Key messages for Europe from the World Energy Outlook 2014

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The International Energy Agency released its World Energy Outlook (WEO) on the 12th of November, 2014. The report presents a strategic analysis of global energy markets with a focus on energy trends, emerging technologies, markets and emissions. Three scenarios are described in the WEO; A Current Policies Scenario (CPS), takes account of policies that have been formally adopted as of mid-2014, the New Policies Scenario (NPS), also includes relevant proposed policies, and the 450 Scenario, assumes policies that may limit the rise in long term global average temperatures to 2 degrees Celsius. The three scenarios presented demonstrate, in particular, the impact of the policy choices made by governments: the rates of growth in energy use and the types of fuels supplied are markedly different across those scenarios. This Hot Energy Topic assesses findings from the WEO and derives key messages for the EU.

Energy Trends

In the European Union (EU) the decline in primary energy demand until 2040 continues at much the same rate as over the past decade (around -0.2%/year).

Within the WEO energy demand is primarily driven by GDP, population and energy prices. Energy demand tends to grow in line with GDP, though typically at a lower rate especially in the most advanced economies. In WEO-2014, world GDP growth averages 3.4% per year over 2012-2040 (EU 1.6%). Economic growth slows or peaks in all parts of the world during the projection period. WEO-2014 assumes world population expands from 7.0 billion in 2012 to 9.0 billion in 2040 with the EU seeing a slight increase in population from 507 million in 2012 to 516 million in 2040. A feature of the changing global energy map is the increasing predominance of non-OECD countries in global energy demand as a result of much faster rates of economic and population growth. The patterns of trade are also changing, in line with the new geography of global production and consumption.

		New Policies			450 Scenario		
	2012	2020	2030	2040	2020	2030	2040
Energy-related CO2 emissions (GtCO2)	3.4	3.1	2.7	2.3	3.0	2.0	1.4
Energy intensity (toe/in €2013 MER*)	0.07	0.06	0.05	0.05	0.06	0.05	0.04
Carbon intensity (tCO2/toe*)	2.1	1.9	1.7	1.5	1.9	1.4	1.0
Clean energy investment* (billion €2013/year)	82	129	161	162	281	263	256
Energy-import bills (billion €2013/year)	398	392	407	398	358	283	202

Notes: Clean energy in this table includes energy efficiency, renewables, nuclear, and CCS in the power and industry sectors. Energy efficiency investment is measured relative to a 2012 baseline efficiency level. MER = market exchange rate; tCO2/toe = tonnes of carbon dioxide per tonne of oil equivalent

Table 1: Energy- and Climate-related indicators by Scenario for the EU

The INSIGHT_E project is funded by the European Commission under the 7th Framework Program for Research and Technological Development (2007-2013).

This means a major shift in trade of energy away from the Atlantic Basin towards the Asia-Pacific region.

Figure 1 presents the EU primary energy by fuel and scenario (more details are in Appendix A). In the New Policies Scenario for the EU, the role of coal and oil in the total energy mix decreases particularly fast (the share of coal drops by about half to just 9% and oil decreases by 10% to reach 22% in 2040), while the share of nuclear remains stable, that of renewables rises more than one-quarter and that of natural gas demand also expands modestly. These trends are primarily driven by the power sector.

