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Top Key Messages around an EU 2050 Roadmap & Full responses to questionnaire

A. Top key messages around an EU 2050 roadmap

1. European emissions reductions by 2050 need to be on the order of 95%, and -40% by 2020

On 30 October 2009 the European Council stated that they supported 80-95% greenhouse gas emissions cuts by 2050. WWF-sponsored research echoes the results of other work which identifies a 95% cut as the appropriate target for Europe. Forty percent by 2020 is not an onerous target consider that the baseline (1990) is already 20 years behind us and that our current 2020 target (20%) is already close to being met.

The risk that a stable greenhouse gas concentration of e.g. 450 ppmv CO_2eq would result in global average temperature above 2°C in the long term is around 50%. At 400 ppmv CO_2eq, the risk is 30%**1**. Limiting concentrations to this latter figure implies a global carbon budget between 1990 and 2100 of 1800 GT CO2e without land use change and forestry. Under this constraint, global reductions would need to be 30% by 2020 and 80% by 2050.

There are several methodologies to divide this reduction between developed and developing countries, in the context of common but differentiated responsibilities. Among the most common are greenhouse development rights (GDR)**2**, common but differentiated convergence (CDC)**3**, and contraction and convergence (C&C)**4**.

In 'Sharing the effort under a global carbon budget'**5**, Ecofys and WWF demonstrate that the 2050 reduction obligation for Annex I regions, including Europe, would be -157% under the GDR framework (i.e. requiring responsibility for reductions far in excess of their own) and -95% under either of the other two methodologies.

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1 M. Meinshausen. (2005). *On the risk of overshooting 2°C.* Paper presented at the Scientific Symposium "Avoiding Dangerous Climate Change", MetOffice.

2 P. Baer, Athanasiou, T., and Kartha, S. (2007). *The right to development in a climate constrained world. The Greenhouse Development Rights framework*. Publication series on ecology, volume 1, Berlin: Heinrich-Böll-Foundation, Christian Aid, EcoEquity and the Stockholm Environment Institute

3 Höhne, N., M. G. J. den Elzen, and M. Weiss. (2006). Common but differentiated convergence (CDC), a new conceptual approach to long-term climate policy. *Climate Policy*, *6* , 181-19

4 A. Meyer. (2000). *Contraction & convergence. The global solution to climate change*. Schumacher Briefings, No. 5. Bristol, UK.

5 N. Höhne and S. Moltmann, 2009.

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These more 'lenient' approaches are the basis for WWF's contention that a 95% cut for Europe is appropriate: it is a fair level of effort that allows a better than even chance of helping the globe avoid greater than 2 degree warming, and retains the possibility of limiting it to 1.5 degrees.

A consequence of this 2050 goals is that 2020 reductions need to be around -40% to stay within the carbon budget and avoiding heroic assumption about rapid reductions post-2020.

2. Energy Demand: Importance & benefits of reducing energy demand

Reducing energy demand, through both behavioural change and energy efficiency measures, should be a key feature of EU energy policy. There is a substantial potential for reducing energy demand within the EU. Whilst the measures required to initially trigger the reduction in demand may have a cost attached to them, the ultimate savings that these measures would give customers and the reduction in the cost of decarbonising the power sector means that achieving substantial reduction in the EU's levels of energy demand would be of great benefit to the EU's economy in the long term.

For an energy savings targets to be effective, transparent and easy to monitor, these targets would be better expressed in absolute terms of energy use rather than by reference to a subjective "business as usual" scenario. Below are illustrations of the potential for reducing energy demand in the EU and at member state level, as well as an overview of the economic benefits of reducing energy demand.

Illustration at EU Level

In the recently launched *Roadmap 2050* study, the European Climate Foundation (ECF) makes clear that the EU's (currently non-binding) target of reducing primary energy consumption by 20% by 2020, which would then set the foundation for continuing to deliver energy efficiency gains of 1% to 2% each year out to 2050 (in addition to the 1-2% gains assumed in the baseline scenario), is absolutely key in the efforts to decarbonise the European power sector in a cost-efficient manner. **In particular, the ECF shows that energy efficiency measures that would deliver these levels of energy demand reduction could reduce the costs of the transition to a decarbonised power sector by up to 30%, by avoiding more expensive generation and transmission needs6**.

The *Roadmap 2050* study also refers to a recent study by Ecofys and Fraunhofer**7**, which concludes that the impact of energy savings policies in the EU will need to increase by a factor of nearly three times in order to reach the EU's 20% energy savings target by 2020. **Failure to do so would cost an estimated €70bn per year in unrealised potential savings to European energy consumers8**, a considerable missed opportunity for the EU and its

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6 Roadmap 2050: A Practical Guide to a Prosperous, Low-Carbon Europe, European Climate Foundation, April 2010, http://www.roadmap2050.eu/downloads. See Executive Summary to Volume 1 and Chapter 2 of the draft ECF study *'Energy Savings 2020: How to triple the impact of energy savings policies in Europe'*, September 2010, unpublished report.

7 'The Feasibility of Binding Energy Savings Targets in the EU' by Ecofys and Fraunhofer (Part 1: facts and figures, April 1, 2010, unpublished report).

8 Roadmap 2050: A Practical Guide to a Prosperous, Low-Carbon Europe, European Climate Foundation, April 2010, http://www.roadmap2050.eu/downloads. See Volume 2, *'Policy Recommendations'*, page 19.

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member states given the importance of ensuring continued public legitimacy and support for low carbon policies. The same study shows that the EU's aspirational 20% energy savings target could actually be met largely through cost effective measures.

Illustrations at Member State Level

The following examples show the potential for reducing energy demand at UK level and the benefits this could bring to the UK economy.

- In its first report, *'Building a low-carbon economy – the UK's contribution to tackling climate change'***9**, the UK's Committee on Climate Change (CCC) estimates that in the residential sector, there is technical potential to reduce emissions by almost 40 MtCO2, over half of which is through negative cost energy efficiency improvements and lifestyle changes, and with much of the remainder costing less than CCC's forecast carbon price of £40/tCO2.

- In the report *'Building a roadmap for heat'***10** commissioned by the UK's Combined Heat and Power Association (CHPA), the University of Surrey and Imperial College London showed that under the assumptions used by the CCC in its 80% CO2 emission reduction scenario for 2050, UK energy demand in 2050 will decrease to 46% below 2007 levels, which is considerably lower than most of the demand scenarios put forward by the illustrative pathways.

