts to labour demand will push up wages rather than employment levels. Wages consequently are based upon a bargaining equation which is dependent on the slack in the labour market.

In both the GEM-E3 and E3ME modelling an **assumption has been made about the use of ETS revenue**, which is to remain with the government in order to finance the energy efficiency investments.

- In general, GEM-E3 allows for the recycling of additional public revenues (in this case from ETS) via reduction in employers' social security contributions, lump-sum payments to households, subsidies to RES, etc. This option is applied in cases where the simulated policies generate additional public revenues from reference. This is particularly the case in decarbonisation scenarios where carbon prices increase so as to drive lower GHGs emissions. In all the energy efficiency scenarios presented in this IA, the ETS revenues are modelled to remain with the government and be allocated to lower the employers' social security contributions.[24].

- In E3ME, the revenues from the ETS allowances that are auctioned to the Power generation sector are recycled into a fund that is used to finance energy efficiency investment in other sectors. In the baseline, the value of ETS allowances purchased by the power generation sector is used to reduce direct income taxes. In the policy scenarios, auctioned ETS allowances (from power generation and industry sectors) are used to fund the investment in energy efficiency, with the balance (either surplus or deficit) made up by adjusting income tax rates. The scenarios are therefore 'revenue neutral' with no direct changes on Member State government balances.

GEM-E3 model

Table below provides a theoretical summary of the changes induced in GEM-E3 and the expected effects and outcomes. The system is subjected to an initial change associated with energy efficiency targets and the undertaking of related expenditures. Expenditures are financed by both households and the production sectors of the economy.

[24] The assumption is made already in the Reference case that recycling of the ETS revenues happens via the reduction of employer's social security contribution. It is also assumed that the government policy on employment remains the same in the energy efficiency scenarios and the lower rate of social security contributions remains the same as in the reference case (even though the revenue from ETS would decline as the scenarios become more ambitious). Such an approach enables to compare the net effects on EE policies.

Table 29: Changes and effects from energy efficiency expenditures

Change simulated	Trigger effects	Outcome	Total effect on the economy
Increase in expenditures in energy efficiency	Increase in demand for sectors providing inputs to energy efficiency improvements projects	Positive effect on activity and employment in sectors providing inputs to energy efficiency projects	Depending on the net effect of contradicting outcomes combining economy expansion (Keynesian multiplier) effects and negative effects stemming from crowding out and pressures on primary factor markets
Increase in energy savings	Reduced energy demand and energy related imports	Negative effect on activity and employment in energy sectors. Reduction of energy imports dependence. Positive effects on all sectors which see lower variable costs in purchasing energy commodities.	
Financing scheme	Increase in energy efficiency related expenditures	Crowding out effects due to equity-based funding. Crowding out effects due to funding from borrowed capital, possible increase in interest rates and higher cost of capital, slowdown of productive investment in other sectors of activity consumption reduction, deterioration in terms of trade, etc.	

Source: E3M Lab notes

The energy efficiency policies lead to higher expenditures by firms, the public sector and the households to implement investment in building insulation and renovation or in industrial processing helping to lower energy consumption per unit of output. In addition they promote the purchase of more expensive equipment, appliances or vehicles which are more energy efficient than the existing cheaper varieties. The main macroeconomic effects of these policies on the EU economy are summarized below:

a) Keynesian multiplier effect: the additional energy efficiency expenditure, relative to a reference scenario, implies higher demand for goods and equipment which are used to implement energy efficiency improvement and lower demand for energy commodities; this shift implies higher demand for domestically produced goods and services and less imports of energy in the EU countries; thus overall demand increases driven by a Keynesian multiplier effect and as the goods and services replacing energy are more labour intensive in their production, employment and activity tend to increase in the energy efficiency scenarios relative to the reference.

b) Crowding out effects on primary production factors and on capital markets: the incremental activity generated by the energy efficiency expenditures requires higher financial amounts and higher amounts of production factors (especially labour) than in the reference scenario. Depending on the tightness conditions in the markets of capital and labour, pressures on capital and labour prices will be experienced which implies higher scarcity of primary production factors and capital as used in other sectors of the economy.

If financing conditions are favourable, the financial closure can be managed at a broad geographical scale and not at a country level. It also implies that appropriate leveraging can accommodate financing over a long period of time at low interest rates. If financing conditions are not favourable, a country will have to draw the funding to the detriment of other financing, probably also prior to implementation of the energy efficiency project. So the degree of crowding out effects due to capital market tightness can vary depending on assumed conditions. Similarly, the labour market conditions influence the impact of energy efficiency expenditures on wage rates. If unemployment is high and if the labour market is sufficiently flexible, the increase in demand for labour may not imply higher wage rates and thus impacts on costs and prices will be limited. Conversely, tightness in labour supply or rigidities in the labour market will imply increase in real wage rates as a result of energy efficiency expenditures, which could be detrimental to competitiveness in foreign markets and will offset employment increasing trends. Crowding out effects due to changes in the costs of primary production factors can vary in intensity depending on assumptions and will be experienced in all sectors of the economy.

c) Income effects due to higher costs: the energy efficiency substitution essentially is an exchange of reduced variable operating costs over time with higher upfront costs. Depending on the technical parameters of the energy efficiency expenditure by sector and also on the intensity of energy efficiency ambition, the present value of costs of the energy efficiency cash flow may be less or more expensive than the alternative which consists of keeping variable operating costs unchanged.

   The energy efficiency potential is known to exhibit decreasing return to scale in the sense that, beyond a certain level, incremental energy efficiency requires increasing marginal expenditures per unit of energy savings. Due to this feature, cost-effectiveness of energy efficiency expenditures decreases with the amount of energy savings targeted. So beyond a certain threshold, it is possible that the present value of energy efficiency cash flows implies higher costs than keeping energy consumption unchanged. In principle this situation is unlikely and can only occur in analytical studies which assume that the majority (if not all) of the cost effective energy efficiency expenditures take place already in the reference scenario Otherwise, the income effect will tend to increase with the level of ambition of the energy efficiency policy due to the diseconomies of scale.

d) Foreign competitiveness effects: Currently the EU economies are strongly exposed to foreign competition both in the intra-EU and in the global markets. The relative competitiveness of the domestic economy can be potentially weakened as a result of eventual pressures in primary production factor markets leading to higher interest or wage rates Under such circumstances, exports will decrease and imports will increase and thus domestic activity will tend to reduce implying offsetting of increasing trends due to the multiplier effect.

e) Positive externalities in technology: Implementing ambitious energy efficiency improvement implies usage of more advanced technologies which may profit from increased market potential to become commercially mature with higher performance and lower unit cost. This is a kind of positive externality through learning by doing. Its occurrence depends on the nature of technology, the size of the market, the spill-over conditions and other factors. Positive externalities alleviate both the income and the foreign competitiveness effects.

The net outcome on economic activity and employment depends on the equilibrium resulting between the forces described in the last column of the table. On a positive outcome, activity increases as a result of increased demand for inputs in energy efficiency projects. Following this change, employment in the sectors also tends to increase (with noticeable effects as construction sector is fairly labour intensive). On the negative side, activity and employment tend to decrease in the energy sectors and in sectors affected by lower consumption and potential loss of competitiveness (in foreign trade) due to crowding out effects.

The policy scenarios analysed in this IA have assumed very significant increase of expenditures for energy efficiency purposes especially in the period until 2030. These expenditures are assumed to be partly financed by the economic agents (households and firms) and partly by the economies' aggregate savings.

Consequently, a fairly realistic approach has been adopted assuming that the financing of the energy efficiency expenditures from saving resources in the economy is effectively leveraged throughout the projection period (till 2050); this implies less pressure until 2030 and a smaller crowding out effect. Should a full funding of the energy efficiency expenditures was made through the closure with savings till 2030, the macroeconomic impacts would be found increasingly negative after 2030 and higher in magnitude.

E3ME model

In the scenarios modelled for this IA, E3ME uses the following outputs from the PRIMES model:

- Energy balances
- Energy prices
- CO2 prices
- Investment costs

As noted above, an additional assumption is made about how the investment is financed, using ETS auction revenues, with income tax rates adjusted to achieve revenue neutrality.

The figure below summarises how these inputs (the top half of the diagram) affect key macroeconomic indicators in the model (the lower half). Although it is not possible to capture all the interactions in a single diagram, the most important ones are included. The main ways in which GDP is affected are:

- Higher electricity prices and CO2 prices, which feed through to the prices of final products, depending on the rate of cost pass-through in the sectors involved (which is estimated empirically). Higher product prices will both reduce the purchasing power of domestic households (leading to lower real incomes and expenditure) and will adversely affect the competitiveness of European firms (leading to a worsening trade balance). In both cases the result will be a reduction in GDP.

- The revenue recycling, through changes to income tax rates, will also affect household incomes. In the scenarios with high levels of energy efficiency, income tax rates must increase to fund the measures. Reduced household income will lead to lower rates of spending and lower GDP.

- Higher rates of investment will provide a boost to output in the construction and engineering sectors and their associated supply chains. Investment itself is a component of GDP and so the changes in investment have a direct impact.

- For most European countries, a reduction in energy demand will lead to reduced imports of fossil fuels, as long as Europe remains dependent on imported fuels. Resources that would have been spent on imported fuels may instead be spent on domestically-produced goods (households) or returned in the form of higher profits (businesses), in both cases providing a boost to GDP.

The net impact on GDP is the sum of these separate impacts. The impacts on employment are determined by a combination of the GDP impact and the sectoral pattern of output. As the scenarios modelled in this IA are based on a shift from energy to labour-intensive activities it is reasonable to expect employment to increase. As described below, this outcome is conditional on labour being available and wage rates not increasing to any significant extent.

Employment and multiplier effects

As noted above, E3ME does not assume an optimal starting point so it is possible for output to increase unless there are capacity constraints (see below). In addition, multiplier effects are a standard feature of the modelling results.

Type I multiplier effects occur through the supply chains that are represented in the model's input-output structure. In these scenarios, it is mainly the basic manufacturing sectors (e.g. metals, cement) that supply the sectors that produce and install investment goods. These supply chains may cross borders, with activity levels in one country allowed to influence those in its trading partners.

Type II multiplier effects are shown in the diagram as the loop from GDP to employment, real incomes and household expenditure. Essentially, higher employment levels and incomes are able to stimulate spending in other parts of the economy (e.g. in the retail sector), leading to further output and job creation. A positive feedback from this loop depends on there being available workers to meet an increase in the demand for labour; otherwise the result will instead be higher wages and inflation.

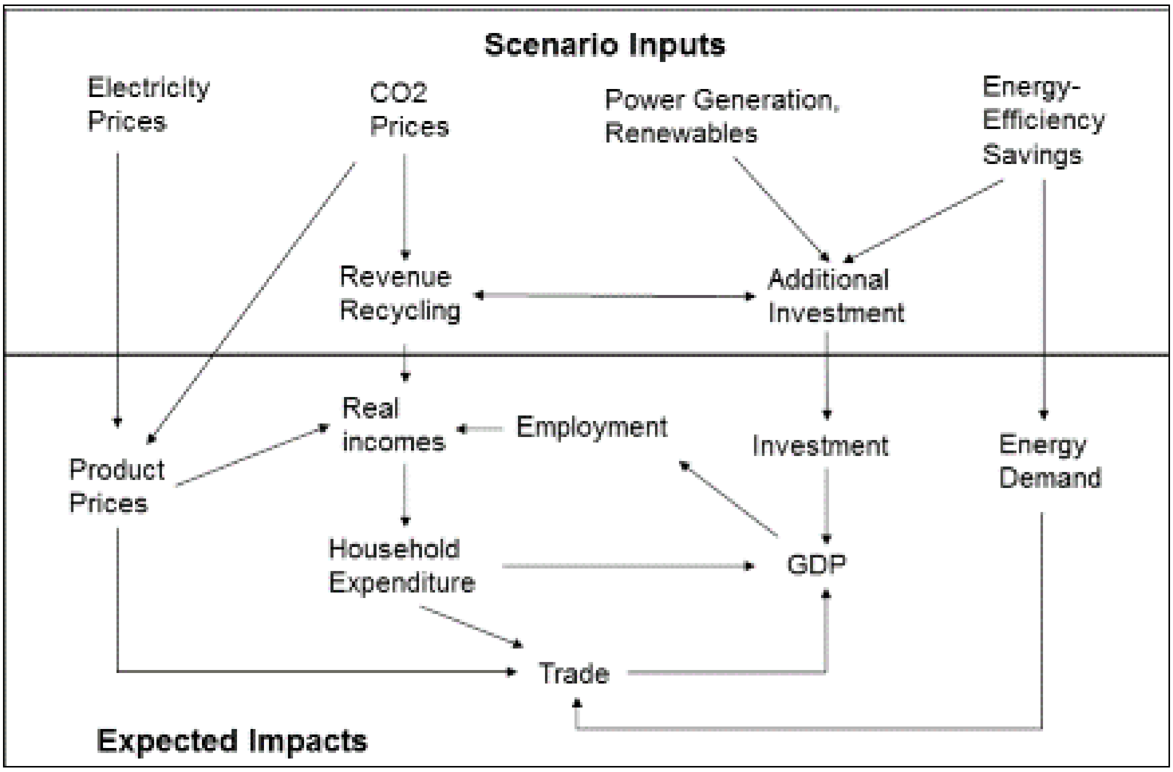
Capacity constraints

Economists engage in efforts to estimate the 'output gap' and economic capacity at national level but there is no agreed definition and very few estimates at sectoral level. Over time, new investment can add to capacity. E3ME's equation structure allows prices to increase as output moves beyond a 'normal' or expected level, but does not attempt to estimate or impose an absolute level of capacity for industry production. This approach is in contrast to the CGE modelling approach, where the economy as a whole is effectively operating at capacity to begin with.

The exception to this in E3ME is the labour market, where there is a clear constraint imposed by the available labour force. As the economy moves towards full employment, further increases in labour demand translate into higher wage rates, leading to a crowding out of labour (increases in one sector drive up wage rates and reduce employment elsewhere). Nevertheless, this representation is still not complete; as with other modelling approaches, there is an implicit assumption that the workforce has the necessary skills to fill the available vacancies.

Overall, it is up to the model user to determine whether the scenarios that are being modelled breach constraints that are likely to exist in reality but are not recognised formally in the modelling framework. For marginal changes it is reasonable to assume that it would be possible to adjust production patterns to meet the additional demands placed on the economy. For the more ambitious scenarios, however, there is a much higher degree of uncertainty around the model results and a supplementary analysis would be required to investigate whether the changes are possible.

Figure 31: E3ME structure



Source: E3ME

Annex VII: Additional modelling results

In addition to the results shown in the main text of this IA some more details are given in this annex on the effects of the different energy efficiency scenarios.

1. PRIMES modelling

Buildings renovation

As described in the Annex V on the PRIMES methodology and modelling assumptions, the energy savings obligations related to the thermal integrity of dwellings is increased for the different energy efficiency scenarios by varying the energy efficiency values. The projected renovation rates escalate across scenarios mainly in the time period until 2030 reflecting the assumption that the efficiency ambition varies in the scenarios mainly for 2030. The average renovation rate increases from 1.37 % in 2021-2030 in the Reference to 2.42% in the most ambitious energy efficiency scenario. Beyond 2030 the renovation rates decrease again.

The deepness of renovation in relation to energy is projected to double in the decade of 2020 compared to the previous decade. The average energy savings after renovation increase from 31,47% in Reference to more than 46% in the very ambitious energy efficiency scenarios in the period 2021-2030.