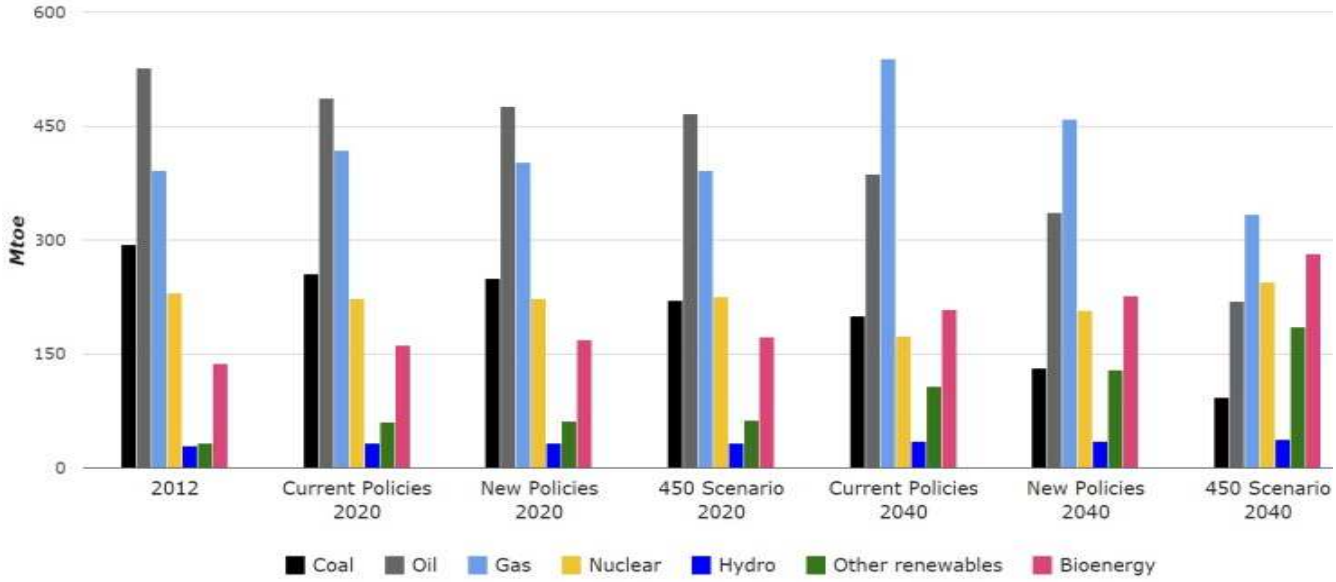

Figure 1: EU Primary Energy by fuel and scenario (Mtoe)

The Power Sector

Europe is faced with a competitiveness/capacity dilemma. Higher market prices are required to encourage investment in generation capacity in Europe 'to keep the lights on', but higher prices risk increasing end user bills adding to the current strain on households and competitiveness of industry in the EU.

Wholesale electricity prices in the USA are estimated to remain the lowest in the world, increasing by 50% between today ($50/MWh) and 2040. This is largely due to the abundance of low cost coal and gas. In the EU, wholesale electricity prices in the NPS are also projected to increase by 50-60% from about $70/MWh to $110/MWh by 2040. In 2040, European industrial prices are expected to be double US prices while Chinese industrial prices are expected to be 75% higher than the United States.

Within the power sector in Europe, current market prices are not sufficient to cover the fixed costs of all plants operating on the system, a situation that is expected to become more critical in particular due to the current overcapacity induced by the economic slowdown in recent years and the penetration of renewables, which predominantly have fixed costs. The WEO states that immediate reform of the wholesale market is required in Europe if prices are to rise sufficiently high to encourage investments, particularly investments that rely on competitive wholesale prices to recover costs. Enabling investments is all the more important as Europe faces some stark challenges to replace existing capacity. The WEO estimates that up to 60% (630 GW) of generation capacity in the

European Union is expected to be retired by 2040 and an additional 900 GW of new capacity will be required, over two thirds of which are renewables, with a cumulative total cost of €1.5 trillion by 2040 (about €65bn/year on average).

Within these capacity assumptions, phase out of nuclear capacity is assumed in Germany by 2022 and in Belgium by 2025. Nuclear power output in the NPS falls across Europe out to 2040 by 10% as only 70% of existing capacity is replaced. Almost 75% of existing OECD nuclear capacity is over 25 years old and this raises important questions about the scheduling of retirements and construction of new nuclear plants. According to the WEO (which has a special focus on nuclear energy this year), nuclear power is and will remain an important part of energy policy as it inherently works on long timelines. However addressing public concerns about safety, costs, proliferation and long-term waste disposal is of paramount importance.

Fossil Fuels

The transition to a low carbon energy system requires strong adjustments for fossil fuel industries in Europe.