- In a report commissioned by WWF-UK and Greenpeace in 2008, *'Implications of the UK meetings its 2020 Renewable Energy Targets'***11**, Pöyry energy consultants looked into what a low energy demand scenario could look like for 2020 and 2030. Pöyry concluded that under a low-energy demand scenario, end-use demand in the UK could fall from approximately 1,800 TWh in 2008 to 1414 TWh in 2020 and 1274 TWh in 2030. This scenario was based on the UK's 18% energy saving target for the 2008-2016 period set out in the UK Energy Efficiency Action Plan 2007**12** (which would ultimately deliver savings of 272.7 TWh by the end of 2016), which was produced by DEFRA in accordance with the EU Energy End-Use Efficiency and Energy Services Directive. Therefore, this low energy demand scenario, whilst ambitious, was not based on irrational assumptions but on targets that the UK government had already set itself.

- The UK Energy Research Centre (UKERC) made it clear in its report, *'Making the transition to a secure and low-carbon energy system'* that energy demand reduction is key in making the transition to a low-carbon and resilient energy system. In particular, based on a study looking at "what might be reasonable changes to expect in the future"**13** in terms of future

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9 Building a low-carbon economy – the UK's contribution to tackling climate change, The First Report of the Committee on Climate Change, December 2008, http://www.theccc.org.uk/reports/building-a-low-carbon-economy, p. 212.

10 Building a roadmap for Heat, University of Surrey and Imperial College London, March 2010, http://www.chpa.co.uk/building-a-roadmap-for-heat---2050-scenarios-and-heat-delivery-in-the-uk_161.html, chapter 3.

11 Implications of the UK meeting its 2020 Renewable Energy Target, Pöyry energy consultants, July 2008, http://www.ilexenergy.com/pages/Documents/Reports/Renewables/July08_2020RenewablesTarget.pdf, Chapter 3.

12 The UK Energy Efficiency Action Plan 2007, DEFRA, http://ec.europa.eu/energy/demand/legislation/doc/neeap/uk_en.pdf.

13 See Footnote 1, page 104.

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energy lifestyles, **UKERC estimates that a combination of energy service demand change and efficiency improvement in the transport and residential sectors could reduce UK energy demand in these 2 sectors by more than 50% by 2050 compared to business as usual levels in that same year.** Not only is the potential for energy demand reduction key in helping reduce CO2 emissions, it is also compelling from an economic point of view. In particular, UKERC estimate in the same report that "in an energy system constrained to 80% carbon emissions reduction, the main effect of social and lifestyle change is to reduce the costs of delivering a low-carbon energy system, up to £70 billion"**14**.

4. Reducing demand in the transport sector through energy efficiency measures and electrification of vast part of the transport sector is key in helping reduce overall energy demand

The transport sector is currently more oil dependent than any other sector. After energy, it is the second largest emitting sector in the EU. It is also the only sector in the EU where emissions are continuing to grow. Decarbonising transport, and especially road transport, will not only reduce EU dependency on oil imports, it will also be required if the EU is to meet its carbon reduction targets by 2020 and 2050.

An EU 2050 Roadmap for Transport must focus on three aspects: energy efficiency, electrification and demand reduction.

Energy efficiency measures should include:

- Strengthening of EU CO2 emissions standards for new sales of internal combustion engine vehicles (ICEVs), currently set at 130g/km from 2012 and 95g/km from 2020
- Enforcement of ICAO's 2% per annum fuel efficiency target for EU airlines to 2020 and beyond

Electrification measures should include:

- Creation of the right conditions and infrastructure to support the rapid ramp up of EVs, including…
- EU support for a decarbonised, integrated European grid to ensure that EVs are powered by renewable energy
- Roll-out of an EU-wide, standardised charging infrastructure, with compatible charging technology

Demand reduction measures should include:

- EU support for road and congestion charging
- More encouragement of cycling, walking and public transport as alternatives to driving

14 See Footnote 1, page 103.

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- More encouragement of rail and conferencing technologies as alternatives to flying
- An aviation charge for increasing EU revenue as well as VAT and fuel duty on intra-EU flights

Illustrations at Member State Level

The Republic of Ireland has already planned the roll out of infrastructure and ownership of charging points and electricity. Ireland has a target of 10% of all cars on the road to be EVs by 2020, with 1500 charging points to be installed by 2011, including 30 fast charging points at 60km intervals between major towns. Ireland will also provide 2000 home charging circuits for the first 2000 EV owners.

France is offering a €5,000 subsidy (grant) on the purchase of EVs (until 2012), has mandated EV charging for all new building developments and is encouraging ramp up by ordering a public/private fleet of up to 50,000 EVs with the possibility of expansion to 100,000.

WWF-UK's soon to be published EV report shows that if EVs are to make a difference at reducing fuel demand and carbon emissions, they will have to represent 15% of new car sales by 2020 and 20% of new car sales by 2030. Assuming decarbonisation of the UK grid and together with ICEV improvements and demand management measures, EVs can help to deliver an 80% reduction in fuel demand from cars and a 75% reduction in car emissions by 2030.

5. Priority should be given to increased investment in renewable energy over other forms of electricity generation

Decarbonising the EU's power sector is key if EU member states want to meet their climate change commitments. In its forthcoming 2050 roadmaps, the EU should give a clear priority to investment in renewable energy. Not only is a large-scale deployment of renewable energy in the EU technically feasible, it also provides the EU with its best chance of decarbonising its power sector, without endangering energy security (as the EU would be relying on its own indigenous energy sources that will always be available) and whilst providing great benefits to the EU economy through the creation of a substantial number of new jobs in the EU's renewable energy industry.

Below are examples of the potential and benefits of a large scale deployment of renewable energy both in the EU and at Member State level.

Illustration at EU Level

The European Climate Foundation's Roadmap 2050 study found that **100% renewable energy future in Europe, with limited backup generation, was technically feasible without endangering system reliability and at a cost that was not substantially higher than the cost**

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of other pathways to decarbonise the power sector, as long as Europe invests in interconnection infrastructure to connect the different national grids (see section 4 below).

Illustrations at member state level

The great environmental, economic and energy security potential offered by renewable energy was well reflected in the UK's Offshore Valuation Report. This report, recently prepared by the UK's Department of Energy and Climate Change (DECC) and various players in the energy industry, showed that **by just using 29% of the UK's practical offshore resource, the UK could install an offshore renewable energy capacity of 169GW that could enable the UK to become a net exporter of electricity by 2050, creating 145,000 UK jobs in the process and generating £62bn of annual revenues to the UK's offshore renewable energy industry.** The report found that the UK could even become a net exporter of energy by using 76% of its practical offshore resource to deploy offshore renewable energy. These assumptions were based on a high level of electricity demand by 2050, envisaging a 74% increase in electricity demand by 2050 (which is much higher than our proposed scenario), implying that if the UK was successful at substantially reducing its demand for energy, an even smaller amount of the UK's offshore resource would have to be used to make it an electricity or energy exporter**15**.