Table 30: Renovation projections (average) in the various scenarios

(%)	Average renovation rate EU28			Average energy saving % after renovation EU28		
	2015-2020	2021-2030	2031-2050	2015-2020	2021-2030	2031-2050
Reference 2013	1,28	1,37	1,11	20,91	31,47	35,68
EE27	1,44	1,67	1,11	21,78	40,73	42,73
EE28	1,48	1,84	1,15	21,93	43,55	45,79
EE29	1,53	2,11	1,22	22,04	45,04	47,55
EE30	1,61	2,21	1,26	22,08	45,82	48,48
EE35D	1,64	2,39	1,32	22,10	46,19	48,84
EE40	1,65	2,42	1,33	22,11	46,18	48,85

Source: PRIMES 2014

The question arises how these levels benchmark against existing practice, i.e. are they realistic. Renovation rates observed across the different Member States vary greatly. They depend on several circumstances, such as the state of the economy. More importantly, these rates also depend on whether specific programmes were deployed at a given time in a given Member State. This points to the conclusion that well-targeted policies can significantly increase renovation rates. Renovations rates observed in recent years across the different MS and EEA range from 0.36% in Lithuania to 3.5% in the Netherlands in the case of residential and from 1.5% in Norway to 2.75% in Lithuania in the case of non-residential[25].

Energy-using equipment and appliances

In the tables below, the indicators of energy efficiency improvement by category (improvement of output compared to a fixed energy input) of equipment or appliance, grouped by purpose of use, is shown for the residential and the tertiary sector. The resolution of the PRIMES model is lower than the list of products considered in the Ecodesign regulations. In addition, the model has limited representation of engineering bottom-up information regarding the use of each equipment. Therefore, direct comparisons of model projections with Ecodesign regulations is hardly possible; comparison can only be drawn from projections of energy efficiency improvements by category of energy use.

With regard to the 2030 horizon, the effects of eco-design are simulated to intensify relative to the Reference and across the EE scenarios. Moving from 2030 to 2050, the effects are simulated to intensify further and approach technical potential in the very ambitious cases. The learning effects are modelled to be relatively lower until 2030 than after 2030.

It can be seen in the tables below that with increasing levels of policies focusing on the reduction of the perceived costs of advanced technologies and policies aiming to improve the technical characteristics of technologies the equipment output is projected to increase significantly over the next years in the more ambitious scenarios.

Table 31: Indicative ratios of improvement of energy using equipment in residential sector

Avg. Energy Efficiency improvement in equipment as effectively used by scenario, relative to 2010 (in % change)

	2020	2030	2050	2020	2030	2050
	Heating			Cooling		
Reference	7,7	18,8	28,8	17,6	28,3	62,1
EE27	11,3	28,1	44,4	22,6	66,0	115,2
EE28	11,4	28,8	46,5	22,5	65,5	115,1
EE29	11,6	29,2	47,7	22,5	65,4	115,0
EE30	13,2	30,7	49,4	24,5	73,1	124,3
EE35	14,2	31,3	50,5	25,9	76,4	129,0
EE40	14,1	31,3	50,8	25,8	76,9	129,1
	Water heating			Cooking		
Reference	10,7	17,9	26,5	3,9	6,4	9,3
EE27	11,6	19,9	23,1	5,5	14,6	32,7
EE28	11,6	19,9	23,1	5,6	15,3	34,2
EE29	11,6	19,9	23,2	5,7	15,6	35,0

[25] Europe's buildings under the microscope, BPIE, 2011

EE30	12,0	20,9	24,7	7,0	18,9	40,5
EE35	12,2	21,7	25,9	8,0	21,3	43,5
EE40	12,2	21,6	26,1	8,1	21,2	43,6
	Lighting			**White appliances**		
Reference	163,7	372,9	400,2	45,9	60,5	66,3
EE27	184,7	380,3	415,0	47,3	69,2	82,9
EE28	184,6	380,2	414,9	48,0	69,4	83,3
EE29	181,4	377,1	414,9	47,3	69,3	83,2
EE30	185,5	380,6	414,8	48,0	70,7	89,7
EE35	186,9	381,2	414,7	48,3	71,0	96,4
EE40	186,1	380,7	414,6	48,6	70,9	96,4
	Black appliances			**Central boilers**		
Reference	18,2	27,9	30,3	11,2	23,6	45,9
EE27	19,0	34,6	49,0	14,1	31,7	57,3
EE28	19,0	34,5	49,0	14,1	31,6	57,0
EE29	19,0	34,5	49,0	14,0	31,5	57,0
EE30	19,1	34,7	53,7	15,5	32,7	58,5
EE35	19,1	34,9	60,3	16,2	33,6	59,7
EE40	19,1	34,8	60,5	16,2	33,6	60,3
	Gas heaters			**Heat pumps**		
Reference	14,2	28,1	49,1	18,1	35,5	61,5
EE27	16,3	33,5	57,7	20,7	44,4	73,2
EE28	16,3	33,4	57,5	20,8	44,5	73,1
EE29	16,3	33,3	57,5	21,0	44,4	73,3
EE30	17,0	34,3	59,0	22,8	46,3	75,3
EE35	17,5	34,8	60,1	23,5	47,3	77,0
EE40	17,5	34,8	60,7	23,4	47,2	77,9

Source: PRIMES 2014

Table 32: Indicative ratios of improvement of energy using equipment in tertiary sector

Avg. Energy Efficiency improvement in equipment as effectively used by scenario, relative to 2010 (in % change)

	2020	2030	2050	2020	2030	2050
	Heating			**Cooling**		
Reference	15,6	36,7	49,8	16,3	27,2	44,7
EE27	19,1	49,8	58,7	17,4	30,2	55,0
EE28	19,3	54,9	63,7	17,4	30,1	54,9
EE29	19,8	57,3	66,6	17,4	30,1	54,9
EE30	21,0	59,2	68,0	17,7	31,1	56,6
EE35	22,0	60,3	68,2	17,8	31,5	57,1
EE40	22,1	59,5	67,5	17,8	31,7	57,2

	Lighting			Electric appliances		
Reference	156,8	374,3	394,4	5,5	21,3	54,1
EE27	225,0	371,6	392,8	6,9	27,7	63,9
EE28	224,7	371,3	392,8	6,9	27,4	63,4
EE29	224,2	371,2	392,8	6,9	27,2	63,3
EE30	235,9	372,5	394,5	7,3	28,9	65,7
EE35	242,5	375,5	395,0	7,7	29,8	66,6
EE40	240,1	375,1	395,9	7,5	30,4	66,8
	Greenhouses-agriculture			**Pumping in agriculture**		
Reference	3,9	7,4	9,8	9,8	16,4	28,1
EE27	5,3	11,9	22,5	10,3	19,2	68,0
EE28	5,3	11,9	22,4	10,3	19,3	68,3
EE29	5,3	11,9	22,5	10,4	19,5	68,4
EE30	5,8	14,0	26,7	10,6	20,0	68,8
EE35	6,2	15,0	28,7	10,7	20,5	68,8
EE40	6,2	15,0	28,7	10,8	20,3	68,5

Source: PRIMES 2014

The modelling of product efficiency is based on currently-available technologies, i.e. it does not assume technological breakthroughs therefore it can be considered as realistic or even conservative.

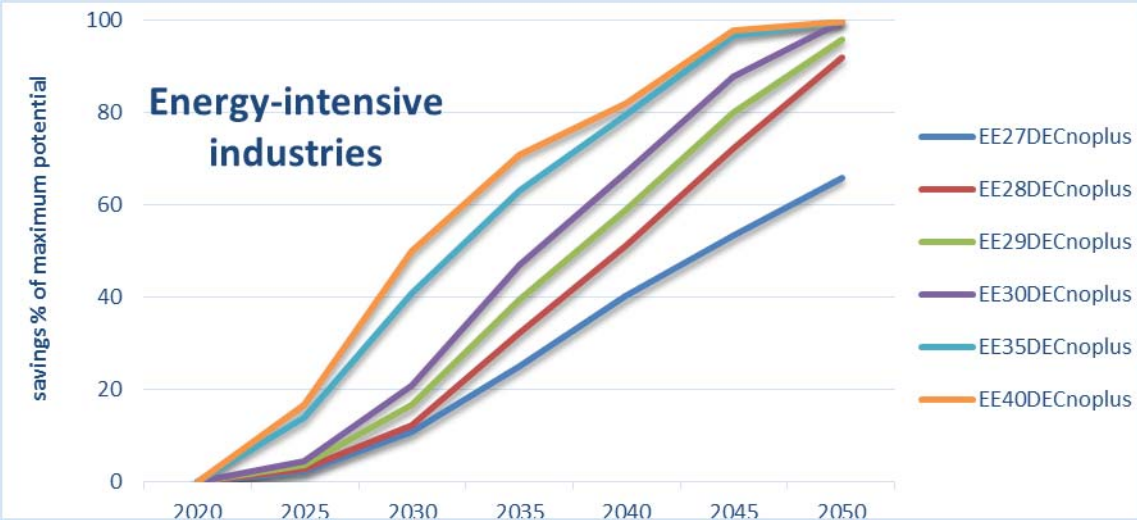
Best available technology in industry

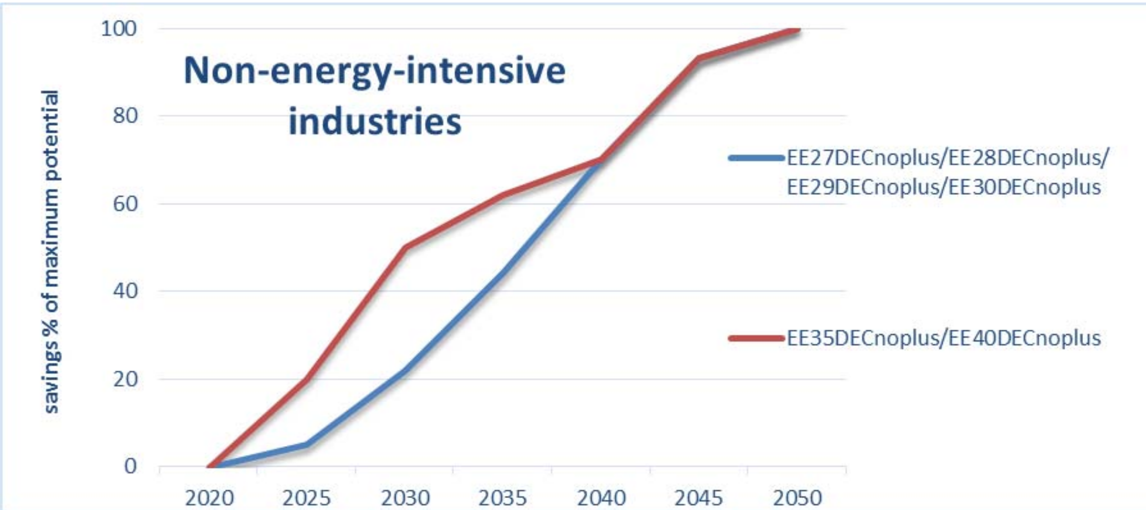
As described in the Annex V on the PRIMES methodology and modelling assumptions the uptake of BAT in industry is varied across the energy efficiency scenarios.

Regarding the horizontal BAT, their deployment leads to energy savings at all process levels. PRIMES considers a maximum potential for energy savings from horizontal BAT adoption, which is different by sector and by country. The energy efficiency scenarios are designed to exploit partly the maximum potential, at a degree reflecting the intensity of energy efficiency ambition by scenario. Therefore the uptake of horizontal BAT increases by scenario but is limited by potential.

As shown in the figure below, in the EE27 scenario, the energy savings potential that energy intensive industry is able to exploit in 2030 is assumed to be app. 11% of its maximum level. Already in the EE29 scenario this figure increases considerably, reaching by 2030 16.5%. In the EE30, EE35 and EE 40 scenarios, energy intensive industries can exploit even larger percentages of their maximum savings potential, reaching for the most ambitious scenario 50%. These savings further increase in longer term perspective. In non-energy intensive industries, the differences are assumed only between the moderate and ambitious scenarios.

Figure 32: Assumed uptake of horizontal energy saving BATs in the industrial sector as % of maximum potential





Source: PRIMES 2014

CHP and district heating

In the six energy efficiency scenarios different levels of policies focusing on district heating and the penetration of CHP are modelled. This leads to a visible increase from 11% to 14% of households connected to district heating networks in 2030. Beyond 2030, further increases in the shares can be seen in the most ambitious scenarios.

Table 33: % of households connected to district heating networks

% of households connected to district heating networks	2010	2020	2030	2050
Reference 2013	9	10	11	11
EE27	9	10	11	16

EE28	9	10	11	16
EE29	9	10	11	15
EE30	9	10	12	15
EE35	9	10	14	15
EE40	9	10	14	16

Source: PRIMES 2014

These numbers are fairly conservative: even in the ambitious scenarios the share of CHP (see Chapter 5) and district heating does not increase substantially, mainly due to a lower heat demand associated with better insulated buildings. In a study by Aalborg University the share of district heating is substantially greater with a 30% share in 2030[26].

POLES modelling

In addition to the PRIMES, GEM-E3 and E3ME model the POLES model was used to analyse the effects of different levels of energy savings on the international fuel prices due to reduced energy demand.

POLES is a simulation model to develop long-term energy supply and demand scenarios for different regions of the world. It includes modelling of primary fuel supply and international fuel markets. It can give some insights on the effect of energy policies with respect on the impact on prices as it does not take international fuel prices as an exogenous input parameter as in other models. Therefore, it is possible to project impacts of EE policies on prices of internationally-traded fuels, namely the coal, gas and oil prices.

In order to analyse the impact on the fuel prices of the scenarios analysed with PRIMES, the POLES model was calibrated to reproduce the PRIMES reference case on the aggregated EU level in terms of energy consumption.[27]

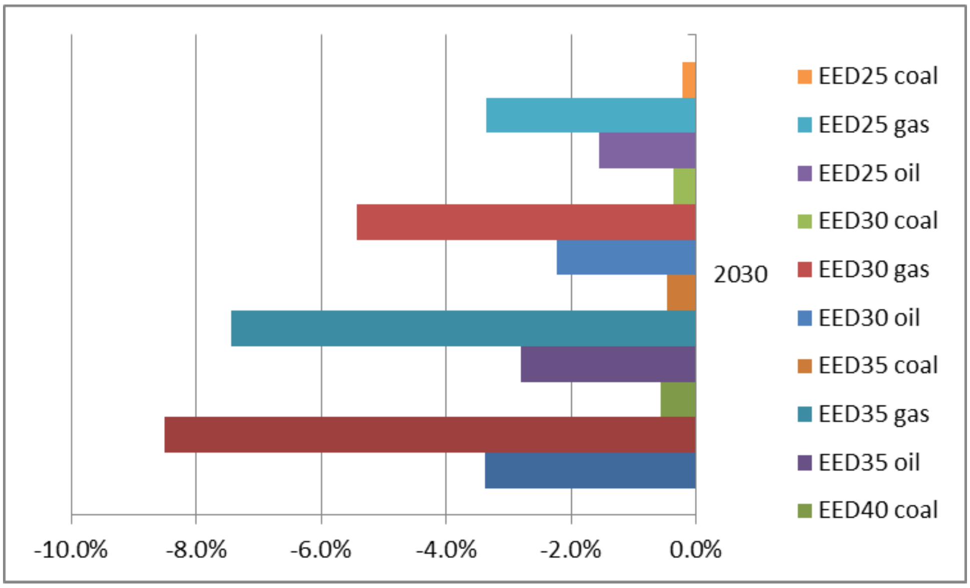
Starting from that Reference, the final energy consumptions as produced by the PRIMES model for the EE scenarios were reproduced with the POLES model[28]. The relative changes of the energy demand with respect to the reference result in a set of different prices in POLES. These relative price changes are reported and can be used as an estimate of the impact of reduced energy use due to EE policies in the EU on the international fuel prices.

[26] Heat Roadmap 2050, Aalborg University, 2013.

[27] Please note that the international energy prices in that POLES reference case are not the same as assumed in the PRIMES scenarios.