As a reflection of the EU's now long-established environmental commitment, the share of fossil fuels in total EU primary energy demand is expected to decline in all scenarios (from 74% in 2012 to 61% in the NPS scenario). It stems from sharp decreases in oil and coal demand (respectively -1.6% and -2.9% per year on average) while gas demand is set to increase modestly (+0.6% per year on average), although returning to its 2010 level by 2035 only. This downward trend for oil and coal demand is reflected in all scenarios while the upward trend for gas is verified in all but one scenario (450 Scenario), where it starts decreasing from as early as 2020. In the NPS the increase in fossil fuels import prices (around +24% for oil, +20% for gas and +28% for steam coal by 2040) is counterbalanced by the demand projections and the overall import bill of the EU remains at a similar level as in 2012.

In this new landscape where fossil fuel demand shifts to non-OECD regions and Asia in particular, the EU's coal, oil and associated petrochemical industries are pressured to adapt, with potentially significant job losses. Considering that both refineries and coal mines are significant job providers, closures in these sectors will need to be carefully anticipated.

The IEA suggests that Europe will continue to face a large excess of refinery capacity, as new capacities are built elsewhere (China, Middle-East, India, Africa, Brazil and S-E Asia) and global demand for refined product sees an increase of only 10mb/d by 2040 – while demand in Europe drops by 3.8mb/d mostly due to efforts in transport networks and mobility efficiency.

With regards to the EU's demand for coal, the resurgence observed over the last number of years is not expected to last. Consequently, coal production in OECD Europe is expected to continue its decline at a 3.1% rate per year on average. Another factor leading to mines being closed in Europe is the competition from international suppliers. Overall, coal imports to Europe are expected to decrease but the import dependency is actually rising to 56% (compared with 46% today) as the EU's production decreases faster than demand.

In addition, the IEA's gas demand outlook for the European Union may also raise the question of how to justify and trigger further investments in infrastructures, in a context where consumption is expected to remain reasonably stable. The declining domestic production, the need to diversify supplies and to complete the internal market would call for the development of new infrastructures, but the costs implied would have to be spread over constant volume sales, which could lead to acceptability issues for final customers. The IEA's projections are a reminder of the need to define in advance how the sector should best adapt, as a way to ensure that the energy transition is socially sustainable as well.

Security of Supply

While future developments may improve the EU's gas security of supply outlook, new risks are identified for long term oil supplies.

Remaining economically exploitable resources of fossil fuels and uranium worldwide are easily sufficient to meet the projected growth in global energy demand through to 2040 in all scenarios. Inter-regional trade is also set to provide for a gradually rising share of global energy supply.

Securing gas supplies remains a strong issue for the EU, especially because the decrease in conventional gas production is set to continue and unconventional resources such as shale gas are not expected to compensate for this loss, with imports as a share of demand rising from 64% to 81%. However, the IEA points to a number of facts which could be beneficial to the EU's security of gas supplies: restored volumes from North Africa, new deliveries from the Southern corridor and lastly more flexible LNG markets. New LNG exporters (i.e. North America, Australia, East Africa) may not direct significant volumes to the EU itself but they will contribute to reducing tightness on the global LNG markets. The EU would be able to make better use of its ample regasification capacities, translating into more diversified and flexible supplies. With more buyers and sellers, the global LNG markets are expected to become more open and to progressively acquire the characteristics of a standard commodity market. However, Russia would remain a significant supplier to Europe and would be able, if it chooses to do so, out-compete other suppliers on price; Russia is expected to diversify its export destinations and reduce its revenue dependence to Europe.

More broadly, the WEO-2014 argues that pricing mechanisms for internationally traded natural gas around the world are expected to become more flexible and sensitive to the underlying supply and demand balance in each market. This is a gain in terms of security of supply and it would also support the move towards hub-based pricing and short term trading, as foreseen in the Gas Target Model. For the EU to maximize its benefits, interconnections between market areas would need to be sufficiently developed for each source to be able to spread across the European transmission network and compete with one another.

The outlook is less positive when it comes to oil supplies. According to the IEA, the current rise in non-OPEC production may divert the attention from the fact that OPEC resource holders, notably in the Middle-East, will play an increasing role in meeting long-term oil demand. Given the risks for oil production in this region and the long lead times for new upstream projects, a shortfall of oil production cannot be excluded. As the IEA does not anticipate significant oil production in the EU, reducing the reliance on oil can be presented as a cautious orientation as it tends to limit the exposure to potentially tight oil markets and higher prices.