3. Investment in grid infrastructure is the cheapest way to guarantee the reliability of the EU's energy system and effectively manage the variability of wind energy at EU level

We believe that the building of more interconnection infrastructure between European grids is absolutely key in helping to decarbonise the power sector. The European Climate Foundation's Roadmap 2050 study found that **the building of interconnection between European states was the cheapest and most efficient way of dealing with the variability of renewable energy**, by in particular helping to spread that intermittency over a much wider geographical area.

The report also found that with better interconnection infrastructure between European states, the level of backup generation in an energy system with a high volume of renewable energy would actually be very limited. In particular, the report concluded that **in an European electricity system with 80% renewable energy, backup plant would only need to operate with a load factor (i.e. a utilisation rate) of 5%, increasing to 8% in a 100% renewable energy system.** This low level of backup generation could be met for example by a limited number of plants equipped with carbon capture and storage technology if the technology is proven or by efficient gas-fired combined heat and power plants.

4. New nuclear power stations are not necessary to decarbonise the power sector in a safe and reliable way.

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15 The Offshore Valuation Report: A valuation of the UK's offshore renewable energy resource, 2010, http://www.offshorevaluation.org/downloads/offshore_valuation_exec.pdf

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The ECF's Roadmap 2050 study shows that as long as the right levels of investments are made in new renewable energy and interconnection capacity and that the EU is successful in achieving its aspirational energy efficiency targets, new nuclear and coal CCS plants "**are not essential to decarbonise the power sector whilst safeguarding system reliability"**.

The construction of new nuclear power stations is extremely complex and particularly expensive. In particular, the World Nuclear Industry Status Report 2009**16**, commissioned by the German Federal Ministry of Environment, Nature Conservation and Reactor Safety, makes clear that **"while many industries experience declining costs as they move out of their technological learning curve, the nuclear industry continues to face steadily increasing costs on existing construction and future cost estimates"17**. In particular, the same report refers to the May 2009 nuclear investment cost estimate update by the Massachusetts Institute of Technology (MIT), which doubled an earlier estimate from $2,000 to $4,000 cost (excluding financing) per installed kilowatt. The flagship EPR project at Olkiluoto in Finland provides a very telling example of the extreme cost and timing difficulties faced by the nuclear industry. It is estimated that the project is more than three years behind schedule and at least 55% over-budget, reaching a total cost estimate of €5 billion ($7 billion) or close to €3,100 ($4,400) per kilowatt.

In addition to the cost and timing complexities associated with building a large number of new nuclear power stations, there is also a significant shortage of a skilled workforce to deliver the growth in nuclear power contemplated by some European governments. In particular, the World Nuclear Industry Status Report 2009 points out that the "lack of a trained workforce and massive loss of competence are probably the most difficult challenges for proponents of nuclear expansion to overcome"**18**. It is very telling that this problem will include countries such as France, which probably has the strongest base of nuclear civilian competence, where 40% of EDF's nuclear staff is set to retire by 2015.

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16 The World Nuclear Industry Status Report 2009, Mycle Schneider, Steve Thomas, Anthony Frogatt, and Doug Koplaw, April 2009. Report commissioned by the German Federal Ministry of Environment, Nature Conservation and Reactor Safety, http://www.nirs.org/neconomics/weltstatusbericht0908.pdf.

17 http://www.nirs.org/neconomics/weltstatusbericht0908.pdf, see page 7.

18 http://www.nirs.org/neconomics/weltstatusbericht0908.pdf, see page 6.

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Roadmap 2050 consultation: full reply

7) The EU has put in place a regulatory framework related to climate and energy. Which of the following EU legislations you expect to be the most effective in terms of delivering emission reductions by 2020 and beyond? (select maximum 4) -multiple choices reply- (optional)

EU ETS (European Emission Trading Scheme) Directive
Effort Sharing Decision
Renewable Energy Directive
Eco-design of energy-using products Directive
Energy Labelling of products Directive
Directive on Cogeneration (CHP)
Directive on end-use energy efficiency and energy efficiency services (ESD)
Recast Energy performance of Buildings Directive
Fuel quality directive
Regulation to reduce CO2 emissions from passenger cars
Proposal for a Regulation to reduce CO2 emissions from vans
Proposal for a revised Eurovignette Directive
Proposal for a Car Labelling Directive
Aviation in EU ETS Directive
CCS Directive
Regulation on substances that deplete the ozone layer
Waste Framework Directive

8) Do you have any comments on the policies evaluated in the previous question? Do you have any comments on any other policies? -open reply- (optional)
What these pieces of legislation cover and their potential to deliver emission reductions are in fact two rather separate issues. In principle the EU ETS should be a major driver of reductions, but we see that, due to consistent over-allocation as well as CDM credit it is unlikely to deliver domestic action by 2020, and is only on a pace to cut emissions 70% by 2050 in covered sectors, whilst the power sector would essentially need to decarbonise by 2040 to permit a 95% economy-wide cut by 2050. In addition, the EU ETS has not driven the necessary investment on energy efficiency in the covered industries.

We note other specific points:

- ETS and effort sharing targets need to be in line with a 2050 goal of 80-95%, meaning a domestic emission reduction target by 2020 of at least 30%, preferably 40%.
- The ESD has missed the mark: a new Directive needs to tackle the 2020 energy saving target head-on by making it binding, and providing better guidance on market design and funding that will in fact lead to an energy services market being created, as well as placing energy savings obligations on power companies.
- The EPBD has usefully extended its scope but has weak enforcement rules and does next to nothing to ensure that renovation rates at a high standard of efficiency are

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sped up.

- The EU is creating a large biofuels market through the RED and is responsible for ensuring its sustainability – both direct and indirect effects both in terms of GHG emissions and social and ecological sustainability need to be fully accounted for.
- The RES Directive has several weaknesses, e.g. sustainability criteria of solid biomass is missing, and criteria for biofuels are incomplete – for example treatment of ILUC.
- Taking renewable energy goals beyond 2020 will be facilitated by effective infrastructure planning and legislation.
- The Industrial emissions directive missed the opportunity of instituting an emissions performance standard on the largest EU power emitters, but this could be rectified in future, for example through the review of the CCS directive.
- Car CO2 emissions standards were watered down under industry pressure but once put in place the reaction was immediate, showing the potential for significant tightening.
- The Ecodesign of Energy Using Products Directive is one of the most successful pieces of legislation in reducing energy consumption. However, the current process to adopt implementing measures could be further improved by setting clearer deadlines to avoid unnecessary delays in their adoption, as in the case of the long-awaited measure on boilers and water heaters.
- The energy taxation Directive needs to allow for taxation of bunker fuels to provide member states the chance to address this large and growing source of emissions.