[28] Similarly as for macro-economic modelling with GEM-E3 and E3ME, the POLES scenarios that have been modelled build upon PRIMES scenarios with 25, 28, 30, 35 and 40% energy savings. The scenario with 25% energy savings has ambition similar to GHG40 scenario but is built on the PRIMES scenario that has concrete EE policies rather than carbon values - for better comparability with other scenarios. The macro-economic modelling building on EE27 and EE29 scenarios would likely have very similar outcome to results presented in the chapter for EE28 and EE30, with little additional insight brought to the analysis – for practical reasons, smaller number of scenarios is consequently presented.

Figure 33: Projected impacts of EE policies on international fuel prices (in%)



Source: POLES

It is projected that European EE policies would have an impact on international fossil fuel prices. Especially the gas price could be lower. This can be explained because of the significant reduction of the gas demand in the EE scenarios in the EU. The missing flexibility of the gas infrastructure produces a higher price effect on the European gas markets since the gas producers cannot easily redirect their fuel exports to other markets.

As these results were not fed back into the PRIMES model it is not possible to quantify possible rebound effects of decreasing global coal, gas and oil prices. The bigger the decrease of global coal, gas and oil prices is the more important it would be to use these decreased prices in PRIMES again to show the rebound effects on the European energy consumption, GDP and employment again. This has to be taken into account when interpreting these modelling results.

Annex VIII. Overview of national energy efficiency measures investigated by Fraunhofer and their expected impact[29]

Identifier in MURE or other source	Measure Code	Starting impact year	Country	Sector	Title	Updated impact (Mtoe) 2016	2020
AU36		2009	Austria	Transport	Subsidies for scrapping of old cars		
AU18		2008	Austria	Cross-Cutting	Transport measures of the Climate and Energy Fund		
AU21		2008	Austria	Residential	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy Certificates for Build		
AU26		2009	Austria	Residential	National recovery plan / renovation voucher	0.039	0.092
AU28		2008	Austria	Residential	Smart Metering and informative Billing		
		2011	Austria	Cross-Cutting	Price impact of Green Electricity Act	0.003	0.006
BEL24		2009	Belgium	Residential	Flanders - Reduction in property tax		
BEL25		2009	Belgium	Residential	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Brussels - Act structurally or	0.091	0.143
BEL28		2012	Belgium	Residential	Wallonia - Potential impact of AEE (Employment Environment Alliance)	0.052	0.052
BEL8		2009	Belgium	Residential	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Wallonia - Thermal regulatic	0.056	0.056
BEL7		2008	Belgium	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Brussels - Act structurally or		
BEL14		2012	Belgium	Tertiary	Brussels - Impose a plan for reduction of energy consumption on major consumers ("PLAGE": Loca	0.026	0.026
BEL15		2013	Belgium	Tertiary	Brussels - Make performance of an energy audit mandatory for any building of more than 3500 m^2	0.025	0.025
BEL19		2009	Belgium	Tertiary	Flanders - Reduction in property tax		
BEL20		2008	Belgium	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Wallonia - Thermal regulati		
BEL27		2012	Belgium	Tertiary	Wallonia - Potential impact of AEE (Employment Environment Alliance)		
BEL19		2008	Belgium	Transport	Wallonia - Financial incentives or funding devoted to transport	0.055	0.055
BEL4		2008	Belgium	Transport	Wallonia - Saving measures for transport in the public sector	0.012	0.012
BEL37		2012	Belgium	Residential	Wallonia - ECOPACK (Zero-rated eco-loan)		
FL-M1		2014	Belgium	Industry	Flanders: Energy policy agreement with companies operating under the verifiable emission	0.123	0.286
FL-M2		2014	Belgium	Industry	Flanders: Energy policy agreement with companies not operating under the verifiable emission	0.031	0.072
FL-M3		2014	Belgium	Cross-Cutting	Flanders: Grant for roof insulation		0.165
FL-M4		2014	Belgium	Cross-Cutting	Flanders: Grant for wall insulation		0.018
FL-M5		2014	Belgium	Cross-Cutting	Flanders: Grant for cellar or floor insulation		0.003
FL-M6		2014	Belgium	Cross-Cutting	Flanders: Grant for high efficiency glazing		0.036
W-M1		2014	Belgium	Industry	Wallonia: Voluntary agreements 2nd generation	0.045	0.105
W-M2		2014	Belgium	Industry	Wallonia: New voluntary agreements in preparation	0.014	0.032
W-M3		2013	Belgium	Cross-Cutting	Wallonia: Subsidies to energy efficiency in buildings (UREBA ordinaire AGW 28/03/2013)	0.007	0.016
W-M4		2013	Belgium	Cross-Cutting	Wallonia: Subsidies to energy efficiency in buildings (UREBA exceptionnel AGW28/03/2013)	0.005	0.011
W-M5		2012	Belgium	Cross-Cutting	Wallonia: Subsidies+soft loan for social housing (ECO PACKS FLFNW et ECO PACKS SWCS AGW	0.007	0.017
W-M6		2013?	Belgium	Cross-Cutting	Wallonia: Subsidies for thermal building rehabilitation (Réhabilitation logement améliorable	0.025	0.059
W-M7		2010	Belgium	Cross-Cutting	Wallonia: Subsidies for thermal building rehabilitation (Primes énergie AM 22/03/2010 - pour	0.076	0.178
W-M8		2010	Belgium	Industry	Wallonia: Subsidies for energy efficiency in industry (Primes énergie AM 22/03/2010 - industrie)	0.001	0.003
BL-M1_8			Belgium	Cross-Cutting	Brussels region: Bundle of 8 mesures. Most important Measure 6: PRIMES ENERGIE (Subsidy progr	0.053	0.115
		2014	Bulgaria	Cross-Cutting	Energy efficiency obligation	0.104	0.340
		2014	Croatia	Residential	Programme of incentives to improve outer envelopes of single-family houses	0.004	0.009
		2014	Croatia	Residential	Programme of incentives for heating system replacement	0.007	0.016
		2014	Croatia	Cross-Cutting	Programme of incentives to use renewable energy sources (RES)	0.003	0.008
		2014	Croatia	Cross-Cutting	Energy audits and energy certification of buildings		
		2014	Croatia	Residential	Aid for the preparation of project documentation for building renovation		
		2014	Croatia	Residential	Integral multi-dwelling unit renovation incentives	0.026	0.061
		2014	Croatia	Residential	Individual thermal energy consumption metering system installation	0.029	0.029
		2014	Croatia	Cross-Cutting	Increasing the number of nearly zero-energy buildings	0.008	0.022
		2012	Croatia	Tertiary	Energy renovation of public sector buildings programme	0.013	0.024
		2012	Croatia	Tertiary	Energy renovation of commercial non-residential buildings	0.035	0.065
		2011	Croatia	Industry	Introduction of efficient electric motor drives	0.020	0.024
		2007	Croatia	Industry	CO2 emissions fees		
		2011	Croatia	Transport	Financial aid for energy-efficient vehicles	0.009	0.031
		2011	Croatia	Transport	Advanced regulation of traffic intersections equipped with intelligent traffic lights	0.004	0.026
		2013	Croatia	Transport	Introduction of a special environmental fee payment scheme for motor vehicles	0.012	0.040
CY4		2008	Cyprus	Industry	EU-related: Amended EU Emission Trading Scheme (Directive 2009/29/EC) - Emission Trading Scheme (2008-2012)		
CY3		2011	Cyprus	Tertiary	EU-related: Recast Ecodesign Directive for Energy-related Products (Directive 2009/125/EC) - Eco design requirements for		
CY8		2010	Cyprus	Tertiary	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Information, awareness, training for ene		
CY15		2008	Cyprus	Transport	Express Bus transportation to airports		
CY18		2011	Cyprus	Transport	EU-related: Promotion of clean and energy-efficient road transport vehicles (Directive 2009/33/EC) - Law for the public pu		
CY5		2008	Cyprus	Cross-Cutting	EU-related: Passenger Car Labelling on fuel economy rating (Directive 1999/94/EC) - Energy label of new passenger cars		
CY4		2011	Cyprus	Residential	EU-related: Recast Ecodesign Directive for Energy-related Products (Directive 2009/125/EC) - Efficiency requirements for en		
CY13		2008	Cyprus	Transport	Fiscal incentives for old cars scrapping		
CY14		2013	Cyprus	Transport	Registration fee and annual vehicle tax reduction for clean vehicles.		
CY17		2010	Cyprus	Transport	National Strategy for the development / upgrading of public transport		
CY5		2013	Cyprus	Transport	EU-related: Fiscal Measures to Promote Car Fuel Efficiency - Vehicle taxation based on CO2 criteria		
CY11		2014	Cyprus	Residential	Net metering scheme was introduced for the promotion of small residential photovoltaic systems		
CY19		2013	Cyprus	Transport	EU-related: Energy labelling of tyres (Regulation 1222/2009/EC) - Law for the implementation of energy labelling of tyre:		
CY20		2010	Cyprus	Transport	Creating Infrastructure for using bicycles		
			Cyprus	Residential	***Measure Package Residential sector***	0.049	0.058
			Cyprus	Tertiary	***Measure Package Tertiary sector***	0.007	0.009
			Cyprus	Industry	***Measure Package Industry***	0.000	0.000
			Cyprus	Transport	***Measure Package Transport***	0.001	0.001

[29] The list includes significant planned and existing measures in 15 Member States covering 91.5% of EU primary energy consumption. The impact corresponding to the measures in the remaining Member States was based on the extrapolation of results for the 15 Member States covered.

CZ9	2008	Czech Repul	Industry	Promotion of energy efficiency in the Operational Programme Industry and Innovation	0.163	0.379
CZ6	2009	Czech Repul	Tertiary	EU-related: Energy Labelling Office Equipment (Energy Star) - (Uplatnini dohody o Energy Star o ka	0.008	0.013
CZ8	2011	Czech Repul	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Extension of the role of pub	0.041	0.069
CZ9	2010	Czech Repul	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Electric energy savings in th	0.012	0.022
CZ7	2010	Czech Repul	Transport	EU-related: Emission performance standards new passenger cars (Regulation 443/2009/EC) -)	0.037	0.146
CZ40	2008	Czech Repul	Cross-Cutting	Taxes on registration of a new cars		
CZ42	2008	Czech Repul	Cross-Cutting	Emission performance standards new passenger cars (Regulation 443/2009/EC)		
CZ49	2008	Czech Repul	Cross-Cutting	Community framework for the taxation of energy products and electricity (Directive 2003/96/EC)		
CZ54	2010	Czech Repul	Cross-Cutting	Promotion of clean and energy-efficient road transport vehicles (Directive 2009/33/EC)		
CZ55	2014	Czech Repul	Cross-Cutting	Passenger Car Labelling on fuel economy rating (Directive 1999/94/EC)		
CZ10	2011	Czech Repul	Industry	Support of voluntary commitments to energy savings	0.026	0.095
CZ18	2009	Czech Repul	Residential	Electric energy savings in the area of household lighting	0.023	0.044
CZ19	2009	Czech Repul	Residential	Green Savings Programme	0.063	0.222
DK31	2011	Denmark	Residential	EU-related: Performance of Heat Generators for Space Heating/Hot Water (Directive 92/42/EEC) -		
DK31	2011	Denmark	Residential	EU-related: Performance of Heat Generators for Space Heating/Hot Water (Directive 92/42/EEC) -		
DK33	2010	Denmark	Residential	Scrapping scheme for oil-fired boilers		
DK15	2009	Denmark	Transport	A green certification of communes and transporters		
DK16	2008	Denmark	Transport	Modular concept road train field operational trial		
DK17	2010	Denmark	Transport	Fiscal incentive scheme aimed at better aerodynamics for heavy goods vehicles		
DK7	2010	Denmark	Cross-Cutting	Energy Conservation Programme for Truck and Van Transport		
DK8	2008	Denmark	Cross-Cutting	Energy Conservation Programme for Public Transport		
DK12	2010	Denmark	Transport	Eco driving - energy efficient driving technique		
DK12	2010	Denmark	Transport	Eco driving - energy efficient driving technique		
DK14	2009	Denmark	Transport	Guidelines for green procurement of vehicles		
DK18	2009	Denmark	Transport	Energy and emission regulations for taxis, limos and healthcare transportations		
DK10	2012	Denmark	Cross-Cutting	Danish Energy Agreement 2012		
DK5	2013	Denmark	Industry	Renewable energy for production processes		
DK34	2008	Denmark	Residential	Knowledge centre for energy savings in buildings		
DK35	2009	Denmark	Residential	EU-related: Recast Ecodesign Directive for Energy-related Products (Directive 2009/125/EC) - EU		
DK36	2012	Denmark	Residential	Information effort for energy efficiency regarding end-users (sparenergi.dk)		
DK37	2012	Denmark	Residential	Strategy for energy renovation		
DK38	2012	Denmark	Residential	Build up skills		
DK39	2013	Denmark	Residential	Fund for advancement of alternatives to oil and natural gas boilers		
DK11	2008	Denmark	Tertiary	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Inspection of		
DK6	2012	Denmark	Cross-Cutting	Energy-policy agreement of 22 March 2012: Update of the The Energy Companies' saving effort	0.629	1.503
EST10	2008	Estonia	Industry	The programme of technology investment support for manufacturers		
EST15	2008	Estonia	Residential	Minimum energy performance requirements (for buildings)		
EST16	2008	Estonia	Residential	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy performance of buildings		
EST16	2008	Estonia	Residential	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy performance of buildings		
EST17	2008	Estonia	Residential	National Development Plan for Housing Sector 2008-2013		
EST18	2010	Estonia	Residential	Building design and construction supervision support for apartment associations for making preparations for major renovati		
EST19	2010	Estonia	Residential	Support scheme for reconstruction of apartment buildings		
EST20	2012	Estonia	Residential	Drawing up instructions and/or regulation on application of individual energy cost calculations		
EST21	2009	Estonia	Residential	The programme of renovation loan for apartment buildings (under the OperationalProgramme for the Development of the		
EST22	2014	Estonia	Residential	Devisal of the principles of the support scheme for renovation of private houses with an aim of achieving energy savings, ar		
EST24	2008	Estonia	Residential	Construction of sample buildings on the territories of local authorities in compliance with the standard for low-energy builc		
EST25	2012	Estonia	Residential	More detailed specification of procedures and development of aids for certifyingcompliance with the minimum requiremer		
EST29	2011	Estonia	Residential	Carrying out surveys on energy consumption of households		
EST8	2008	Estonia	Tertiary	Minimum energy performance requirements (for buildings)		
EST9	2008	Estonia	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy performance of buildings		
EST11	2008	Estonia	Tertiary	Development of legislative acts on environmentally friendly public procurements and the related instruction materials		
EST14	2010	Estonia	Tertiary	Provision of training on environmentally friendly public procurements, development and distribution of respective informa		
EST17	2009	Estonia	Tertiary	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - A requirement to have an energy perform		
EST18	2011	Estonia	Tertiary	Obligations for building managers stipulated in the State Assets Act		
EST26	2009	Estonia	Tertiary	Informing local authority officials of regulation on energy performance of buildings		
EST29	2011	Estonia	Tertiary	Increasing the awareness of clients commissioning construction or design work, green public procurements		
EST30	2008	Estonia	Tertiary	Information dissemination among public sector managers and officials engaged in building management		
EST10	2011	Estonia	Transport	Energy conservation criteria in public procurements for motor vehicles		
EST13	2011	Estonia	Transport	A pilot project for electric cars		
EST15	2010	Estonia	Transport	Free parking for electric cars		
EST21	2009	Estonia	Transport	To create a national public transport planning system that would take into account local needs and eliminate public transpo		
EST7	2011	Estonia	Transport	Investments in energy efficient public transport vehicles		
EST9	2011	Estonia	Transport	Investments in electric transport		
EST9	2011	Estonia	Transport	Investments in electric transport		
EST13	2013	Estonia	Cross-Cutting	Energy Efficiency Agreement for Freight Transport and Logistics 2008-2016		
	2014	Estonia	Cross-Cutting	Energy and CO2 taxes	0.044	0.102
	2014	Estonia	Cross-Cutting	Financing schemes:		
	2014	Estonia	Tertiary	- Renovation of street lighting	0.002	0.005
	2014	Estonia	Industry	- Energy and resource efficiency of companies	0.004	0.010
	2014	Estonia	Residential	- Reconstruction of apartment buildings	0.010	0.023