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Renewables

Regulatory risks must be minimised including retroactive changes to subsidy schemes.

Among the OECD regions, the use of renewables grows particularly strongly in the European Union, where its share (NPS) in total electricity generation jumps from 24% in 2012 to 46% in 2040, thanks to both strong policy push and growing competitiveness. Almost 60% of the growth in renewables in the EU comes from wind power, which overtakes hydropower in the year 2020 to become the primary source of renewables generation, and contributes 20% to total power generation by 2040. Renewables are expected to make up around 70% of EU new power capacity investment in value.

However the rapid deployment of wind and solar will require careful attention both to the design of electricity markets and the nature of support schemes. The expansion of non-hydro renewables has so far been underpinned by

widespread government support; EU Member States subsidies to renewables are still expected to grow and reach a plateau of $80bn per year around 2020 then decrease (with the EU continuing to be the largest financial supporter of renewables in the future). While providing this support, governments should ensure as much competition as possible between different renewable energy technologies to guarantee decarbonisation is delivered at the lowest cost. They should also aim to withdraw from fostering renewables as soon as they can compete on their own, though giving sufficient notice to safeguard continuing financial flows into the sector. With the right conditions, the risk of stranded investments in renewables can be lowered, helping to boost their expansion.

In the European Union, biofuels made up an increasing share of total liquid fuel demand for road transport since 2005, reaching 5% in 2012. In the New Policies Scenario, total EU biofuels consumption is projected to rise from 0.3 mboe/d[1] in 2012 to 0.7 mboe/d in 2040, contributing to 16% of road transport energy consumption, as advanced biofuels increasingly making inroads as their economics improve – however not all of this biofuels volume is produced domestically. In the NPS bioenergy[2] grows from a share of 8% of total primary energy demand in 2012 to 15% in 2040 with the greatest increase seen in the final consumption of energy in buildings of 31% (22 Mtoe) and Transport 39% (14 Mtoe).

[1] mboe/d = million barrels of oil equivalent per day.
[2] Bioenergy is the energy content in solid, liquid and gaseous products derived from biomass feedstocks and biogas. It covers solid biomass (fuelwood, charcoal, agricultural residues, wood waste and other solid waste), biofuels (liquid fuels, including ethanol and biodiesel) and biogas.

Energy Efficiency

The global economic potential for improving efficiency will not be fully realized without action by governments to encourage households and businesses to alter their spending and investments.

A renewed policy focus on efficiency is taking hold in many countries and the transport sector is in the front line. In the New Policies Scenario, energy intensity is expected to decrease by 1.8% annually to 2040, a rate about twice as high as that achieved over the last two decades. Looking specifically at primary energy savings by sector, the power sector accounts for less than 5% of total savings. The buildings and transport sectors are expected to save the most (31% each), followed by industry (26%). Most of the expected energy savings in transport reduce the consumption of oil and biofuels, while in buildings and industry the savings are primarily electricity.

However intervention may be necessary in order to overcome the manifold and divergent barriers to energy efficiency, including the lack of visibility, low awareness, limited know-how and fragmentation of energy consumption. These policies may include incentives to adopt energy management systems and to undergo energy audits, the phase-out of fossil-fuel subsidies, the enhanced use of energy service companies and fiscal incentives. Making test cycles more representative of real life conditions would also be an important step in attaining higher fuel efficiency levels in transport.

Financial constraints do not generally pose a problem for energy efficiency spending by households but, especially for larger amounts, like for renovation or positive energy-buildings, financing mechanisms are needed that address the issues related to high upfront costs. The advantage of residential energy efficiency measures is not only the reduction in energy costs, but also a drier and cleaner environment with more uniform temperatures and associated health benefits.