9) The EU will need a diverse portfolio of technologies to build a low-carbon future. Some examples of potential technologies and energy efficiency solutions are carbon capture and storage, renewable energy technologies, electric vehicles, fuel cells, smart grids, heat pumps, cogeneration, next generation nuclear power, zero emission buildings, etc. Which technologies do you think will be the most important in achieving a low carbon economy by 2050 and how can the EU foster their development and deployment? -open reply- (optional)

The question states without justification that all of the named technologies are 'needed'. This is not the case – there are any number of 2050 scenarios that do not rely on nuclear energy, for example, and any inclusion of CCS can only be called speculative. For instance, the recent Roadmap 2050 Report published by the European Climate Foundation showed that a European electricity system based on 100% renewable energy system was technically feasible, without endangering system reliability and at an economically affordable cost. WWF is also preparing a global 100% renewable energy vision that will be released in January 2011.

The EU will need a systemic approach in the transition to a low carbon economy. Every credible low-carbon energy scenario starts with controlling energy demand – for instance, the Roadmap 2050 report referred to above highlighted that energy demand reduction measures could result in a reduction of the costs of decarbonising the power sector by 30%, thereby avoiding the construction of up to 440 mid-sized coal power stations. Then, we need to use a diversity of renewable energy solutions, enabled by smart grids.

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But in view of deep decarbonisation needs by 2050, it's important that solutions are realised in every part of the economy; the EU will need to increase the implementation of truly transformative solutions – incremental improvements are necessary but will not suffice. For example, the EU should make sure to use the full potential of an ICT infrastructure to enable decarbonisation of societal functions (e.g. travels, transports, education etc); we need to investigate biomimicry (e.g. algae for water purification and biomass, enhanced materials, green chemistry) for radically new ways of providing goods and services using substantially less energy and resources. Around 40 percent of the primary energy demand are consumed by the buildings sector, therefore at least doubling the renovation rate of existing buildings should be one of the primary goals of EU action in the field of energy efficiency.

Finally, bringing low carbon solutions to the market at speed and scale is not only about the technologies. The introduction of innovative business models that rewards closed-loop management of goods and service needs to be stimulated.

10) What are in your opinion the most important initiatives the EU should pursue in the next five to 10 years to secure a successful transition towards a low carbon economy by 2050? -open reply- (optional)

- A 40% 2020 reduction target of which at least 30% will be achieved within the EU, with appropriate adjustments to ETS, effort sharing and other legislative instruments;
- A 95% 2050 target to accompany a comprehensive assessment of policies to reach the goal.
- The EU should strive to achieve an international legally binding agreement on climate change.
- Redirection of public funding toward the public good: ensuring European expenditures not only avoid negative impacts (climate proofing) but also contribute to deep reductions. This will mean a significant realignment in most funding areas. Cohesion policy only spends 2.9% on energy, and project implementation is lagging behind.
- Prioritisation of infrastructure in the long-term interest, i.e. electricity above fossil fuels; current EU plans for access to oil and gas are non consistent with a rational phase-out of their use in the coming decades. Within electricity infrastructure integration of renewable energies should be prioritized.
- Ensuring no unabated coal power is built in Europe from now on, and no unabated gas from 2020. Theoretically the ETS could have this effect but not with the current design. An emission performance standard would be an effective means to ensure this.
- Sharpening the targets and implementation of existing legislation, including:
- A binding primary energy saving target by at least 20% by 2020 that is legally binding: a mandatory target will provide a framework that drives actions on energy savings at the EU and national level and ensure accountability, urgency and focus.
- Tougher targets for the CO2 and cars legislation.
- A standard for efficiency renovation rates of 3% per year. Effective EU legislation to improve the energy performance of existing buildings, EU funding program to foster renovation efforts.

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11) The EU Emissions Trading Scheme is a central element of EU climate policy. The EU wants to foster international climate action by reinforcing international carbon markets, e.g. by making links among emissions trading systems and by further developing crediting systems. What elements do you think should go into the EU low-carbon roadmap? (e.g. bilateral agreements to recognise international allowances and credits, sectoral crediting systems, separate financing mechanism for the purchase of international credits from developing countries, etc.) -open reply- (optional)

The cap under the post 2012 phase of the EU ETS should be adjusted in order to take into account of the combined effects of overallocation and the economic downturn with the goal to enhance the EU carbon price thus stimulating investments in renewables and energy saving technologies.

The EU 2020 objective should be adjusted to a 40% reduction target, of which minimum three-quarters of the reduction effort is to be achieved within the EU and not through offset mechanisms. The EU ETS should be adjusted to the -95% emission reduction path by 2050. An increase in the overall EU emissions reduction target must therefore lead to a tighter ETS cap, and in particular to doubling of the annual linear reduction factor.

Fifty percent of the EU ETS auctioning revenues should be earmarked to support international financial commitments to climate change, but not counting towards Official Development Aid objectives, nor with the aim of generating reduction offsets. The remaining fifty percent of revenues should be used to advance the transition to clean, sustainable, energy-efficient and prosperous European economy.

The current international offset market mechanisms should be improved significantly on issues such as long term contribution to a low-carbon economy, additionality and sustainable development. In the long term, these project-based instruments should be replaced by sectoral mechanisms that contribute to a low-carbon development path in host countries and to a level-playing field globally.

All linkages between the EU ETS and other emission trading systems should take into account impacts on the EU carbon price and should be made under comparable conditions particularly in terms of cap. A steadily increasing EUA price signal is important to guide investments in energy savings and renewable energies.

12) Achieving a low-carbon future means investing in the medium to long-term. How can the EU roadmap help to create a stable environment to encourage investment in low carbon technologies? Would it be a good idea to consider a mid-term objective for 2030 and, if so, in what form? -open reply- (optional)

There's no lack of resources, the question is how investments are allocated according to the 2050 climate scenarios. The EU needs to clarify the investment requirements 2010-2050 and commission key private financial market actors to participate in designing an enabling framework that will materialize the investments needed. This means setting us off on the

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right foot with a meaningful 2020 target (e.g. 40%), and an endpoint target for 2050 (95%). Once, but not before, these are established the 2050 target may very well be marked by milestones per decade.

Low carbon investment targets must be implemented along the entire financial market value chain, from institutional funds to venture capital. These investments need to be supported by: (a) long term (>10 years) and harmonized EU wide regulations and incentive programmes, including ambitious green procurement with high requirements not only for energy efficiency but also for new proven but not yet widely distributed technologies; (b) EU recognizing its role as public funder, i.e. by providing guarantees and risk reduction for investments initiatives in low-carbon solutions while commissioning execution to private financial market actors; (c) facilitating the development of buy-side financing instruments as well to stimulate demand for low carbon solutions.

It is also important to note that investment certainty goes paired with stability in policy design: already the EU ETS has shown its vulnerability to variations in the market and in policy choices that make for a variable price signal. The primary effect is therefore to influence current operational and short-term investment decisions. The ETS could be accompanied by a framework providing longer-term certainty such as an EU-wide emissions performance standard.