FIN21	2009	Finland	Industry	Energy Advice to SMEs		
FIN28	2010	Finland	Residential	Coordinated energy advice to the consumers		
FIN29	2010	Finland	Residential	Energy Efficiency Agreement of the Property and Building Sector - Rental Property Action Plan		
FIN31	2008	Finland	Residential	Building code D5: guidelines on the calculation of power and energy needs for heating of buildings		
FIN33	2011	Finland	Residential	Building code D1: Water and Drainage Systems for Properties		
FIN28	2010	Finland	Tertiary	Building code D3: Orders for energy efficiency in buildings		
FIN19	2008	Finland	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Periodic inspections of air conditioning systems		
FIN20	2010	Finland	Tertiary	Mandatory energy efficiency plans in the public sector		
FIN21	2011	Finland	Tertiary	Energy Efficiency Agreement of the Property and Building Sector - Commercial Property Action Plan		
FIN24	2008	Finland	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Mandatory energy efficiency certificates for buildings		
FIN29	2009	Finland	Tertiary	Renovation of State Property Stock		
FIN30	2009	Finland	Tertiary	Improving energy efficiency in new construction for the state		
FIN35	2009	Finland	Tertiary	Energy Advice for SMEs		
FIN22	2008	Finland	Transport	Car Tax Revision		
FIN24	2008	Finland	Transport	EU-related: Promotion of Biofuels or other Renewable Fuels for Transport (Directive 2003/30/EC) - Mandatory introduction		
FIN25	2010	Finland	Transport	Mobility Management Programme		
FIN26	2011	Finland	Transport	Promoting walking and cycling		
FIN27	2009	Finland	Transport	EU-related: Emission performance standards new passenger cars (Regulation 443/2009/EC) - Improving the energy efficienc		
FIN29	2014	Finland	Transport	EU-related: CO2 Standards for Light Duty Vehicles - Improving the energy efficiency of vans		
FIN31	2012	Finland	Transport	EU-related: Procurement of clean and energy-efficient road transport vehicles		
FIN32	2010	Finland	Transport	Vehicle tax revision		
FIN17	2010	Finland	Cross-Cutting	EU-related: Energy End-use Efficiency and Energy Services ESD (Directive 2006/32/EC) - Law on		
FIN19	2011	Finland	Industry	Analysis model for steam-condensate systems		
FIN7	2010	Finland	Residential	Building codes C3 and C4: Thermal insulation		
FIN32	2008	Finland	Residential	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Mandatory energy efficiency certificates for buildings		
FIN14	2010	Finland	Tertiary	Farm Energy Programme		
FIN23	2010	Finland	Tertiary	Energy efficiency in server halls		
FIN32	2008	Finland	Tertiary	Fresh grain silos		
FIN33	2008	Finland	Tertiary	Unheated cattle buildings		
FIN18	2008	Finland	Transport	Energy Efficiency Agreement for Freight Transport and Logistics 2008-2016		
FIN19	2008	Finland	Transport	Energy Efficiency Agreement for Public Transport 2008-2016		
FIN28	2012	Finland	Transport	EU-related: Energy labelling of tyres (Regulation 1222/2009/EC) - Energy labelling of tyres		
FIN10	2008	Finland	Cross-Cutting	Long-Term National Climate and Energy Strategy 2008		
FIN12	2009	Finland	Cross-Cutting	EU-related: Ecodesign Directive for Energy-using Products (Directive 2005/32/EC) - Ecological		
FIN14	2010	Finland	Cross-Cutting	Government decision on energy efficiency measures on 4 February 2010		
FIN16	2011	Finland	Cross-Cutting	Support to renewables		
FIN23	2011	Finland	Industry	National Roadmap: Ensuring Energy Efficiency Competence in Construction		
FIN34	2013	Finland	Residential	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Decree on		
FIN37	2012	Finland	Tertiary	National focal point for sustainable public procurement		
FIN36	2009	Finland	Tertiary	Environmental programmes for state organisations and the Eco-Office		
		Finland	***Total***	***Total***	1.579	2.142
FRA15		France	Industry	OSEO subsidised Green Loans		
FRA28		France	Residential	Sustainable building training scheme		
FRA31		France	Residential	Zero-rated eco-loan		
FRA40		France	Residential	"Modernising buildings and cities" programme		
FRA42		France	Residential	Targeting of aid for housing purchase towards BBC dwellings		
FRA43		France	Residential	Social housing eco-loan		
FRA48		France	Residential	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Building codes " RT 2012"		
FRA49		France	Residential	Feasibility study for energy supplies		
FRA51		France	Residential	Evaluation of energy performance of co-ownerships		
FRA52		France	Residential	Exemption from property tax on existing buildings for BBC dwellings		
FRA55		France	Residential	Change to co-ownership decision-making rules		
FRA57		France	Residential	Distribution of energy savings between owner/landlord and tenant		
FRA17		France	Tertiary	Energy advisors for local authorities		
FRA15		France	Tertiary	"Moderning building and cities" programme		
FRA18		France	Tertiary	Feasibility study for energy supplies		
FRA20		France	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Thermal Regulations for existing buildings		
FRA22		France	Transport	Voluntary agreements		
FRA24		France	Transport	The national plan : "clean vehicle"		
FRA29		France	Transport	Sea motorways		
FRA31		France	Transport	Employer responsibility for half of the cost of public transport season tickets		
FRA33		France	Transport	EU-related: Promotion of clean and energy-efficient road transport vehicles (Directive 2009/33/EC) - European regulation or		
FRA36		France	Transport	Development of non-motorised and active modes		
FRA37		France	Transport	CO2 display and OEET		
FRA38		France	Transport	Voluntary commitment by the FNTV		
FRA39		France	Transport	Voluntary commitment in the aviation sector		
FRA14		France	Cross-Cutting	Improvements in Public Transport Networks		
FRA16		France	Cross-Cutting	EU-related: Passenger Car Labelling on fuel economy rating (Directive 1999/94/EC) - Energy and CO2 labelling for new cars		
FRA17		France	Cross-Cutting	EU-related: Passenger Car Labelling on fuel economy rating (Directive 1999/94/EC) - Energy and CO2 labelling for new cars		
FRA18		France	Cross-Cutting	EU-related: Passenger Car Labelling on fuel economy rating (Directive 1999/94/EC) - Energy and CO2 labelling for new cars		
FRA19		France	Cross-Cutting	Replacement and promotion of Low Polluting Vehicles		
FRA2		France	Cross-Cutting	Replacement and promotion of Low Polluting Vehicles		
FRA20		France	Cross-Cutting	Urban mobility plans		
FRA3		France	Cross-Cutting	EU-related: Emission performance standards new passenger cars (Regulation 443/2009/EC) -) - Emissions based Annual Mot		
FRA53		France	Residential	Targeting of Scellier aid for rental investment towards BBC dwellings		
FRA50		France	Residential	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Thermal Regulations for existing buildings "RT 2007"		
FRA54		France	Residential	Relief from property tax on existing buildings for households		
FRA60		France	Residential	Measures to tackle fuel poverty		
FRA19		France	Tertiary	Obligation regarding work in existing service buildings		
		France	***Buildings***	***Measure Package Buildings***	8.745	11.205
		France	***Transport***	***Measure Package Transport***	1.330	2.240
		France	***Industry***	***Measure Package Industry***	0.120	0.180
		France	***Tertiary***	***Measure Package Tertiary sector***		

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COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

Communication from the Commission to the European Parliament and the Council

Energy Efficiency and its contribution to energy security and the 2030 Framework for climate and energy policy

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Annex VIII. Overview of national energy efficiency measures investigated by Fraunhofer and their expected impact (continued)

GER36	2008	Germany	Industry	Special fund for energy efficiency in SME´s (Sonderfonds Energieeffizienz in KMU)	0.800	0.800
GER17	2009	Germany	Cross-Cutting	Renewable Energy Sources Act for Heat (Gesetz zur Förderung Erneuerbarer Energien im Wärmeb	0.155	0.217
GER19	2008	Germany	Cross-Cutting	National Energy Efficiency Action Plan (NEEAP) of the Federal Republic of Germany		
GER21	2010	Germany	Cross-Cutting	Sustainability Ordinance for Electricity from liquid Biomass		
GER28	2012	Germany	Cross-Cutting	Act revising the legislation on renewable energy sources in the electricity sector 2012 (EEG Novell		
GER29	2008	Germany	Cross-Cutting	National Climate Initiative (Nationale Klimainitiative, NKI)	0.021	0.033
GER30	2010	Germany	Cross-Cutting	Energy concept and accelerated transformation of the energy system ("Energiewende")		
GER47	2008	Germany	Residential	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy certificates for buildi		
GER64	2010	Germany	Residential	Smart Metering		0.451
GER65	2008	Germany	Residential	Information Campaign on Climate Protection		
GER67	2014	Germany	Residential	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Energy Savings	0.081	0.311
GER72	2011	Germany	Residential	EU-related: Revised Directive for Labelling of Energy-related Products (Directive 2010/30/EU) - En	0.078	0.221
GER8	2009	Germany	Residential	EU-related: Ecodesign Directive for Energy-using Products (Directive 2005/32/EC) - Energiebetrieb	0.800	1.200
GER94	2009	Germany	Residential	KfW-programme "Energy-efficient construction"	0.150	0.225
GER95	2009	Germany	Residential	Energy Saving Ordinance (residential buildings)	2.422	3.583
GER96	2009	Germany	Residential	KfW Energy-efficient Redevelopment	1.194	1.791
GER43	2009	Germany	Industry	ERP Environmental and Energy Efficiency Programme	0.131	0.131
GER25	2009	Germany	Tertiary	Stimulus programme for the promotion of climate protection measures in commercial cooling ins	0.002	
GER29	2008	Germany	Tertiary	Special fund for energy efficiency in SME's (Sonderfonds Energieeffizienz in KMU)	0.222	0.321
GER31	2011	Germany	Tertiary	EU-related: Ecodesign Directive for Energy-using Products (Directive 2005/32/EC) - Eco-Design of E	0.251	
GER32	2010	Germany	Tertiary	Smart Metering		
GER33	2008	Germany	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy Certificates for build		
GER34	2008	Germany	Tertiary	Information Campaign on Climate Protection		
GER35	2011	Germany	Tertiary	EU-related: Recast Ecodesign Directive for Energy-related Products (Directive 2009/125/EC) - Eco-I	0.400	0.520
GER40	2012	Germany	Tertiary	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Energy Savings	0.838	1.257
GER41	2012	Germany	Tertiary	Mission E	0.007	0.007
GER25	2008	Germany	Transport	Biomass Sustainability Ordinance		
GER26	2010	Germany	Transport	Statutatory Ordinance on Hydrogenation of vegetable oil		
GER28	2008	Germany	Transport	Campaign "ich und mein auto. Clever fahren, Sprit sparen" ("me and my car. Driving smart, Saving		
GER30	2008	Germany	Transport	Aktionsprogramm Mobilitätsmanagement (Promoting mobility, communication and city logistics)		
GER33	2009	Germany	Transport	Car scrapping (Umweltprämie)	0.096	0.088
GER39	2009	Germany	Transport	EU-related: Emission performance standards new passenger cars (Regulation 443/2009/EC) - Accel	1.524	1.992
GER5	2011	Germany	Transport	Levy on air traffic (Luftverkehrsabgabe)	0.100	0.100
	2012	Germany	Tertiary	KfW Energy Efficiency Supply of Town Quarters (KfW Energieeffiziente Quartiersversorgung --Kor	0.000	0.000
	n.a.	Germany	Tertiary	KfW Social Investment - Energetic Building Renovation (KfW Sozial Investieren -- Energetische Ge	0.012	0.017
	2009	Germany	Tertiary	KfW Energy Efficient Rehabilitation of Buildings - Municipalities (KfW Energieeffizient Sanieren --	0.038	0.057
	2012	Germany	Tertiary	KfW Investment Credit Premium Municipality - efficient street lighting (KfW-Investitionskredit Ko	0.005	0.007
	2009	Germany	Tertiary	Future Investments Act (Zukunftsinvestitionsgesetz)	0.165	0.165
	2012	Germany	Industry	KfW Energy Advice SMEs (KfW-Energieberatung Mittelstand = Nachfolgeprogramm Sonderfonds E	0.289	0.423
	2013	Germany	Industry	Energy efficiency networks in companies (Energieeffizienz-Netzwerke in Unternehmen)	0.002	0.005
	2014	Germany	Tertiary	Energy Efficiency Fund: Municipal networks (Effizienz-Fonds: Kommunale Netzwerke)	0.000	0.000
	2013	Germany	Industry	Energy Efficiency Fund: Cross-cutting Technologies (Effizienz-Fonds: Querschnittstechnologien)	0.064	0.131