Policies to stimulate improvements in energy efficiency offer several other benefits: they can improve the stability and reliability of production systems, lower maintenance needs, improve product quality, reduce waste streams, boost disposable household incomes, raise economic growth and prosperity, foster the local energy industry, improve trade balances and cut airborne emissions of pollutants and greenhouse gases. Additionally, efficiency measures can help in part to address the concern, felt in some import-dependent regions, that relatively high prices for natural gas and electricity put their energy-intensive industries at a competitive disadvantage.

New Technologies

Increased spending on RD&D in emerging technologies is required.

Beyond the considerable decrease in renewable power technologies costs, especially PV and for the longer term CSP, the outlook does not assume any technological breakthrough such as CCS or cost-effective storage options. The outlook points to only modest growth in the electric vehicles fleet; however a breakthrough in battery and recharging technology could revolutionise road transport in the longer term. The WEO also assumes that some hydro plants need replacing and this may be conservative as these plants could be refurbished or repowered. Energy efficiency improves fastest in motor-driven systems, steam systems and furnaces for the provision of heat. A further factor is fuel switching, especially in space heating towards electric heat pumps.

The development and deployment of advanced energy technologies will have a major impact on the evolution of energy markets over the long term and on the achievement of economic competitiveness, socio-economic, energy security and environmental goals, not least of which those of limiting greenhouse-gas emissions. New ways of converting fossil fuels into higher value end-use products are set to play an increasingly important role in meeting global energy needs in the coming decades, e.g. Coal-to-gas, Gas-to-liquids, Coal-to-liquids and Coal-to-petrochemicals.

Further cost reductions and technological advances for solar photovoltaic (PV) could lead to even higher levels of deployment and further transform the way the world meets its rapidly growing demand for electricity. Strong cost reductions are expected for offshore wind as well, but they still require subsidies in most regions in 2040.

A principal factor in the long-term prospects for biofuels is the likelihood of commercialization of advanced technologies that offer higher yields and have better environmental credentials (including lower life-cycle carbon emissions, lower water requirements and avoid causing indirect land-use change). Cellulosic ethanol is a promising advanced biofuel that can be produced from many feedstocks, including agricultural and forestry residues, dedicated energy crops and forestry products. Algae-based advanced biofuels are also promising, with many research efforts under way to improve the efficiency of the process and reduce the costs of production. The IEA assumes that, as technologies advance, some forms of advanced biofuels will become commercial on a large scale around the start of the next decade however for this to occur long-term policies to encourage investment in advanced biofuel projects must be implemented.

Climate Policy

To shift energy sector investment onto a low-carbon track, the UNFCCC 2015 agreement will need to send a strong signal to private and public energy investors that all major countries are committed to long-term decarbonisation.

Achieving the 2° C objective requires urgent action now to steer the energy system onto a lower emissions path. The reductions in emissions in the 450 Scenario, relative to the NPS, result from the assumption of much stronger government policies (See Appendix

B). These measures include energy efficiency, limits to the use and construction of inefficient coal power stations, minimizing methane emissions from upstream oil and gas and accelerating the phase-out of fossil-fuel consumption subsidies. For the EU, this will mean significant shifts in the energy system and a deep change of the economics of fuels and technologies; all fossil fuel consumption is expected to decrease even faster and gas power plants are expected to move towards peak-load uses only.

Conclusion

This Hot Energy Topic presents summary messages for the European Union from the World Energy Outlook 2014. Key findings highlight important challenges for the power sector and fossil fuel sectors as Europe transitions to a low carbon energy system. Securing gas supplies will remain a strong issue for the EU and Russia is expected to remain a significant supplier of gas over the outlook period. However Europe maybe in a position to benefit from new sources of LNG in the medium to long term. In the transport sector, the outlook points to only modest growth in the electric vehicles fleet, however a breakthrough in battery and recharging technology could revolutionise road transport in the longer term. Bioenergy is expected to almost double its share in total primary energy to 2040 with strong projected uptake of bioenergy in the transport and building sector. Finally achieving the 2°C objective requires urgent action now to steer the energy system onto a lower emissions path. For the EU, this will mean significant shifts in the energy system and a deep change of the economics of fuels and technologies