Lastly, it is imperative to ensure phasing out and eventual removal of fossil subsidies, and the recycling of these amount into green economy.

13) We want to cut emissions in the EU by 80% to 95% by 2050. Some of the measures needed to achieve this could bring about more sustainable growth, extra jobs, accelerated innovation, cleaner air, increased energy security and lowering our vulnerability to external energy shocks. Which of these do you think should be top of the list? What should the EU do to maximise the benefits you think should be delivered in priority by future climate action? -open reply- (optional)

There are a number of studies indicating the least-cost pathway to 2050 decarbonisation, as well as several indicating the employment, social and health impacts of different policies. We highlight the following:

- RECIPE – a Report on Energy and Climate Policy in Europe, conducted by the Potsdam Institute for Climate Impact Research (PIK) and four other European research institutes for Allianz and WWF found that effective climate protection measures would cost just one year of delayed economic growth by 2050. However, wasting the next decade before taking meaningful action on climate change would result in an increase of mitigation costs of at least 46 % compared to early action.
  http://wwf.panda.org/who_we_are/wwf_offices/germany/?179241/New-recipe-for-a-fast-acting-Europe-to-profit-from-going-it-alone-on-climate-action
- WWF published a report “Green jobs for Europe” (June, 2009, http://wwf.panda.org/wwf_news/?167022/Going-green-is-where-the-jobs-are-new-study) showing that green industry is becoming mainstream – already there are at least 3.5 million direct green jobs in energy, efficiency and transport in Europe; this eclipses the amount in heavy industries like cement and steel.

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- Central European University showed that a concerted programme of building retrofits in Hungary would generated 131,000 jobs by 2020. It would also cut January peak gas demand by 59% by 2030, showing both the cost savings and energy security potential of energy savings. http://3csep.ceu.hu/sites/default/files/field_attachment/project/node-6234/employment-impactsofenergyefficiencyretrofits.pdf.
- A report by Bloomberg for Novozymes (September 2010, http://www.bioenergy.novozymes.com/files/documents/BNEF_report_nextgeneration_biofuels.pdf) demonstrated that a sustainable use of agricultural wastes in Europe would be sufficient to replace 52 to 65% of European petrol with second-generation bioethanol, saving €31bn per year from 2020, and creating a million person-years of employment, most of which dispersed in rural areas around Europe.
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15) Do you have success stories that could lead to new initiatives for steering EU transition to a low-carbon economy you wish to highlight? Please add other further comments or suggestions here if you wish. -open reply- (optional)

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- WWF Germany's 'Modell Deutschland/Blueprint Germany' studies in detail how to reach deep decarbonisation by 2050, indicating solutions across the whole economy. http://www.wwf.de/themen/klima-energie/modell-deutschland-klimaschutz-2050/
- WWF Climate Savers (panda.org/climatesavers) is a global leadership platform which positions multi-national corporations at the forefront of the low-carbon economy. Member companies set sector-leading targets for GHG reductions and work with other companies, suppliers and partners to implement innovative solutions. A case study on innovation among Climate Savers companies includes creative ideas in renewable energy generation, management initiatives designed to motivate and fully involve staff, adaptation of business models and cutting back travel through the use of leading edge telepresence solutions (http://wwf.panda.org/what_we_do/how_we_work/businesses/climate/climate_savers/climate_savers_publications/?184823/WWF-Climate-Savers-Innovations-Case-Studies)
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A. Full responses to questionnaire
B. Top Key Messages around an EU 2050 Roadmap

A. Roadmap 2050 consultation: full reply to questionnaire

7) The EU has put in place a regulatory framework related to climate and energy. Which of the following EU legislations you expect to be the most effective in terms of delivering emission reductions by 2020 and beyond? (select maximum 4) -multiple choices reply- (optional)

EU ETS (European Emission Trading Scheme) Directive
Effort Sharing Decision
Renewable Energy Directive
Eco-design of energy-using products Directive
Energy Labelling of products Directive
Directive on Cogeneration (CHP)
Directive on end-use energy efficiency and energy efficiency services (ESD)
Recast Energy performance of Buildings Directive
Fuel quality directive
Regulation to reduce CO2 emissions from passenger cars
Proposal for a Regulation to reduce CO2 emissions from vans
Proposal for a revised Eurovignette Directive
Proposal for a Car Labelling Directive
Aviation in EU ETS Directive
CCS Directive
Regulation on substances that deplete the ozone layer
Waste Framework Directive

8) Do you have any comments on the policies evaluated in the previous question? Do you have any comments on any other policies? -open reply- (optional)
What these pieces of legislation cover and their potential to deliver emission reductions are in fact two rather separate issues. In principle the EU ETS should be a major driver of reductions, but we see that, due to consistent over-allocation as well as CDM credit it is unlikely to deliver domestic action by 2020, and is only on a pace to cut emissions 70% by 2050 in covered sectors, whilst the power sector would essentially need to decarbonise by 2040 to permit a 95% economy-wide cut by 2050. In addition, the EU ETS has not driven the necessary investment on energy efficiency in the covered industries.

We note other specific points:

- ETS and effort sharing targets need to be in line with a 2050 goal of 80-95%, meaning a domestic emission reduction target by 2020 of at least 30%, preferably 40%.
- The ESD has missed the mark: a new Directive needs to tackle the 2020 energy

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saving target head-on by making it binding, and providing better guidance on market design and funding that will in fact lead to an energy services market being created, as well as placing energy savings obligations on power companies.

- The EPBD has usefully extended its scope but has weak enforcement rules and does next to nothing to ensure that renovation rates at a high standard of efficiency are sped up.
- The EU is creating a large biofuels market through the RED and is responsible for ensuring its sustainability – both direct and indirect effects both in terms of GHG emissions and social and ecological sustainability need to be fully accounted for.
- The RES Directive has several weaknesses, e.g. sustainability criteria of solid biomass is missing, and criteria for biofuels are incomplete – for example treatment of ILUC.
- Taking renewable energy goals beyond 2020 will be facilitated by effective infrastructure planning and legislation.
- The Industrial emissions directive missed the opportunity of instituting an emissions performance standard on the largest EU power emitters, but this could be rectified in future, for example through the review of the CCS directive.
- Car CO2 emissions standards were watered down under industry pressure but once put in place the reaction was immediate, showing the potential for significant tightening.
- The Ecodesign of Energy Using Products Directive is one of the most successful pieces of legislation in reducing energy consumption. However, the current process to adopt implementing measures could be further improved by setting clearer deadlines to avoid unnecessary delays in their adoption, as in the case of the long-awaited measure on boilers and water heaters.
- The energy taxation Directive needs to allow for taxation of bunker fuels to provide member states the chance to address this large and growing source of emissions.