GRE10	2008	Greece	Cross-Cutting	EU Structural Funds 2007-2013: Comprehensive development of ecological public transport		
GRE11	2008	Greece	Cross-Cutting	EU Structural Funds 2007-2013: Comprehensive development of ecological public transport		
GRE15	2011	Greece	Cross-Cutting	EU Structural Funds 2007-2013: Comprehensive development of ecological public transport		
GRE9	2008	Greece	Cross-Cutting	EU Structural Funds 2007-2013: Essential economic infrastructure		
GRE10	2009	Greece	Industry	Promotion of Combined heat and power (CHP) and district heating systems- Industry Sector		
GRE11	2010	Greece	Industry	Creating a 'Green Business Parks "- Enhancing investment projects in Industrial Business Zones (V.E.P.E.) and Innovation Zor		
GRE6	2008	Greece	Industry	Incentives for obligatory implementation of Energy Management Systems		
GRE7	2014	Greece	Industry	GRE7-Promotion of voluntary agreements in industrtial sector		
GRE8	2009	Greece	Industry	Installation of electronic and intelligent metering of electricity and natural gas industrial consumers		
GRE9	2012	Greece	Industry	Energy upgrading of existing buildings through third-party financing arrangements (TPF), energy performance contracting ar		
GRE2	2008	Greece	Residential	Allocation of heating costs in collective buildings		
GRE12	2012	Greece	Residential	Obligatory installation of central thermal solar systems in residential buildings.		
GRE16	2011	Greece	Residential	"Energy Savings in households" Program		
GRE17	2009	Greece	Residential	"Changing Air-Condition" Program		
GRE15	2010	Greece	Residential	Energy Performance of residential Buildings		
GRE18	2011	Greece	Residential	GRE18-Energy Upgrading of social housing- The "Green Neighborhoods"” Program		
GRE20	2010	Greece	Residential	Installation of electronic and intelligent metering of electricity and natural gas residential consumers		
GRE21	2012	Greece	Residential	Energy upgrading of existing buildings through Energy Service Companies		
GRE22	2009	Greece	Residential	Promotion of Combined heat and power (CHP) and district heating systems- Residential Sector		
GRE23	2011	Greece	Residential	"Xtizodas to Mellon" Project- Residential sector		
GRE1	2016	Greece	Tertiary	Energy Auditing Procedures, Requirements and Guidelines		
GRE7	2011	Greece	Tertiary	Obligatory replacement of all lighting systems of low energy output in public sector		
GRE8	2008	Greece	Tertiary	Obligatory installation of central thermal solar systems in buildings of tertiary sector		
GRE9	2011	Greece	Tertiary	Energy savings in Local Self-Governments. - "Economize" program		
GRE10	2011	Greece	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy Performance of Buildings of Tertiary sector		
GRE11	2008	Greece	Tertiary	EU-related: Energy Labelling Office Equipment (Energy Star) - Energy Labelling of appliances and minimum energy efficienc		
GRE12	2009	Greece	Tertiary	Installation of electronic and intelligent metering of electricity and natural gas tertiary consumers		
GRE13	2012	Greece	Tertiary	Energy upgrading of existing buildings through third-party financing arrangements (TPF), energy performance contracting ar		
GRE14	2009	Greece	Tertiary	Promotion of Combined heat and power (CHP) and district heating systems- Tertiary Sector		
GRE15	2008	Greece	Tertiary	Mandatory procurement procedures (for energy efficient technologies and renewable energy technologies – green p		
GRE16	2014	Greece	Tertiary	Green Roof Application in Public Buildings		
GRE17	2014	Greece	Tertiary	The Program “Bioclimatic Urban Reformation”		
GRE18	2014	Greece	Tertiary	Installation of high-efficiency CHP units in conjunction with natural gas cooling systems in hospitals		
GRE19	2014	Greece	Tertiary	Measures for energy efficiency improvements in school buildings		
GRE20	2014	Greece	Tertiary	Measures for energy efficiency improvements in public buildings		
GRE21	2014	Greece	Tertiary	Implementation of an energy management system (EMS) in the tertiary and public sectors		
GRE10	2011	Greece	Transport	Incentives for replacement private vehicles		
GRE11	2010	Greece	Transport	Introduction of Biofuels		
GRE12	2011	Greece	Transport	Energy savings in Local Self-Governments. -"ECOnomize" program-transport		
GRE13	2010	Greece	Transport	Taxation of new cars according CO2 emission		
GRE15	2009	Greece	Transport	Promotion of economical, safe and eco-driving		
GRE9	2011	Greece	Transport	Urban mobility plans		
GRE13	2008	Greece	Cross-Cutting	Information system for monitoring energy efficiency and achieved energy savings		
GRE14	2010	Greece	Cross-Cutting	Tax exemptions for energy saving investments		
		Greece	***Residential***	***Measure Package Residential Sector***	0.161	0.375
		Greece	***Tertiary***	***Measure Package Tertiary Sector***	0.085	0.199
		Greece	***Transport***	***Measure Package Transport***	0.041	0.095
		Greece	***Cross-Cutting***	***Increasing excise duty on heating oil consumption***	0.096	0.225
HUN20	2008	Hungary	Residential	Residential energy saving programme for 2008		
HUN22	2009	Hungary	Residential	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - HU71 Energy performance certificate for new dwelling		
HUN25	2009	Hungary	Residential	Residential energy saving programme for 2009		
HUN26	2009	Hungary	Residential	Green Investment Climate-friendly Home Sub-programme (ZBR-Panel) / Green Investment System Climate friendly Home E		
HUN27	2008	Hungary	Residential	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy review of heat producing sets and air condition		
HUN29	2009	Hungary	Residential	Replacement of household appliances subprogramme of the Green Investment System		
HUN11	2008	Hungary	Transport	EU-related: Speed limitation devices for certain categories of motor vehicles (Directive 2002/85/EC) - Speed limits for cars,		
HUN12	2011	Hungary	Transport	On the facilitation of the procurement of energy efficient public vehicle		
HUN16	2008	Hungary	Cross-Cutting	Integration of the sub-urban railway and public transport system in Riga		
		Hungary	***Residential***	***Measure Package Households***	0.251	0.251
		Hungary	***Tertiary***	***Measure Package Public institutions***	0.176	0.176
		Hungary	***Industry***	***Measure Package Industry, productive sectors***	0.156	0.156
		Hungary	***Transport***	***Measure Package Transportation***	0.055	0.055
		Hungary	Cross-Cutting	***Measure Package Horizontal and Cross-sectoral (other)***	0.048	0.048
	2014	Hungary	Cross-Cutting	Energy saving obligation	0.194	0.633

IRL14	2008	Ireland	Industry	Assessment of Renewable Energy Alternatives at Design Stage		
IRL16	2008	Ireland	Industry	Building Energy Rating		
IRL17	2008	Ireland	Industry	Tax Relief for Energy Saving Equipment - Accelerated Capital Allowance	0.016	0.030
IRL25	2008	Ireland	Residential	Building Regulations 2008	0.104	0.181
IRL27	2009	Ireland	Residential	EU-related: Recast Ecodesign Directive for Energy-related Products (Directive 2009/125/EC) - Ener	0.103	0.103
IRL29	2016	Ireland	Residential	Smart Metering	**0.032**	**0.054**
IRL30	2009	Ireland	Residential	Upgrade of Older Housing Stock - Home Energy Savings Scheme & Housing Aid for Older People Sc	0.031	0.031
IRL32	2012	Ireland	Residential	Micro CHP		
IRL34	2008	Ireland	Residential	Condensing Boilers - Minimum Boiler Efficiency	0.069	0.103
IRL35	2012	Ireland	Residential	Periodic Mandatory inspection of Boilers		
IRL40	2011	Ireland	Residential	Building regulations 2011	0.033	0.072
IRL41	2016	Ireland	Residential	Building Regulations - Nearly Zero Energy Homes	**0.001**	**0.019**
IRL22	2008	Ireland	Tertiary	Assessment of Renewable Energy Alternatives at Design Stage		
IRL24	2008	Ireland	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Building Energy Rating		
IRL26	2009	Ireland	Tertiary	Energy Efficient Lighting		
IRL28	2008	Ireland	Tertiary	Energy Star		
IRL29	2008	Ireland	Tertiary	Air Conditioning		
IRL30	2008	Ireland	Tertiary	Tax Relief for Energy Saving Equipment - Accelerated Capital Allowance		
IRL33	2008	Ireland	Tertiary	Minimum efficiency standards for boilers		
IRL35	2008	Ireland	Tertiary	2008 Building Regulations - Adjustments to Part L- Conservation of Fuel and Energy		
IRL12	2009	Ireland	Transport	Sustainable Travel and Transport Action Plan		
IRL18	2008	Ireland	Transport	Mineral Oil Tax		
IRL22	2008	Ireland	Transport	EU-related: Promotion of the Use of Biofuels or Other Renewable Fuels for Transport (2003/30/EC)		
IRL23	2010	Ireland	Transport	Private car scrappage scheme		
IRL25	2009	Ireland	Transport	Ecodriving - driver training and licensing		
IRL5	2010	Ireland	Cross-Cutting	Toll Rates for the Use of Motorways		
IRL6	2008	Ireland	Cross-Cutting	Development of public transport network		
IRL42	2011	Ireland	Residential	Better Energy Homes (Residential Retrofit)		
IRL15	2008	Ireland	Transport	EU-related: Emission performance standards new passenger cars (Regulation 443/2009/EC) -) - Emissions based Annual Mot		
IRL16	2008	Ireland	Transport	EU-related: Emission performance standards new passenger cars (Regulation 443/2009/EC) -) - Emissions based Vehicle Reg		
IRL20	2008	Ireland	Transport	EU-related: Promotion of Biofuels or other Renewable Fuels for Transport (Directive 2003/30/EC)		
IRL21	2009	Ireland	Transport	National Cycling Policy Framework		
IRL27	2011	Ireland	Transport	Electric Vehicles		
ITA17	2008	Italy	Tertiary	Measure for efficient lighting and control systems		
ITA18	2009	Italy	Transport	Improved Mobility in the Smaller Italian Islands (MINIMI Project) [Mobilità Innovativa Nelle Isole Minori Italiane]		
ITA20	2008	Italy	Transport	Financial package for old vehicles scrapping		
ITA10	2011	Italy	Cross-Cutting	Taxes on gasoline and auto diesel oil		
ITA13	2013	Italy	Industry	Market incentives: white certificates		
ITA13	2013	Italy	Industry	Market incentives: white certificates		
ITA1	2012	Italy	Residential	EU-related: Revised Directive for Labelling of Energy-related Products (Directive 2010/30/EU) - Energy labelling of househol		
ITA28	2009	Italy	Residential	Mandatory use of solar thermal energy in buildings		
ITA32	2011	Italy	Residential	EU-related: Revised Directive for Labelling of Energy-related Products (Directive 2010/30/EU) - Eco Design Directive. Framev		
ITA32	2011	Italy	Residential	EU-related: Revised Directive for Labelling of Energy-related Products (Directive 2010/30/EU) - Eco Design Directive. Framev		
ITA33	2013	Italy	Residential	White Certificates		
ITA33	2013	Italy	Residential	White Certificates		
ITA33	2013	Italy	Residential	White Certificates		
ITA33	2013	Italy	Residential	White Certificates		
ITA29	2011	Italy	Residential	EU-related: Ecodesign Directive for Energy-using Products (Directive 2005/32/EC) - Standard for efficient lighting and electri		
ITA30	2013	Italy	Residential	Fiscal incentives for energy savings in the household sector:Ecobonus 2014 and tax deduction for r	1.360	1.920
ITA30	2013	Italy	Residential	Fiscal incentives for energy savings in the household sector:Ecobonus 2014 and tax deduction for renovations and appliance:		
ITA37	2013	Italy	Residential	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Energy performance of newly erected an		
ITA4	2013	Italy	Tertiary	Design Norms for Thermal Plant Regulation and Metering		
ITA14	2013	Italy	Tertiary	White Certificates		
ITA2	2013	Italy	Cross-Cutting	White certificates: market based instruments promoting energy efficiency	4.140	5.490
ITA11	2013	Italy	Cross-Cutting	Renewable energy for heating & cooling support scheme	0.630	1.470
ITA38	2013	Italy	Residential	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Nearly Zero		
ITA39	2013	Italy	Residential	Design Norms for Thermal Plant Regulation and Metering		
ITA40	2013	Italy	Residential	Renewable energy for heating & cooling support scheme		
ITA21	2013	Italy	Tertiary	Renewable energy for heating & cooling support scheme		
ITA22	2013	Italy	Tertiary	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Nearly Zero		
ITA23	2013	Italy	Tertiary	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Energy		

LV21	2008	Latvia	Industry	Investments in Rural Villages' Energy Supply Systems Utilising Renewables		
LV27	2011	Latvia	Industry	Energy Efficiency Investments in Industrial Heat Supply		
LV27	2009	Latvia	Residential	EU-related Energy Performance of Buildings (Directive 2002/91/EC)		
LV28	2009	Latvia	Residential	Increasing Energy Efficiency in Multi Apartment Buildings	0.014	0.032
LV14	2009	Latvia	Industry	Energy Efficiency Investments in District Heating (Measures to Improve the Efficiency of Centralis	0.055	0.086
LV15	2009	Latvia	Industry	Investments to Produce Energy from Biomass of Agriculture and Forestry Origin		
LV16	2011	Latvia	Industry	Development of CHP Utilising Renewables		
LV19	2011	Latvia	Industry	Agreements on Improving Energy Efficiency by Promoting the Implementation of Industrial Energy Audits and		
LV22	2010	Latvia	Industry	Reduced Excise Duties Rate for Oil Products Mixed with Biofuel and Utilised for Heat Production		
LV23	2008	Latvia	Industry	EU-related: EU Emission Trading Scheme (2003/87/EC) - ETS 2008-2012		
LV24	2012	Latvia	Industry	Complex Solutions for GHG Emissions Reduction in Industrial Buildings	0.009	0.029
LV25	2012	Latvia	Industry	Investments in Renewable Technologies for Heat and Electricity Production to Reduce GHG emissions		
LV26	2010	Latvia	Industry	Energy Efficiency Requirements for District Heating Systems		
LV29	2010	Latvia	Residential	Information Campaign "Live Warmer"		
LV30	2013	Latvia	Residential	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Energy Audits and Energy Cε		
LV31	2012	Latvia	Residential	Grants for Renewable Energy Technologies in Households		
LV32	2014	Latvia	Residential	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Improving mini	0.003	0.015
LV33	2010	Latvia	Residential	Increasing Heat Energy Efficiency in Social Apartment Buildings (Measures to Improve the Therma	0.000	0.001
LV34	2011	Latvia	Residential	Low Energy Building		
LV35	2012	Latvia	Residential	Minimal Energy Efficiency Requirements for Multidwelling Buildings		
LV36	2011	Latvia	Residential	EU-related: Recast Ecodesign Directive for Energy-related Products (Directive 2009/125/EC) - EU-related Recast		
LV3	2008	Latvia	Tertiary	Information campaigns on applying energy efficient electrical equipment		
LV6	2008	Latvia	Tertiary	Implementation of the Exemplary Role of the Public Sector	0.002	0.001
LV6	2015	Latvia	Tertiary	Implementation of the Exemplary Role of the Public Sector	0.001	0.005
LV7	2010	Latvia	Tertiary	Investments in Municipal Public Buildings' Energy Efficiency to Reduce GHG emissions	0.011	0.018
LV8	2011	Latvia	Tertiary	Investments in Complex Solutions for GHG Emissions Reduction in Professional Education Institut	0.003	0.005
LV9	2012	Latvia	Tertiary	Investments in Renewable Technologies for Heat and Electricity Production to Reduce GHG emissions		
LV10	2013	Latvia	Tertiary	Low Energy Buildings		
LV11	2012	Latvia	Tertiary	Investments in Public Territories' Lighting Infrastructure to Reduce GHG Emissions		
LV12	2014	Latvia	Tertiary	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Improving minimum energy		0.023
LV13	2009	Latvia	Tertiary	Green Public Procurement		
LV14	2010	Latvia	Tertiary	Reduced excise duties rate for oil products mixed with biofuel and utilised for heat production		
LV15	2013	Latvia	Tertiary	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Energy Certification of Non-		
LV16	2010	Latvia	Transport	Integration of the sub-urban railway and public transport system in Riga		0.004
LV19	2010	Latvia	Transport	EU-related: Fiscal Measures to Promote Car Fuel Efficiency - Fiscal Measures to Reduce CO2 emissions of Cars		
LV20	2010	Latvia	Transport	Increasing the Efficiency of the Existing Main Road Network and Planning the Transport System in the City of Ri		0.007
LV22	2010	Latvia	Transport	Biofuel Mix Obligation		
LV23	2014	Latvia	Transport	Toll Rates for the Use of Motorways		
LV24	2011	Latvia	Transport	Development of public transport network		
LV14	2011	Latvia	Cross-Cutting	Promotion Public Understanding on the Importance and Possibilities of GHG Emissions Reduction		
LV8	2010	Latvia	Cross-Cutting	Preferential Feed-in tariffs for Renewables		
LV9	2009	Latvia	Cross-Cutting	Preferential Feed-in Tariffs for CHP		
LV15	2014	Latvia	Cross-Cutting	Taxation of Subsidized Electricity		
LV41	2009	Latvia	Residential	Increasing Energy Efficiency in Multi Apartment Buildings (Measures to Improve the Thermal		
LV25	2010	Latvia	Transport	EU-related: Promotion of clean and energy-efficient road transport vehicles (Directive		
	2014	Lithuania	Cross-Cutting	Energy efficiency obligation	0.023	0.161
	2014	Lithuania	Cross-Cutting	Complementing measures (financed from structural funds, state budget and other sources)	0.011	0.040
LUX10	2011	Luxembourg	Industry	Voluntary Agreement of 2011	0.009	0.009
LUX3	2012	Luxembourg	Industry	Realising electricity savings potential of industrial cross-cutting technologies	0.005	0.010
LUX5	2010	Luxembourg	Industry	EU-related: Combined Heat Power (Cogeneration) (Directive 2004/8/EC) - Grand Ducal Regulation		
LUX6	2010	Luxembourg	Industry	EU-related: Amended EU Emission Trading Scheme (Directive 2009/29/EC) - Grand Ducal Regulatic		
LUX7	2010	Luxembourg	Industry	EU-related: Integrated Pollution Prevention and Control IPPC (Directive 2008/1/EC) - Grand Ducal		
LUX9	2008	Luxembourg	Industry	Voluntary Agreement of 2008	0.004	0.004
LUX14	2008	Luxembourg	Residential	Old building upgrade programme	0.002	0.002
LUX16	2012	Luxembourg	Residential	Expansion of the upgrading programme for old buildings	0.003	0.005
LUX17	2010	Luxembourg	Residential	Renewal of oldest heating systems	0.001	0.001
LUX18	2012	Luxembourg	Residential	Increase in promotion of efficient new building (new buildings, as against WD2008)	0.000	0.002
LUX19	2009	Luxembourg	Residential	EU-related: Ecodesign Directive for Energy-using Products (Directive 2005/32/EC) - Law establishir		
LUX20	2010	Luxembourg	Residential	EU-related: Recast Ecodesign Directive for Energy-related Products (Directive 2009/125/EC) - Law		
LUX24	2010	Luxembourg	Residential	Support of efficiency labelling	0.001	0.002
LUX2	2008	Luxembourg	Tertiary	Improvement in the U-values of the non-domestic buildings (WD2008)	0.008	0.008
LUX3	2011	Luxembourg	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Expansion of the Ordinance	0.017	0.031
LUX4	2012	Luxembourg	Tertiary	Realising electricity savings potential in the TCS sector	0.009	0.016
LUX4	2008	Luxembourg	Cross-Cutting	Further realising of potential for decentralised renewables (excluding biomass)		
LUX6	2010	Luxembourg	Cross-Cutting	Further expansion of decentralised biomass use		
LUX13	2008	Luxembourg	Residential	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Ordinance on the energy pe	0.030	0.052
LUX15	2008	Luxembourg	Residential	Promotion of energy-efficient new homes (new building compared with WD2008: low-energy ho	0.001	0.002
LUX21	2012	Luxembourg	Residential	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Ordinance on tl	0.005	0.014
	2014	Malta	Cross-Cutting	Energy efficiency obligation	0.003	0.010