For further reading or information, please visit www.insightenergy.org

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Appendix A

Scenario projections for the European Union

		New Policies		Current Policies		450 Scenario	
	2012	2020	2040	2020	2040	2020	2040
Total primary energy demand (TPED) (Mtoe)							
Coal	294	249	131	255	200	221	93
Oil	526	476	336	487	387	466	219
Gas	392	403	459	418	539	391	334
Nuclear	230	223	207	223	174	225	244
Hydro	29	33	35	32	35	33	37
Bioenergy*	137	169	226	162	209	172	282
Other renewables	33	61	129	60	107	63	186
Total	1 641	1 615	1523	1 638	1 652	1 571	1 395
Fuel input: Power generation (Mtoe)							
Coal	227	189	87	193	152	162	53
Oil	20	11	4	11	4	11	3
Gas	116	116	164	126	221	118	79
Nuclear	230	223	207	223	174	225	244
Hydro	29	33	35	32	35	33	37
Bioenergy*	54	66	83	65	80	66	94
Other renewables	30	56	111	55	95	57	151
Total	709	695	691	705	760	672	661
Fuel input: Other energy sector (Mtoe)							
Total	136	125	111	127	122	121	96
Electricity generation (Mtoe)							
Total	*42*	*39*	*39*	*40*	*44*	*38*	*34*

Total final consumption (TFC) (Mtoe)							
Coal	38	35	25	35	28	34	24
Oil	471	434	306	445	354	426	196
Gas	258	270	279	275	302	257	241
Electricity	241	255	284	259	315	249	271
Heat	48	51	56	51	61	49	49
Bioenergy*	82	101	141	96	127	104	186
Other renewables	2	5	18	5	13	6	35
Total	1 141	1 150	1 111	1 167	1 200	1 124	1 002
Final energy consumption: Industry (Mtoe)							
Coal	25	23	17	23	18	22	16
Oil	31	28	19	28	20	27	17
Gas	83	77	65	79	69	76	57
Electricity	87	91	90	92	97	90	84
Heat	16	16	14	16	14	16	12
Bioenergy*	23	28	32	29	35	28	36
Other renewables	0	0	1	0	0	0	3
Total	265	263	238	267	253	259	225
Final energy consumption: Transport (Mtoe)							
Oil	284	265	192	273	231	260	92
Electricity	6	7	11	6	10	7	28
Biofuels	15	22	36	18	30	22	60
Other fuels	3	4	9	3	6	4	15
Total	307	298	248	302	277	293	196
Final energy consumption: Buildings (Mtoe)							
Coal	10	9	6	9	8	9	6
Oil	56	47	22	50	30	45	17
Gas	157	173	191	177	213	162	154
Electricity	145	154	179	157	204	149	156
Heat	32	35	42	35	47	33	36
Bioenergy*	42	48	70	47	59	51	85
Other renewables	2	5	17	4	12	5	32
Total	445	471	528	480	572	455	486
Final energy consumption: Other (Mtoe)							
Total	124	118	97	118	97	118	95
Total CO2 emissions (Mt)							
Coal	1 137	960	415	984	699	845	179
Oil	1 408	1 263	873	1 296	1 024	1 232	502
Gas	898	924	1 048	959	1 238	895	714
Total	3 442	3 147	2 336	3 238	2 961	2 972	1 396
CO2 emissions: Power generation (Mt)							
Coal	940	782	282	801	554	671	90
Oil	62	35	11	36	12	35	9
Gas	271	272	378	294	513	276	163
Total	1 273	1 089	672	1 131	1 079	982	262
CO2 emissions: TFC (Mt)							
Coal	168	153	112	156	123	149	77
Oil	1 241	1 139	789	1 172	934	1 113	451
Transport	*852*	*796*	*576*	*820*	*694*	*781*	*276*
Gas	594	621	643	633	696	590	526
Total	2 003	1 913	1 545	1 961	1 754	1 852	1 054
*Includes traditional and modern uses of biomass							