9) The EU will need a diverse portfolio of technologies to build a low-carbon future. Some examples of potential technologies and energy efficiency solutions are carbon capture and storage, renewable energy technologies, electric vehicles, fuel cells, smart grids, heat pumps, cogeneration, next generation nuclear power, zero emission buildings, etc. Which technologies do you think will be the most important in achieving a low carbon economy by 2050 and how can the EU foster their development and deployment? -open reply- (optional)

The question states without justification that all of the named technologies are 'needed'. This is not the case – there are any number of 2050 scenarios that do not rely on nuclear energy, for example, and any inclusion of CCS can only be called speculative. For instance, the recent Roadmap 2050 Report published by the European Climate Foundation showed that a European electricity system based on 100% renewable energy system was technically feasible, without endangering system reliability and at an economically affordable cost. WWF is also preparing a global 100% renewable energy vision that will be released in January 2011.

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The EU will need a systemic approach in the transition to a low carbon economy. Every credible low-carbon energy scenario starts with controlling energy demand – for instance, the Roadmap 2050 report referred to above highlighted that energy demand reduction measures could result in a reduction of the costs of decarbonising the power sector by 30%, thereby avoiding the construction of up to 440 mid-sized coal power stations. Then, we need to use a diversity of renewable energy solutions, enabled by smart grids.

But in view of deep decarbonisation needs by 2050, it's important that solutions are realised in every part of the economy; the EU will need to increase the implementation of truly transformative solutions – incremental improvements are necessary but will not suffice. For example, the EU should make sure to use the full potential of an ICT infrastructure to enable decarbonisation of societal functions (e.g. travels, transports, education etc); we need to investigate biomimicry (e.g. algae for water purification and biomass, enhanced materials, green chemistry) for radically new ways of providing goods and services using substantially less energy and resources. Around 40 percent of the primary energy demand are consumed by the buildings sector, therefore at least doubling the renovation rate of existing buildings should be one of the primary goals of EU action in the field of energy efficiency.

Finally, bringing low carbon solutions to the market at speed and scale is not only about the technologies. The introduction of innovative business models that rewards closed-loop management of goods and service needs to be stimulated.

10) What are in your opinion the most important initiatives the EU should pursue in the next five to 10 years to secure a successful transition towards a low carbon economy by 2050? -open reply- (optional)

- A 40% 2020 reduction target of which at least 30% will be achieved within the EU, with appropriate adjustments to ETS, effort sharing and other legislative instruments;
- A 95% 2050 target to accompany a comprehensive assessment of policies to reach the goal.
- The EU should strive to achieve an international legally binding agreement on climate change.
- Redirection of public funding toward the public good: ensuring European expenditures not only avoid negative impacts (climate proofing) but also contribute to deep reductions. This will mean a significant realignment in most funding areas. Cohesion policy only spends 2.9% on energy, and project implementation is lagging behind.
- Prioritisation of infrastructure in the long-term interest, i.e. electricity above fossil fuels; current EU plans for access to oil and gas are non consistent with a rational phase-out of their use in the coming decades. Within electricity infrastructure integration of renewable energies should be prioritized.
- Ensuring no unabated coal power is built in Europe from now on, and no unabated gas from 2020. Theoretically the ETS could have this effect but not with the current design. An emission performance standard would be an effective means to ensure this.
- Sharpening the targets and implementation of existing legislation, including:
- A binding primary energy saving target by at least 20% by 2020 that is legally

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binding: a mandatory target will provide a framework that drives actions on energy savings at the EU and national level and ensure accountability, urgency and focus.
- Tougher targets for the CO2 and cars legislation.
- A standard for efficiency renovation rates of 3% per year. Effective EU legislation to improve the energy performance of existing buildings, EU funding program to foster renovation efforts.

11) The EU Emissions Trading Scheme is a central element of EU climate policy. The EU wants to foster international climate action by reinforcing international carbon markets, e.g. by making links among emissions trading systems and by further developing crediting systems. What elements do you think should go into the EU low-carbon roadmap? (e.g. bilateral agreements to recognise international allowances and credits, sectoral crediting systems, separate financing mechanism for the purchase of international credits from developing countries, etc.) -open reply- (optional)

The cap under the post 2012 phase of the EU ETS should be adjusted in order to take into account of the combined effects of overallocation and the economic downturn with the goal to enhance the EU carbon price thus stimulating investments in renewables and energy saving technologies.

The EU 2020 objective should be adjusted to a 40% reduction target, of which minimum three-quarters of the reduction effort is to be achieved within the EU and not through offset mechanisms. The EU ETS should be adjusted to the -95% emission reduction path by 2050. An increase in the overall EU emissions reduction target must therefore lead to a tighter ETS cap, and in particular to doubling of the annual linear reduction factor.

Fifty percent of the EU ETS auctioning revenues should be earmarked to support international financial commitments to climate change, but not counting towards Official Development Aid objectives, nor with the aim of generating reduction offsets. The remaining fifty percent of revenues should be used to advance the transition to clean, sustainable, energy-efficient and prosperous European economy.

The current international offset market mechanisms should be improved significantly on issues such as long term contribution to a low-carbon economy, additionality and sustainable development. In the long term, these project-based instruments should be replaced by sectoral mechanisms that contribute to a low-carbon development path in host countries and to a level-playing field globally.

All linkages between the EU ETS and other emission trading systems should take into account impacts on the EU carbon price and should be made under comparable conditions particularly in terms of cap. A steadily increasing EUA price signal is important to guide investments in energy savings and renewable energies.

12) Achieving a low-carbon future means investing in the medium to long-term. How can the EU roadmap help to create a stable environment to encourage investment in low carbon technologies? Would it be a good idea to consider a mid-term objective for 2030

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and, if so, in what form? -open reply- (optional)

There's no lack of resources, the question is how investments are allocated according to the 2050 climate scenarios. The EU needs to clarify the investment requirements 2010-2050 and commission key private financial market actors to participate in designing an enabling framework that will materialize the investments needed. This means setting us off on the right foot with a meaningful 2020 target (e.g. 40%), and an endpoint target for 2050 (95%). Once, but not before, these are established the 2050 target may very well be marked by milestones per decade.

Low carbon investment targets must be implemented along the entire financial market value chain, from institutional funds to venture capital. These investments need to be supported by: (a) long term (>10 years) and harmonized EU wide regulations and incentive programmes, including ambitious green procurement with high requirements not only for energy efficiency but also for new proven but not yet widely distributed technologies; (b) EU recognizing its role as public funder, i.e. by providing guarantees and risk reduction for investments initiatives in low-carbon solutions while commissioning execution to private financial market actors; (c) facilitating the development of buy-side financing instruments as well to stimulate demand for low carbon solutions.