NLD19	2008	Netherlands	Industry	Long Term Agreements with the industry, third phase (MJA3)		
NLD20	2009	Netherlands	Industry	Heatmaps		
NLD17	2008	Netherlands	Residential	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Energy		
NLD20	2009	Netherlands	Residential	Heat distribution law (warmtewet)		
NLD21	2008	Netherlands	Residential	More with Less plan (Meer met Minder)		
NLD22	2008	Netherlands	Residential	Pilots energy saving for homeowners and private landlords in combination with district approach		
NLD23	2008	Netherlands	Residential	Financial support homeowners		
NLD25	2008	Netherlands	Residential	Covenant energy savings in newly produced buildings (Spring Agreement)		
NLD27	2008	Netherlands	Residential	Covenant energy savings by housing corporations		
NLD19	2010	Netherlands	Tertiary	Internal emission trading system for the greenhouse sector		
NLD20	2008	Netherlands	Tertiary	Taskforce lighting		
NLD18	2008	Netherlands	Transport	Railfreight (Betuwelijn)		
		Netherlands	**Cross-Cutting**	**Measure Package Buildings**		
		Netherlands		***Established policy, households***		
		Netherlands	Residential	*EPC 0.6*	0.067	0.141
		Netherlands	Residential	*Voluntary agreements, existing buildings*	0.037	0.073
		Netherlands	Residential	*Other policy, including energy taxation and SDE supplement*	0.062	0.143
		Netherlands	Residential	*Further than Ecodesign*	0.007	0.018
		Netherlands		***Established policy, services***		
		Netherlands	Tertiary	*EPC and other national policy*	0.042	0.051
		Netherlands	Tertiary	*Other policy*	0.007	0.018
		Netherlands		***New policy, households and services***		
		Netherlands	Cross-Cutting	*Owner-occupier sector*	0.026	0.060
		Netherlands	Cross-Cutting	*(Social) rental sector*	0.079	0.182
		Netherlands	Cross-Cutting	Social and other real estate	0.134	0.313
		Netherlands	**Industry**	**Measure Package Industry**		
		Netherlands	Industry	***Established policy, industry***		
		Netherlands	Industry	Combined impact of existing policy	0.167	0.394
		Netherlands	Industry	***New policy, industry***		
		Netherlands	Industry	Energy Investment Allowance (EIA)	0.036	0.105
		Netherlands	Industry	Long-term voluntary agreement on energy efficiency, ETS companies (MEE)	0.005	0.012
		Netherlands	Industry	Enforcement, MJA3	0.002	0.007
		Netherlands	Industry	Enforcement, other industry	0.007	0.031
		Netherlands	Industry	Enforcement, building-related consumption, industry	0.026	0.079
		Netherlands	**Tertiary**	**Measure Package Agriculture/Horticulture**		
		Netherlands	Tertiary	***Established policy, agriculture/horticulture***		
		Netherlands	Tertiary	*Direct use of solar heat*		0.001
		Netherlands	Tertiary	*LED lighting*	0.001	0.007
		Netherlands	Tertiary	Avoidance of summer heating	0.001	0.008
		Netherlands	Tertiary	Het Nieuwe Telen [Ecocultivation]	0.001	0.010
		Netherlands	Tertiary	Better insulation		0.001
		Netherlands	Tertiary	***Established policy, agriculture/horticulture***		
		Netherlands	Tertiary	*Private system, greenhouse horticulture*	0.031	0.053
		Netherlands	**Transport**	**Measure Package Transport**		
		Netherlands	Transport	***Established policy transport***		
		Netherlands	Transport	Construction of loading docks for inland waterway transport	0.000	0.001
		Netherlands	Transport	Increase in duty on diesel by 3 ct./l in 2014	0.006	0.013
		Netherlands	Transport	Increase in duty on LPG by 7 ct./l in 2014	0.000	0.001
		Netherlands	Transport	Electric cars		0.051
		Netherlands	Transport	Modal split in freight traffic through port policy	0.002	0.004
		Netherlands	Transport	Electric bicycles with 10% car replacement (or autonomous)		
		Netherlands	Transport	Continuation of more fuel-efficient driving among new drivers	0.005	0.012
		Netherlands	Transport	Continuation of incentives for fuel-efficient cars	0.028	0.066
PL6	2008	Poland	Tertiary	Increasing the proportion of energy saving products available in the market		
PL10	2009	Poland	Transport	Toll on highways		
PL11	2009	Poland	Transport	Vehicle taxation		
PL8	2009	Poland	Transport	Fuel Tax		
PL3	2008					
PL10	2011	Poland	Industry	Priority Programme "Efficient use of energy. Part I" - Grants for energy audits in industrial enterprises		
PL11	2011	Poland	Industry	Priority Programme "Efficient use of energy. Part II" - Soft loans support for investments decreasi	0.105	0.114
PL12	2011	Poland	Industry	Polish Sustainable Energy Financing Facility (PolSEFF)	0.012	0.012
PL13	2012	Poland	Industry	Priority Programme "Smart Grids"		
PL8	2008	Poland	Industry	2007 to 2013 Infrastructure and Environment Operations Programme and Regional Operations Pro	0.023	0.023
PL9	2008	Poland	Industry	2007 to 2013 Infrastructure and Environment Operations Programme and Regional Operations Pro	0.008	0.008
PL11	2009	Poland	Residential	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Certificates of energy perfor		
PL9	2010	Poland	Residential	Promotion of solar collectors in households sector		
PL10	2014	Poland	Residential	Requirements for new and modernised buildings		
PL2	2014	Poland	Tertiary	Technical Requirements for Buildings and theirs Location		
PL13	2010	Poland	Tertiary	Green Investment Scheme. Part 5 – Energy Management in Buildings of Selected Public Sector Ent	0.008	0.014
PL13	2010	Poland	Tertiary	Green Investment Scheme. Part 5 – Energy Management in Buildings of Selected Public Sector Ent		
PL12	2010	Poland	Tertiary	Green Investment Scheme. Part 1 - energy management in public buildings	0.192	0.268
PL14	2013	Poland	Tertiary	Programme "Energy Savings and Renewable Energy Sources Promotion" (under the EEA Financial		
PL9	2008	Poland	Tertiary	Infrastructure and Environment Operations Programme and the Regional Operations Programme	0.015	0.016
PL11	2011	Poland	Tertiary	Exemplary role of public sector		
PL2	2008	Poland	Transport	Traffic management system and transport of goods optimisation	0.044	0.044
PL3	2014	Poland	Transport	Fleet replacement program in public transport and the promotion of eco driving	1.082	2.016
PL12	2013	Poland	Cross-Cutting	System of white certificates - Energy efficiency Act	1.100	1.100
PL9	2012	Poland	Cross-Cutting	Information campaigns, training and education	0.030	0.030
		Poland	Cross-Cutting	Operational Programme PL04	0.016	0.016
		Poland	Cross-Cutting	LEMUR (by National Fund for Environmental Protection)	0.006	0.012
		Poland	Tertiary	Regional Operational Programmes 2007-2013 (public sector)	0.044	0.044
		Poland	Tertiary	Regional Opeartional Programmes 2014-2020 (public sector)	0.015	0.035
		Poland	Cross-Cutting	Operational Programme Infrastructure and Environment 2014-2020	0.003	0.006
		Poland	Cross-Cutting	Green Investment Scheme (SOWA) part 6) - by National Fund for Environmental Protection	0.003	0.003
		Poland	Cross-Cutting	Operational Programme Infrastructure and Environment (activity 9.4 - Energy Generation from RE	0.002	0.002
		Poland	Cross-Cutting	Regional Operational Programmes 2007-2013 (private sector)	0.010	0.010
		Poland	Cross-Cutting	Regional Operational Programmes 2014-2020 (private sector)	0.003	0.008
		Poland	Cross-Cutting	Operational Programme Infrastructure and Environment 2014-2020	0.006	0.013

POR4	2008	Portugal	Industry	Intensive Energy Consumption Management System (SGCIE)		
POR15	2008	Portugal	Residential	Detracting people from acquiring new inefficientequipment		
POR16	2008	Portugal	Residential	Equipment replacement		
POR17	2008	Portugal	Residential	Remodelling Measures		
POR18	2008	Portugal	Residential	Efficiency in Residential Buildings		
POR19	2008	Portugal	Residential	Renewable at the Time: Micro generation		
POR20	2008	Portugal	Residential	Renewable at the Time: Solar Thermal Program		
POR14	2008	Portugal	Tertiary	Office Equipment Renewal		
POR13	2008	Portugal	Tertiary	Efficiency in Office Buildings		
POR11	2009	Portugal	Transport	Programme for Electric Mobility in Portugal		
POR13	2009	Portugal	Transport	State vehicle park procurement rules: Fleet renewal and CO2 emission limits		
POR14	2008	Portugal	Transport	Reviving the decommissioning programme for endof-life vehicles		
POR15	2008	Portugal	Transport	Green Taxes – Review of the private vehicle taxregime (PNAC 2006 Measure)		
POR16	2008	Portugal	Transport	Right Tyre and Fuel Efficiency		
POR17	2008	Portugal	Transport	New vehicles more "aware" of fuel savings		
POR18	2008	Portugal	Transport	Regional Planning and Urban Mobility in DistrictCapitals		
POR19	2008	Portugal	Transport	Urban Mobility Plans in office parks and industrial parks		
POR20	2008	Portugal	Transport	Use of more energy efficient transport		
POR7	2010	Portugal	Cross-Cutting	Speed Limits and Active Traffic Management		
		Portugal	***Transport***	***Measure Package Transport***	0.026	0.058
		Portugal	***Residential***	***Measure Package Residential***	0.103	0.213
		Portugal	***Industry***	***Measure Package Industry***	0.069	0.138
		Portugal	***Tertiary***	***Measure Package Public Sector***	0.035	0.083
RO22	2009	Romania	Residential	Individual billing of the consumers supplied by public distric heating systems		
RO29	2008	Romania	Residential	EU-related: Revised Directive for Labelling of Energy-related Products (Directive 2010/30/EU) - Energy efficiency improveme		
RO39	2012	Romania	Residential	Renewable energy use -The GREEN HOUSE Program		
RO10	2008	Romania	Industry	EU-related: EU Emission Trading Scheme (2003/87/EC) - Implementation of greenhouse gas emission trading in Romania		
RO11	2009	Romania	Industry	EU-related: Combined Heat Power (Cogeneration) (Directive 2004/8/EC) - The promotion of CHP's		
RO2	2008	Romania	Industry	Improvement of Energy Efficiency amongst industrialoperators through the signing of long-term agreements(LTAs)		
RO3	2009	Romania	Industry	The improvement of energy efficiency in industrial operators		
RO7	2010	Romania	Industry	Grant-supported credit line for Romania that has been established by the European Commission and the European Bank for		
RO7	2008	Romania	Tertiary	Improvement of public lighting system		
RO8	2012	Romania	Tertiary	Renewable energy use - The GREEN HOUSE Program		
RO9	2008	Romania	Tertiary	EU-related: Ecodesign Directive for Energy-using Products (Directive 2005/32/EC) - Promoting the development of energy s		
RO11	2009	Romania	Tertiary	EU-related: Energy Labelling Office Equipment (Energy Star) - Promote the use of energy efficient household appliances an		
RO12	2011	Romania	Tertiary	Increase efficiency and reduce consumption of water supply facilities		
RO13	2010	Romania	Tertiary	Making local energy planning		
RO3	2010	Romania	Cross-Cutting	Promotion of high efficiency cogeneration		
	2014	Romania	Cross-Cutting	Alternative policy measures for the implementation of Art. 7 (EED)	0.314	1.027
SK10	2011	Slovakia	Industry	Mandatory Energy Audits in Industry and Agriculture		
SK13	2011	Slovakia	Industry	Promotion of energy efficiency in Industry - SLOVSEFF II		
SK9	2008	Slovakia	Industry	Operational Programme "Competitiveness and Economic Growth" priority line Energy, Measure 1.1 - Innovations and techn		
SK10	2012	Slovakia	Residential	Mandatory technical requirements on insulation of heating and domestic hot water distribution pipes		
SK11	2008	Slovakia	Residential	Hydronic balancing of the heating and domestic hot water systems		
SK17	2009	Slovakia	Residential	Information campaign Live with Energy - EU Structural funds, OP Competitiveness and Economic Growth, Measure 2.2		
SK9	2011	Slovakia	Residential	EU-related: Revised Directive for Labelling of Energy-related Products (Directive 2010/30/EU) - Act on labelling of energy rel		
SK13	2008	Slovakia	Tertiary	Improvement of thermal technical properties of buildings including technical equipment - Eko Fund		
SK18	2011	Slovakia	Tertiary	Improvement of thermal technical properties of buildings - Public buildings - Pilot project for energy efficiency of public bu		
SK21	2009	Slovakia	Tertiary	Information campaign and energy advice services Live with Energy - EU Structural funds, OP Competitiveness and Economic		
SK8	2011	Slovakia	Transport	EU-related: Promotion of clean and energy-efficient road transport vehicles (Directive 2009/33/EC) - Act on promotion of en		
SK9	2009	Slovakia	Transport	Modernization of passenger cars fleet - scrappage scheme		
SK12	2009	Slovakia	Cross-Cutting	Low carbon buses & SAFED bus driver training		
SK14	2009	Slovakia	Cross-Cutting	EU-related: Fiscal Measures to Promote Car Fuel Efficiency - Company Car Taxation		
SK19	2008	Slovakia	Cross-Cutting	Speed limits		
SK20	2008	Slovakia	Cross-Cutting	Subsidies for vehicles with alternative propulsion		
SK21	2008	Slovakia	Cross-Cutting	Energy efficient urban transport		
SK23	2011	Slovakia	Cross-Cutting	Investments for cleaner transport (Environmental protection and energy efficiency Fund)		
SK24	2010	Slovakia	Cross-Cutting	EU-related: Energy labelling of tyres (Regulation 1222/2009/EC) - Law for the implementation of energy labelling of tyre		
SK24	2010	Slovakia	Cross-Cutting	Creating Infrastructure for using bicycles		
	2014	Slovakia	Cross-Cutting	Energy efficiency obligation	0.152	0.427
	2014	Slovakia	Cross-Cutting	Complementary policy measures	0.029	0.082
	2014	Slovenia	Cross-Cutting	Energy efficiency obligation	0.015	0.079
	2014	Slovenia	Cross-Cutting	Eco Fund (Eko sklad)	0.034	0.110