Appendix B

Policies and measures in the European Union as modelled by scenario

Current Policies Scenario	New Policies Scenario	450 Scenario
Cross-cutting policy assumptions		
• EU-level target to reduce GHG emissions by 20% in 2020, relative to 1990. • EU Emissions Trading System. • Renewables to reach a share of 20% in energy demand in 2020.	• Partial implementation of the EU-level target to reduce primary energy consumption by 20% in 2020: o Partial implementation of the EU Energy Efficiency Directive. o National Energy Efficiency Action Plans. • Cautious consideration of the proposed climate and energy policy framework for 2030.	• 30% reduction in GHG emissions by 2020 compared with 1990. • Emissions Trading System strengthened in line with the 2050 roadmap. • Full implementation of the 2030 framework for climate and energy policies, as well as the EU Energy Efficiency Directive.
Power sector policies and measures		
• Climate and Energy Package: o Emissions Trading System. o Support for renewables sufficient to reach 20% share of energy demand in 2020. o Financial support for CCS. • Early retirement of all nuclear plants in Germany by the end of 2020. • Removal of some barriers to combined heat and power (CHP) plants resulting from the Cogeneration Directive 2004. • Industrial Emissions Directive.	• Extended and strengthened support to renewables-based electricity generation technologies. • Further removal of barriers to CHP through partial implementation of the Energy Efficiency Directive.	• Emissions Trading System strengthened in line with the 2050 roadmap. • Reinforcement of government support in favor of renewables. • Expanded support measures for CCS.
Transport sector policies and measures		
• CO2 emission standards for PLDVs by 2015 (130 g CO2/km through efficiency measures, additional 10 g CO2/km by alternative fuels). • Support to biofuels.	• Climate and Energy Package: Target to reach 10% of transport energy demand in 2020 by renewable fuels. • Fuel Quality Directive: Target to reduce the greenhouse-gas intensity of road transport fuels by 6% in 2020. • More stringent emission target for PLDVs (95 g CO2/km by 2020), and further strengthening after 2020. • Emission target for LCVs (147 g CO2/km by 2020), and further strengthening post 2020. • Enhanced support to alternative fuels.	• On-road emission targets for PLDVs in 2040: 45 g CO2/km. • Light-commercial vehicles: full technology spill-over from PLDVs. • Medium- and heavy-freight vehicles: 33% more efficient by 2040 than in New Policies Scenario. • Aviation: 55% efficiency improvements by 2040 (compared with 2010) and support for the use of biofuels. • Other sectors (e.g. maritime and rail): national policies and measures. • Fuels: retail fuel prices kept at a level similar to New Policies Scenario. • Alternative clean fuels: enhanced support to alternative fuels.

Industry sector policies and measures		
• Emissions Trading System. • Voluntary energy efficiency agreements in the following countries: Denmark, Finland, Germany, Ireland, Netherlands, Sweden and United Kingdom. • EcoDesign Directive (including minimum standards for electric motors, pumps, fans, compressors and insulation) • Industrial Emissions Directive: o Application of best available techniques. o Maximisation of energy efficiency. o Preventive measures taken against pollution.	• Partial implementation of Energy Efficiency Directive: o Mandatory and regular energy audits for large enterprises. o Incentives for the use of energy management systems. o Encouragement for SMEs to undergo energy audits. o Technical assistance and targeted information for SMEs. o Training programmes for auditors.	• CO2 pricing introduced from 2025 at the latest in all countries. • International sectoral agreements with energy intensity targets for iron and steel, and cement industries. • Enhanced energy efficiency standards. • Policies to support the introduction of CCS in industry.
Buildings sector policies and measures		
• Energy Performance of Buildings Directive. • EcoDesign and Energy Labelling Directive. • EU-US Energy Star Agreement: energy labelling of appliances. • Phase out of incandescent light bulbs.	• Partial implementation of the Energy Efficiency Directive. • Building energy performance requirements for new buildings (zero-energy buildings by 2021) and for existing buildings when extensively renovated. 3% renovation rate of central government buildings. • Mandatory energy labelling for sale or rental of all buildings and some appliances, lighting and equipment. • Further product groups in EcoDesign Directive.	• Zero-carbon footprint for all new buildings as of 2015; enhanced energy efficiency in all existing buildings. • Full implementation of the Energy Efficiency Directive. • Mandatory energy conservation standards and labelling requirements for all equipment and appliances, space and water heating and cooling systems by 2020.