It is also important to note that investment certainty goes paired with stability in policy design: already the EU ETS has shown its vulnerability to variations in the market and in policy choices that make for a variable price signal. The primary effect is therefore to influence current operational and short-term investment decisions. The ETS could be accompanied by a framework providing longer-term certainty such as an EU-wide emissions performance standard.

Lastly, it is imperative to ensure phasing out and eventual removal of fossil subsidies, and the recycling of these amount into green economy.

13) We want to cut emissions in the EU by 80% to 95% by 2050. Some of the measures needed to achieve this could bring about more sustainable growth, extra jobs, accelerated innovation, cleaner air, increased energy security and lowering our vulnerability to external energy shocks. Which of these do you think should be top of the list? What should the EU do to maximise the benefits you think should be delivered in priority by future climate action? -open reply- (optional)

There are a number of studies indicating the least-cost pathway to 2050 decarbonisation, as well as several indicating the employment, social and health impacts of different policies. We highlight the following:

- RECIPE – a Report on Energy and Climate Policy in Europe, conducted by the Potsdam Institute for Climate Impact Research (PIK) and four other European research institutes for Allianz and WWF found that effective climate protection measures would cost just one year of delayed economic growth by 2050. However, wasting the next decade before taking meaningful action on climate change would result in an increase of mitigation costs of at least 46 % compared to early action.
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recipe-for-a-fast-acting-Europe-to-profit-from-going-it-alone-on-climate-action

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B. Top key messages around an EU 2050 roadmap

1. European emissions reductions by 2050 need to be on the order of 95%, and -40% by 2020

On 30 October 2009 the European Council stated that they supported 80-95% greenhouse gas emissions cuts by 2050. WWF-sponsored research echoes the results of other work which identifies a 95% cut as the appropriate target for Europe. Forty percent by 2020 is not an onerous target consider that the baseline (1990) is already 20 years behind us and that our current 2020 target (20%) is already close to being met.

The risk that a stable greenhouse gas concentration of e.g. 450 ppmv CO_2eq would result in global average temperature above 2°C in the long term is around 50%. At 400 ppmv CO_2eq, the risk is 30%**1**. Limiting concentrations to this latter figure implies a global carbon budget between 1990 and 2100 of 1800 GT CO2e without land use change and forestry. Under this constraint, global reductions would need to be 30% by 2020 and 80% by 2050.

There are several methodologies to divide this reduction between developed and developing countries, in the context of common but differentiated responsibilities. Among the most common are greenhouse development rights (GDR)**2**, common but differentiated convergence (CDC)**3**, and contraction and convergence (C&C)**4**.

In 'Sharing the effort under a global carbon budget'**5**, Ecofys and WWF demonstrate that the 2050 reduction obligation for Annex I regions, including Europe, would be -157% under the GDR framework (i.e. requiring responsibility for reductions far in excess of their own) and -95% under either of the other two methodologies.

These more 'lenient' approaches are the basis for WWF's contention that a 95% cut for Europe is appropriate: it is a fair level of effort that allows a better than even chance of helping the globe avoid greater than 2 degree warming, and retains the possibility of limiting it to 1.5 degrees.

A consequence of this 2050 goals is that 2020 reductions need to be around -40% to stay within the carbon budget and avoiding heroic assumption about rapid reductions post-2020.

2. Energy Demand: Importance & benefits of reducing energy demand

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1 M. Meinshausen. (2005). *On the risk of overshooting 2°C.* Paper presented at the Scientific Symposium "Avoiding Dangerous Climate Change", MetOffice.

2 P. Baer, Athanasiou, T., and Kartha, S. (2007). *The right to development in a climate constrained world. The Greenhouse Development Rights framework*. Publication series on ecology, volume 1, Berlin: Heinrich-Böll-Foundation, Christian Aid, EcoEquity and the Stockholm Environment Institute

3 Höhne, N., M. G. J. den Elzen, and M. Weiss. (2006). Common but differentiated convergence (CDC), a new conceptual approach to long-term climate policy. *Climate Policy*, *6* , 181-19

4 A. Meyer. (2000). *Contraction & convergence. The global solution to climate change*. Schumacher Briefings, No. 5. Bristol, UK.

5 N. Höhne and S. Moltmann, 2009.

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Reducing energy demand, through both behavioural change and energy efficiency measures, should be a key feature of EU energy policy. There is a substantial potential for reducing energy demand within the EU. Whilst the measures required to initially trigger the reduction in demand may have a cost attached to them, the ultimate savings that these measures would give customers and the reduction in the cost of decarbonising the power sector means that achieving substantial reduction in the EU's levels of energy demand would be of great benefit to the EU's economy in the long term.

For an energy savings targets to be effective, transparent and easy to monitor, these targets would be better expressed in absolute terms of energy use rather than by reference to a subjective "business as usual" scenario. Below are illustrations of the potential for reducing energy demand in the EU and at member state level, as well as an overview of the economic benefits of reducing energy demand.

Illustration at EU Level

In the recently launched *Roadmap 2050* study, the European Climate Foundation (ECF) makes clear that the EU's (currently non-binding) target of reducing primary energy consumption by 20% by 2020, which would then set the foundation for continuing to deliver energy efficiency gains of 1% to 2% each year out to 2050 (in addition to the 1-2% gains assumed in the baseline scenario), is absolutely key in the efforts to decarbonise the European power sector in a cost-efficient manner. **In particular, the ECF shows that energy efficiency measures that would deliver these levels of energy demand reduction could reduce the costs of the transition to a decarbonised power sector by up to 30%, by avoiding more expensive generation and transmission needs6**.

The *Roadmap 2050* study also refers to a recent study by Ecofys and Fraunhofer**7**, which concludes that the impact of energy savings policies in the EU will need to increase by a factor of nearly three times in order to reach the EU's 20% energy savings target by 2020. **Failure to do so would cost an estimated €70bn per year in unrealised potential savings to European energy consumers8**, a considerable missed opportunity for the EU and its member states given the importance of ensuring continued public legitimacy and support for low carbon policies. The same study shows that the EU's aspirational 20% energy savings target could actually be met largely through cost effective measures.

Illustrations at Member State Level

The following examples show the potential for reducing energy demand at UK level and the benefits this could bring to the UK economy.

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6 Roadmap 2050: A Practical Guide to a Prosperous, Low-Carbon Europe, European Climate Foundation, April 2010, http://www.roadmap2050.eu/downloads. See Executive Summary to Volume 1 and Chapter 2 of the draft ECF study *'Energy Savings 2020: How to triple the impact of energy savings policies in Europe'*, September 2010, unpublished report.

7 'The Feasibility of Binding Energy Savings Targets in the EU' by Ecofys and Fraunhofer (Part 1: facts and figures, April 1, 2010, unpublished report).