SPA19	2011 Spain	Industry	Action Plan 2011-2020: Energy Audits		
SPA20	2011 Spain	Industry	Action Plan 2011-2020: Improvement in the technologies of equipment and processes (BAT).	1.347	2.747
SPA22	2011 Spain	Industry	Action Plan 2011-2020: Establishment of energy management systems	0.090	0.222
SPA22	2011 Spain	Residential	Action Plan 2011-2020: Improvement of the energy efficiency of the electric appliances stock	0.053	0.061
SPA25	2008 Spain	Residential	Plan for Replacement of Electricity Meters		
SPA30	2011 Spain	Cross-Cutting	Action Plan 2011-2020: Renewal of the thermal casing in the existing buildings	0.448	0.513
SPA31	2011 Spain	Cross-Cutting	Action Plan 2011-2020: Improvement of energy efficiency of the thermal installations in existing b	0.525	0.601
SPA32	2011 Spain	Residential	Action Plan 2011-2020: Improvement of energy efficiency of the indoor lighting installations in ex	0.389	0.557
SPA37	2008 Spain	Residential	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Regulation of Thermal Instal		
SPA38	2009 Spain	Residential	IDAE's Financing Lines for Thermal Renewable Energies in Buildings: BIOMCASA-SOLCASA-GEOTC		
SPA39	2011 Spain	Residential	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Action Plan 201	0.000	0.001
SPA25	2011 Spain	Tertiary	Action Plan 2011-2020: Renewal of the existing outdoor lighting installations	0.011	0.038
SPA26	2011 Spain	Tertiary	Action Plan 2011-2020: Improvement of energy efficiency of the current water purification plants,	0.036	0.067
SPA27	2011 Spain	Tertiary	Action Plan 2011-2020: Studies, feasibility analyses and audits to improve the energy efficiency in		
SPA28	2011 Spain	Tertiary	Action Plan 2011-2020: Training of the local council energy managers		
SPA29	2008 Spain	Tertiary	Action Plan 2008-2012: Energy Saving and Efficiency Plans in Public Administrations		
SPA36	2011 Spain	Cross-Cutting	Action Plan 2011-2020: Construction of new buildings and rehabilitation of the existing ones with	0.129	0.163
	2011 Spain	Tertiary	Action Plan 2011-2020: Bundle of measure for energy saving in agriculture and fishing	0.599	0.885
SPA42	2009 Spain	Tertiary	IDAE's Financing Lines for Thermal Renewable Energies in Buildings: BIOMCASA-SOLCASA-GEOTC		
SPA43	2009 Spain	Tertiary	Energy Efficiency Regulation in Street Lighting Installations		
SPA44	2008 Spain	Tertiary	Green Public Procurement Plan		
SPA46	2010 Spain	Tertiary	Plan to Boost Energy Services Contracts (Plan 2000 ESE)		
SPA48	2011 Spain	Tertiary	Action Plan 2011-2020: Improvement of energy efficiency in commercial refrigeration installation	0.000	0.001
SPA49	2011 Spain	Tertiary	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Action Plan 201	0.000	0.001
SPA30	2011 Spain	Transport	Action Plan 2011-2020: Sustainable Urban Mobility Plans	0.463	0.659
SPA31	2011 Spain	Transport	Action Plan 2011-2020: Transport Plans in firms and activity centres	0.236	0.336
SPA32	2011 Spain	Transport	Action Plan 2011-2020: Larger participation of collective means in road transport	0.049	0.061
SPA33	2011 Spain	Transport	Action Plan 2011-2020: Larger participation of railways in passenger and goods transport	0.648	1.320
SPA35	2011 Spain	Transport	Action Plan 2011-2020: Management of transport infrastructure	1.015	1.290
SPA36	2011 Spain	Transport	Action Plan 2011-2020: Management of road transport fleets	0.232	0.294
SPA37	2011 Spain	Transport	Action Plan 2011-2020: Management of aircraft fleets		0.014
SPA38	2011 Spain	Transport	Action Plan 2011-2020: Eco-driving for cars and vans	0.287	0.326
SPA39	2011 Spain	Transport	Action Plan 2011-2020: Eco-driving for trucks and buses	0.351	0.398
SPA40	2011 Spain	Transport	Action Plan 2011-2020: Eco-driving for aircrafts		0.009
SPA41	2011 Spain	Transport	Action Plan 2011-2020: Renewal of road transport fleets	0.329	0.544
SPA42	2011 Spain	Transport	SPA42 Action Plan 2011-2020: Renewal of air fleets		0.007
SPA43	2011 Spain	Transport	Action Plan 2011-2020: Renewal of sea transport fleets		0.009
SPA44	2011 Spain	Transport	Action Plan 2011-2020: Renewal of car fleets	0.407	0.673
SPA45	2008 Spain	Transport	EU-related: Promotion of Biofuels or other Renewable Fuels for Transport (Directive 2003/30/EC)		
SPA46	2008 Spain	Transport	EU-related: Fiscal Measures to Promote Car Fuel Efficiency - Registration Tax Link to CO2 Emissior		
SPA47	2008 Spain	Transport	VIVE Plan (Aids to purchase clean vehicles)		
SPA49	2010 Spain	Transport	Integral Strategy to Impulse the EV/PHEV in Spain 2010–2014		
SPA14	2011 Spain	Cross-Cutting	Law on Sustainable Economy		
SPA39	2008 Spain	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy Performance Certific		
SPA45	2009 Spain	Tertiary	Activation Plan in the State's General Administration Buildings through ESCOS (Plan 330 ESE)		
SPA48	2009 Spain	Transport	MOVELE Demonstration Project (Electric Mobility)		
SPA48	2009 Spain	Transport	MOVELE Demonstration Project (Electric Mobility)		
SPA15	2013 Spain	Cross-Cutting	JESSICA-F.I.D.A.E Fund (Energy Saving And Diversification Investment Fund)		
SPA40	2014 Spain	Residential	PAREER Program (Aids Program for Energy Rehabilitation in Buildings in Household and Hotel		
SPA41	2013 Spain	Residential	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - CER (Energy		
SPA50	2014 Spain	Tertiary	PAREER Program (Aids Programme For Energy Rehabilitation In Buildings in Household and Hotel		
SPA51	2013 Spain	Tertiary	PIMA SOL (Plan for Promoting Energy Rehabilitation of Hotel Sector)		
SPA52	2013 Spain	Tertiary	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - (Energy		
SPA52	2013 Spain	Tertiary	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - (Energy		
SPA51	2012 Spain	Transport	PIVE Programme - Efficient Vehicle Incentive Programme		
	2007 Spain	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Technical Building Code		
	2009 Spain	Tertiary	IDAE's Financing Lines for Thermal Renewable Energies in Buildings: BIOMCASA-SOLCASA-		
	2008 Spain	Tertiary	Green Public Procurement Plan		

SWE14	2008	Sweden	Industry	Energy efficiency in small and medium sized enterprises		
SWE16	2010	Sweden	Industry	Energy mapping vouchers (Energikartläggningscheckar)		
SWE19	2008	Sweden	Residential	EU-related: Energy Performance of Buildings (2002/91/EC)		
SWE21	2012	Sweden	Transport	EU-related: Energy labelling of tyres		
SWE22	2009	Sweden	Transport	Environmental-vehicle tax waiver		
SWE24	2011	Sweden	Transport	Energy efficiency measures in transport infrastructure		
SWE25	2010	Sweden	Transport	Technology procurement (teknikupphandling)		
SWE10	2010	Sweden	Cross-Cutting	EU-related: Energy End-use Efficiency and Energy Services ESD (Directive 2006/32/EC) - Government Subsidies for Local Ener		
SWE13	2010	Sweden	Cross-Cutting	Regional climate and energy strategies (Regionala klimat och energistrategier)		
SWE14	2010	Sweden	Cross-Cutting	EU-related: Recast Ecodesign Directive for Energy-related Products (Directive 2009/125/EC) - Transposition of Directive 2009		
SWE17	2009	Sweden	Industry	Energy efficiency networks for the industry		
SWE21	2013	Sweden	Residential	Invetsment support for solar cells (Investeringsstöd till solceller)		
SWE21	2013	Sweden	Residential	Invetsment support for solar cells (Investeringsstöd till solceller)		
SWE22	2010	Sweden	Residential	Programme for buildings with very low energy use (Program för byggnader med mycket låg energianvändning - LÅGAN)		
SWE15	2011	Sweden	Cross-Cutting	Sustainable municipality (Uthållig kommun)		
	?	Sweden	Industry	Program for energy-intensive industry		
	?	Sweden	Cross-Cutting	Energy and CO2-taxes		
		Sweden	**Cross-Cutting**	**Measure package residential and service sector**	0.705	0.705
		Sweden		**Measure package industry**	1.462	1.462
		Sweden		**Measure package transport**	0.430	0.430
UK10	2010	United Kingc	Cross-Cutting	EU-related: Promotion of Electricity from Renewable Sources (Directive 2001/77/EC) - UK10_Feed		
UK3	2008	United Kingc	Cross-Cutting	UK3_Climate Change Act		
UK4	2008	United Kingc	Cross-Cutting	Environmental Transformation Fund		
UK6	2010	United Kingc	Cross-Cutting	UK6_Energy Act 2010		
UK7	2009	United Kingc	Cross-Cutting	UK7_Low Carbon Transition Plan		
UK9	2009	United Kingc	Cross-Cutting	EU-related: Promotion of the Use of Energy from Renewable Sources (Directive 2009/28/EC) - Nat		
UK11	2013	United Kingc	Industry	EU-related: EU Emission Trading Scheme (2003/87/EC) - EU Emission Trading Scheme (ETS)		
UK17	2008	United Kingc	Industry	EU-related: Combined Heat Power (Cogeneration) (Directive 2004/8/EC) - Combined Heat and Pov		
UK28	2010	United Kingc	Residential	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Building Regulations 2010	0.970	1.526
UK32	2014	United Kingc	Residential	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Building regula	0.038	0.060
UK17	2010	United Kingc	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Building Regulations 2010	0.370	0.482
UK23	2014	United Kingc	Tertiary	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Building Regula	0.022	0.029
UK12	2010	United Kingc	Tertiary	CRC Energy Efficiency Scheme (CRC)	0.208	0.208
UK16	2008	United Kingc	Transport	EU-related: Promotion of Biofuels or other Renewable Fuels for Transport (Directive 2003/30/EC)		
UK20	2008	United Kingc	Transport	Transport Innovation Fund		
UK11	2013	United Kingc	Cross-Cutting	Green Deal	0.077	0.155
UK12	2011	United Kingc	Cross-Cutting	EU-related: Promotion of the Use of Energy from Renewable Sources (Directive 2009/28/EC) - UK1		
UK20	2008	United Kingc	Cross-Cutting	Suppliers obligations - Carbon Emissions Reduction Target (CERT)	0.621	0.590
UK29	2009	United Kingc	Cross-Cutting	Supplier Obligations - Community Energy Savings Programme (CESP)	0.053	0.050
UK33	2013	United Kingc	Residential	Supplier Obligations - Energy Company Obligation (ECO)	0.418	0.762

Annex IX. Impact of the currently implemented EU energy efficiency legislation

Key conclusions of the impact assessment accompanying a proposal for the recast of the Energy Performance of Buildings Directive[1].

The minimum total impact of the most beneficial options for which quantification was possible, is:

- 60 – 80 Mtoe/year energy savings by 2020, i.e. a reduction of 5-6% of the EU final energy consumption in 2020;

- 160 to 210 Mt/year CO_2 savings by 2020, i.e. 4-5% of EU total CO_2 emissions in 2020;

280,000 (to 450,000) potential new jobs by 2020, mainly in the construction sector, energy certifiers and auditors and inspectors of heating and air-conditioning systems.

- investment requirements and the administrative costs of the measures were analysed and are relatively low compared to the benefits and the returns. For example, on an EU scale abolishing the 1000 m^2 threshold would lead to €8 billion/year additional capital costs but would trigger €25 billion/year energy cost savings by 2020 and therefore create negative CO_2 abatement costs.

- The investment needs differ substantially across Europe depending on the social and economic conditions, on the initial state of the property and on the type of renovations to be undertaken. They are not equally distributed amongst EU citizens, i.e. there will be additional costs for those who make major renovations of their buildings or are engaged in property transaction. However, with high oil prices these initial investments will have attractive returns.

- The overall benefits for society in terms of reduction of energy consumption and thus reduced CO_2 emissions and energy import dependency, job creation, especially at local and regional level, positive health and labour productivity far exceed the costs of the measures analysed.

Key conclusions of the impact assessment accompanying a proposal for the Energy Efficiency Directive[2]:

- The instrument mix put forward will contain a number of overlaps and interactions. The modelling of the whole package showed that primary energy demand in 2020 will be reduced by between 19.7% and 20.9% compared to the PRIMES 2007 baseline projection. The sectors reducing demand most are transport and residential. Reductions are substantial in the tertiary sector, too, due to improved appliances and improved heating and cooling. Generation efficiency also improves and some of the

[1] SEC 2008/2865
[2] SEC 2011/799

measures to reduce final energy demand lead to lower electricity consumption and thus lower production.

- Measures to achieve the 20% energy saving target in 2020 will support the greenhouse gas reduction target, in particular in non-ETS sectors. According to the Low Carbon Economy Roadmap 2050 the achievement of the 20% EE and RES targets enables a 25% greenhouse gas emission reduction. In this context, the Commission has said that it will monitor the impact of new measures to implement the 20% energy efficiency target on the ETS.

- Impacts on the ETS are presented in the overall 20% efficiency model runs, albeit results differ substantially depending on the model used. While both models project a further decrease in GHG emissions, they show different results regarding the impact on the ETS price: the E3ME model run projects a drop to zero of the ETS price in 2020 whereas the PRIMES scenarios project a much lower impact (a reduction from €16.5/t to €14.2/t in 2020).

- Additional costs to the total energy system rise by between 2.6% and 4.7% compared to the reference scenario. The increase in energy efficiency will tend to increase electricity prices in the short term from 141€/MWh to 146€/MWh due to the need to finance the fixed costs of energy efficiency measures. However, in the long run, this increase pays off by stabilising electricity prices through a lower demand.

- It can therefore be confirmed that the package of policy put forward is capable of reaching the 20% objective and reaping additional benefits that remain tangible beyond 2020. The additional costs of achieving the overall 20% target through the set of measures proposed are proportionately small.

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COMMISSION STAFF WORKING DOCUMENT

EXECUTIVE SUMMARY OF THE IMPACT ASSESSMENT

Accompanying the document

Communication from the Commission to the European Parliament and the Council

Energy Efficiency and its contribution to energy security and the 2030 Framework for climate and energy policy

{COM(2014) 520 final}
{SWD(2014) 255 final}

EXECUTIVE SUMMARY OF IMPACT ASSESSMENT

1. Policy context

1. In 2007 the European Council set the target of saving 20% primary energy by 2020 (compared to 2007 projections). The Energy Efficiency Directive (EED) establishes a common framework of measures for the promotion of energy efficiency to ensure the achievement of the target. It requires the Commission to assess by June 2014 whether the EU is likely to reach the target and to propose further measures if necessary.

2. The recent European Energy Security Strategy (EESS)[1] highlights moderating energy demand as *"one of the most effective tools to reduce the EU's external energy dependency and exposure to price hikes"*.

3. The 2030 Communication lays down the broad modalities of the EU climate and energy framework for the period between 2020 and 2030[2]. While the Communication states that *"A greenhouse gas emissions reduction target of 40% would require an increased level of energy savings of approximately 25% in 2030"*[3], it also indicates that the exact ambition of future energy savings policy and measures necessary to deliver it are to be established in the review of the EED building on the analysis underpinning the 2030 framework and the targets and objectives for greenhouse gas reductions and renewable energy proposed in 2030 Communication.

2. Lessons learned and problem definition

4. Having increased from 1618 Mtoe in 2000 to 1721 Mtoe in 2006, the EU's primary energy consumption has been decreasing ever since. While the economic crisis that began in 2008 had a significant impact on energy demand, the effect of efficiency gains (driven by prices and policies) was greater. Efficiency has improved since 2000 and the rate of improvement has accelerated since 2008. However, if current trends continue by 2020, roughly 1/3 of reduction in energy consumption compared to the 2007 Reference will stem from lower growth than anticipated, and only about 2/3 from increasing energy efficiency improvements

5. Between 2008 and 2012, primary energy consumption fell in the majority of Member States. Changes in the level of economic activity played a big part in this, as did changes in the electricity generation mix and changes in industrial structure. In certain countries, the effect of these factors was countered by changes in the level of consumption (e.g. increasing average size of dwellings).

6. The energy efficiency policy framework has developed significantly in the last years. The target EU target on 20% energy savings has now been clearly defined, providing political momentum, guidance for investors and a benchmark to measure progress At European level, the most effective policies so far have been product efficiency standards, including ecodesign and energy labelling of products and the CO_2 legislation for cars and vans. The Energy Performance of Buildings Directive (2010 recast) and the Energy Efficiency

1 COM(2014) 330

[2] COM (2014) 15 final.

[3] 25% energy savings for the target of 40% GHG corresponds to the scenario GHG40 from the 2030 IA, which was identified as the most cost-effective way to achieve 40% GHG savings.

Directive of 2012 have the potential to further drive energy efficiency in the EU provided they are properly implemented by Member States. The long-term potential of the EED is however limited to some extent by the fact that some of the key provisions stop applying in 2020.

7. At national level, Member States report success with different policy measures. The up-to-date information submitted by Member States in their 2014 National Energy Efficiency Action Plans indicates further strengthening of national policies, including new measures to implement the Energy Efficiency Directive, in many Member States.

8. Despite this progress, analysis suggests that at current pace, the EU energy efficiency target of saving 20% of energy by 2020 will be missed by 1 to 2 percentage points.

9. Various analyses looking beyond 2020, including by the IEA and Fraunhofer ISI, indicate that the current policy framework will not suffice to realise the full cost-effective energy-saving potential. The Impact Assessment accompanying the 2030 Communication also makes it clear that current policies (as depicted in the Reference scenario[4]) would not ensure a cost-effective transition to a low-carbon economy achieving merely 21% savings by 2030 compared to 2007 projections.

10. The principal reason why the 2020 target is expected to be missed is that, even with recent more positive developments, there is sometimes insufficient commitment at Member State level to the implementation of the existing legislative framework. As regards the perspective beyond 2020, some of the key policy tools were designed within a 2020 timeframe and therefore do not provide long-term incentives for investing in energy efficiency. Furthermore even with current rules important barriers to energy efficiency persist.

11. Because of these underlying drivers the general problem is that the cost-effective energy-saving potential (both short- and long-term) is not fully realised and therefore energy efficiency does not sufficiently contribute to the EU's energy policy objectives. This has the following consequences: (a) high energy demand increases the dependence of the EU on energy imports, notably of gas; (b) the unused energy efficiency potential negatively impacts the affordability of energy and limits the competitiveness of the EU economy; (c) high energy demand makes the transition to a low-carbon economy more costly because many energy efficiency measures are among options for GHG abatement with the lowest cost.

3. Subsidiarity

12. Member States are at the centre of the realization of energy efficiency policy and EU intervention should be well targeted and supportive to their actions. The EU's role is in: (a) establishing a common framework which creates the basis for coherent and mutually reinforcing mechanisms while leaving in being the responsibility of Member States to set the means to achieve the agreed objectives; (b) creating a platform for exchanging best practice and stimulating capacity building; (c) setting minimum requirements in areas where there is a risk of internal market distortions if Member States take individual measures; (d) using EU instruments to promote energy efficiency, e.g. through financing.

[4] EU ENERGY, TRANSPORT AND GHG EMISSIONS TRENDS TO 2050 - REFERENCE SCENARIO 2013 available at: http://ec.europa.eu/energy/observatory/trends_2030/.

4. Scope and objectives

13. The general objective is to ensure that energy efficiency contributes to the development of a competitive, sustainable and secure EU energy system.

14. The specific objectives are to:

- To agree on the measures necessary to achieve the 20% energy efficiency target in 2020 providing thus the relevant actors with information on the actions that need to be undertaken in the short term;

- To agree on the level of ambition of energy efficiency policy in the long term providing thus Member States and investors with more predictability and certainty.

5. Description of policy options and methodology

15. Regarding policy options for closing the gap towards the 2020 target the following elements are considered:

   a. No action.
   b. New primary legislation laying down binding national targets or additional binding measures.
   c. Strengthened implementation of current policies.

   Option a is discarded from further detailed analysis as the 2020 target would not be fully achieved and the benefits associated with meeting it would not be realised.

16. Regarding the analysis of the optimal level of energy savings for 2030, six scenarios with a stepwise increase in the intensity of energy efficiency efforts in all sectors targeted by current policy measures were modelled. By comparing the results of the scenarios with the Reference case, the impacts of these efforts on energy system (including security of supply aspects), competitiveness and sustainability are assessed in 2030 as well as in 2050 perspective. The scenarios achieve in 2030 respectively: 27.4%, 28.3%, 29.3%, 30.7%, 35.0% and 39.8% of savings compared to PRIMES 2007 baseline and consequently later are referred to as EE27, EE28, EE29, EE30, EE35 and EE40 scenarios. The analysis builds on and is fully coherent with the IA underpinning the 2030 Communication including 40% GHG reductions and (at least) 27% share of renewable energy in final energy consumption proposed by the Commission as binding targets for 2030. It takes into account the progress that Member States are making towards their national targets under the EED.

17. Regarding options for the architecture of the energy efficiency framework post-2020 the following options are identified

   a. No action. This implies that post 2020 there would be no energy efficiency target;
   b. Indicative EU target, coupled with specific EU measures. This would be a continuation of the current framework.
   c. Binding EU target, coupled with specific EU measures. This would replicate the approach proposed by the Commission in the 2030 Communication for RES.
   d. Binding MS targets, coupled with EU polices solely in areas linked to the internal market.

18. In addition, irrespective of the character and level of a possible target, it needs to be considered how it could be formulated. The following options for target formulation are identified:

    a. Consumption target;
    b. Intensity target;
    c. Hybrid approach.

6. Analysis of impacts and conclusions

Policy options for closing the gap to 2020 target

19. For 2020 the impact analysis shows that a proper implementation of the current policy framework would be both necessary and sufficient to bridge the expected gap. By contrast, proposing new primary legislation would be unlikely to make a significant contribution to bridging the gap given the minimum time necessary to carry out the normal legislative procedure and transposition into national law.

Analysis of the optimal level of ambition for 2030

20. In terms of energy system impacts (including security of supply), all scenarios show that energy efficiency policies reduce effectively energy consumption (both primary and final) and decrease the energy intensity. The different policy scenarios demonstrate some differences in terms of the consumption of various primary energy sources.

21. Energy efficiency has a significant impact on security of supply and the level of gas imports in particular. Net energy import decreases translate into savings in the energy fossil fuel imports bill. For the EE27, EE28 and EE29 scenarios, the savings in fossil fuel import costs in the period 2011-30 can reach between €285bn and €346bn. For the more ambitious targets of 30% energy saving and beyond, the savings can reach between €395bn and €549bn.

22. In terms of economic impacts, energy system costs increase in all scenarios compared to the Reference scenario. Increased energy efficiency leads to average annual (2011-2030) energy system costs in policy scenarios that are between 0.01 and 0.8 percentage points of GDP higher than the Reference. The increases in absolute values (average annual for the period 2011-2030) are between €2bn and €114 bn.

23. There is a general shift in the structure of costs with diminishing energy purchases and increasing capital costs and direct efficiency investments. Investment expenditure increases sharply in all scenarios - more significantly in more ambitious scenarios and again mostly in the residential and tertiary sectors.

24. Electricity price changes compared to the Reference are very small in 2030 ranging from 1% to 3% in the year 2030. The ETS price differs substantially across the various scenarios, reflecting the important contribution of energy efficiency to emission reductions in the ETS sectors (via reduction of demand for electricity) and the fact that energy efficiency achieves significant reductions in the non-ETS sector. As their ambition grows, EE policies reduce both costs and incentives from the ETS itself for GHG abatement.

25. GDP impacts for scenarios reducing emissions by 40% GHG and increasing energy efficiency can be either negative or positive (depending on theoretical approach and consequent assumptions) with the main driver being the magnitude of investments. In general-equilibrium modelling, the "crowding out" effect leads to negative results . If it is not assumed that resources are currently fully used -, the effects on GDP are positive.

26. In terms of social impacts, the overall net employment impacts, as for GDP, depend on many assumptions. In general, employment is positively impacted by using carbon pricing revenue to lower labour costs. The analysis suggests that the employment effect will overall be more positive in scenarios with more ambitious energy efficiency policies reflecting the significant job-creation potential in these areas (notably in the construction sector) – with magnitude of effect depending on theoretical approach.

27. Affordability of energy for households is not significantly impacted (compared to the Reference scenario) in scenarios with energy savings up to 28% (both in 2030 and 2050 perspective). The most ambitious scenarios lightly (and mostly in 2050 perspective) increase the share of energy-related costs in household budgets as energy efficiency improvements typically need investment resulting in capital cost increases in such scenarios.

28. In terms of sustainability (and consistency with the targets of the 2030 energy and climate framework), all scenarios (except for EE40) demonstrate reduced GHG emissions in 2030 in line with the GHG target proposed in 2030 Communication and broadly in line with the split of emissions reductions (in 2030) in ETS and non-ETS sectors proposed therein. All scenarios pursue the decarbonisation objective. All scenarios are consistent with the (at least) 27% target for renewables.

29. The balance of GHG emissions reductions in the various sectors of the economy does not change between the scenarios as the mix of energy efficiency policies is not altered among the scenarios (it always follows the logic of current legislation and only the overall level of ambition intensifies). The highest reductions occur in the power generation sector (driven by ETS as proposed in 2030 framework) and in residential and tertiary sector (as the key energy efficiency policies address specifically these two sectors).

Architecture of the 2030 policy framework

30. Regarding the legal nature of a possible future energy efficiency target, the analysis concludes that a purely indicative target would be economically efficient and coherent with the 2030 energy and climate policy framework. National binding targets would be incoherent with the proposed energy and climate policy framework. Their effectiveness and economic efficiency is uncertain. Not proposing any target is an option but this would deprive the post-2020 policy framework of the benefits this element provide to provide so far, i.e. a benchmark for tracking progress and making policy adjustments; a signal to relevant actors, about the policy direction; and a basis for additional policy elements.

31. Irrespective of how a target is formulated economic developments should be taken into account in progress monitoring.

Financing

32. Significant energy efficiency improvements will require significant investments, and these will have to be primarily privately financed. The business case for investing in energy efficiency needs therefore to become more apparent to the financial sector and this will entail a number of actions, such as establishing reliable procedures for measuring and verifying energy savings, developing standards for energy efficiency investment processes and providing technical assistance in order to make energy efficiency projects bankable.

Overview table with key results of the modelling in 2030 (unless otherwise stated)

	Reference	GHG40	EE27	EE28	EE29	EE30	EE35	EE40
MAIN FEATURES OF SCENARIOS								
GHG reductions vs 1990	-32.4	-40.6	-40.1	-40.2	-40.1	-40.1	-41.1	-43.9
Renewables share - Overall	24.4	26.5	27.8	27.7	27.7	27.7	27.4	27.4
Energy Savings in 2030 (*evaluated in % against the 2007 Baseline projections for Primary Energy Consumption)*	21.0%	25.1%	27.4%	28.3%	29.3%	30.7%	35.0%	39.8%
ENERGY SYSTEM IMPACTS								
Gross Inland Energy Consumption (Mtoe)	1611	1534	1488	1470	1450	1422	1337	1243
- Solids share	10.8	10.1	9.9	10.4	10.8	11.3	12.9	12.4
- Oil share	32.3	32.8	32.4	32.6	32.7	33	34.2	36.2
- Natural gas share	24.6	22.5	22.5	21.9	21.5	21	19.2	18.5
- Nuclear share	12.5	13.1	12.7	12.8	12.7	12.5	11.8	11.1
- Renewables share	19.9	21.6	22.6	22.4	22.3	22.3	22	22.1
Energy Intensity (2010=100)	67	64	62	61	61	59	56	52
Gross Electricity Generation (TWh)	3664	3532	3469	3461	3423	3336	3080	2804
SECURITY OF SUPPLY								
Import dependency	55.1	53.6	53	53	52.6	52.8	53.5	54.4
Net Energy Imports (2010=100)	96	89	86	85	83	82	78	74
Net Imports of Gas (2010=100)	105	91	88	84	81	78	67	60
Fossil Fuels Import Bill Savings compared to Reference (bn € '10) *(cumulative 2011-30)*	n.a.	-190	-285	-311	-346	-395	-503	-549
ENVIRONMENTAL IMPACTS								
GHG emissions reduction in ETS Sectors vs 2005	-36.1	-43.3	-45.3	-44.4	-43.3	-42.2	-41.8	-45.6
GHG emissions reduction in non-ETS Sectors vs 2005	-20.3	-30.5	-27.6	-28.7	-29.5	-30.5	-32.9	-35.3

	Reference	GHG40	EE27	EE28	EE29	EE30	EE35	EE40
SYSTEM COSTS								
Total System Costs, avg annual 2011-30 (bn €)	2067	2069	2069	2074	2082	2089	2124	2181
compared to Reference (bn €)		+1	+2	+7	+15	+22	+57	+114
Total System Costs as % GDP, avg annual 2011-30 (bn €)	14.30%	14.31%	14.31%	14.35%	14.40%	14.45%	14.69%	15.09%
compared to Reference (bn €)		+0.01%	+0.01%	+0.05%	+0.11%	+0.15%	+0.39%	+0.79%
Total System Costs in 2030 (bn €)	2338	2364	2361	2389	2423	2455	2632	2999
Total System Costs in 2030 as % GDP	14.03%	14.18%	14.16%	14.33%	14.53%	14.73%	15.79%	17.99%
OTHER ECONOMIC FACTORS								
Investment Expenditures , avg annual 2011-30 (bn €)	816	854	851	868	886	905	992	1147
Energy Purchases, avg annual 2011-30 (bn €)	1454	1436	1422	1417	1411	1401	1378	1365
Average Price of Electricity (€/MWh)	176	179	180	179	178	178	177	182
ETS price (€/t of CO2-eq.)	35	40	39	35	30	25	13	6
MACRO-ECONOMIC MODELLING								
Impacts on GDP (% change from Reference case) Results first for general equilibrium modelling and secondly for post-Keynesian modelling	€ 16.766 bn € 16.960 bn	n.a.	n.a.	- 0.13/ +0.75	n.a.	- 0.22 / +1.06	- 0.52 / +2.02	- 1.20 / +4.45
Impacts on employment (% change from Reference case) Results first for general equilibrium modelling and secondly for post-Keynesian modelling	219 million of people 232 million of people	n.a.	n.a.	+1.47 / +0.29	n.a.	+1.90 / +0.35	+ 2.53 / +0.62	+2.96 / +1.50