8 Roadmap 2050: A Practical Guide to a Prosperous, Low-Carbon Europe, European Climate Foundation, April 2010, http://www.roadmap2050.eu/downloads. See Volume 2, *'Policy Recommendations'*, page 19.

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- In its first report, *'Building a low-carbon economy – the UK's contribution to tackling climate change'***9**, the UK's Committee on Climate Change (CCC) estimates that in the residential sector, there is technical potential to reduce emissions by almost 40 MtCO2, over half of which is through negative cost energy efficiency improvements and lifestyle changes, and with much of the remainder costing less than CCC's forecast carbon price of £40/tCO2.

- In the report *'Building a roadmap for heat'***10** commissioned by the UK's Combined Heat and Power Association (CHPA), the University of Surrey and Imperial College London showed that under the assumptions used by the CCC in its 80% CO2 emission reduction scenario for 2050, UK energy demand in 2050 will decrease to 46% below 2007 levels, which is considerably lower than most of the demand scenarios put forward by the illustrative pathways.

- In a report commissioned by WWF-UK and Greenpeace in 2008, *'Implications of the UK meetings its 2020 Renewable Energy Targets'***11**, Pöyry energy consultants looked into what a low energy demand scenario could look like for 2020 and 2030. Pöyry concluded that under a low-energy demand scenario, end-use demand in the UK could fall from approximately 1,800 TWh in 2008 to 1414 TWh in 2020 and 1274 TWh in 2030. This scenario was based on the UK's 18% energy saving target for the 2008-2016 period set out in the UK Energy Efficiency Action Plan 2007**12** (which would ultimately deliver savings of 272.7 TWh by the end of 2016), which was produced by DEFRA in accordance with the EU Energy End-Use Efficiency and Energy Services Directive. Therefore, this low energy demand scenario, whilst ambitious, was not based on irrational assumptions but on targets that the UK government had already set itself.

- The UK Energy Research Centre (UKERC) made it clear in its report, *'Making the transition to a secure and low-carbon energy system'* that energy demand reduction is key in making the transition to a low-carbon and resilient energy system. In particular, based on a study looking at "what might be reasonable changes to expect in the future"**13** in terms of future energy lifestyles, **UKERC estimates that a combination of energy service demand change and efficiency improvement in the transport and residential sectors could reduce UK energy demand in these 2 sectors by more than 50% by 2050 compared to business as usual levels in that same year.** Not only is the potential for energy demand reduction key in helping reduce CO2 emissions, it is also compelling from an economic point of view. In particular, UKERC estimate in the same report that "in an energy system constrained to 80%

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9 Building a low-carbon economy – the UK's contribution to tackling climate change, The First Report of the Committee on Climate Change, December 2008, http://www.theccc.org.uk/reports/building-a-low-carbon-economy, p. 212.

10 Building a roadmap for Heat, University of Surrey and Imperial College London, March 2010, http://www.chpa.co.uk/building-a-roadmap-for-heat---2050-scenarios-and-heat-delivery-in-the-uk_161.html, chapter 3.

11 Implications of the UK meeting its 2020 Renewable Energy Target, Pöyry energy consultants, July 2008, http://www.ilexenergy.com/pages/Documents/Reports/Renewables/July08_2020RenewablesTarget.pdf, Chapter 3.

12 The UK Energy Efficiency Action Plan 2007, DEFRA, http://ec.europa.eu/energy/demand/legislation/doc/neeap/uk_en.pdf.

13 See Footnote 1, page 104.

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carbon emissions reduction, the main effect of social and lifestyle change is to reduce the costs of delivering a low-carbon energy system, up to £70 billion"**14**.

4. Reducing demand in the transport sector through energy efficiency measures and electrification of vast part of the transport sector is key in helping reduce overall energy demand

The transport sector is currently more oil dependent than any other sector. After energy, it is the second largest emitting sector in the EU. It is also the only sector in the EU where emissions are continuing to grow. Decarbonising transport, and especially road transport, will not only reduce EU dependency on oil imports, it will also be required if the EU is to meet its carbon reduction targets by 2020 and 2050.

An EU 2050 Roadmap for Transport must focus on three aspects: energy efficiency, electrification and demand reduction.

Energy efficiency measures should include:

- Strengthening of EU CO2 emissions standards for new sales of internal combustion engine vehicles (ICEVs), currently set at 130g/km from 2012 and 95g/km from 2020
- Enforcement of ICAO's 2% per annum fuel efficiency target for EU airlines to 2020 and beyond

Electrification measures should include:

- Creation of the right conditions and infrastructure to support the rapid ramp up of EVs, including…
- EU support for a decarbonised, integrated European grid to ensure that EVs are powered by renewable energy
- Roll-out of an EU-wide, standardised charging infrastructure, with compatible charging technology

Demand reduction measures should include:

- EU support for road and congestion charging
- More encouragement of cycling, walking and public transport as alternatives to driving
- More encouragement of rail and conferencing technologies as alternatives to flying
- An aviation charge for increasing EU revenue as well as VAT and fuel duty on intra-EU flights

14 See Footnote 1, page 103.

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Illustrations at Member State Level

The Republic of Ireland has already planned the roll out of infrastructure and ownership of charging points and electricity. Ireland has a target of 10% of all cars on the road to be EVs by 2020, with 1500 charging points to be installed by 2011, including 30 fast charging points at 60km intervals between major towns. Ireland will also provide 2000 home charging circuits for the first 2000 EV owners.

France is offering a €5,000 subsidy (grant) on the purchase of EVs (until 2012), has mandated EV charging for all new building developments and is encouraging ramp up by ordering a public/private fleet of up to 50,000 EVs with the possibility of expansion to 100,000.

WWF-UK's soon to be published EV report shows that if EVs are to make a difference at reducing fuel demand and carbon emissions, they will have to represent 15% of new car sales by 2020 and 20% of new car sales by 2030. Assuming decarbonisation of the UK grid and together with ICEV improvements and demand management measures, EVs can help to deliver an 80% reduction in fuel demand from cars and a 75% reduction in car emissions by 2030.

5. Priority should be given to increased investment in renewable energy over other forms of electricity generation

Decarbonising the EU's power sector is key if EU member states want to meet their climate change commitments. In its forthcoming 2050 roadmaps, the EU should give a clear priority to investment in renewable energy. Not only is a large-scale deployment of renewable energy in the EU technically feasible, it also provides the EU with its best chance of decarbonising its power sector, without endangering energy security (as the EU would be relying on its own indigenous energy sources that will always be available) and whilst providing great benefits to the EU economy through the creation of a substantial number of new jobs in the EU's renewable energy industry.

Below are examples of the potential and benefits of a large scale deployment of renewable energy both in the EU and at Member State level.

Illustration at EU Level

The European Climate Foundation's Roadmap 2050 study found that **100% renewable energy future in Europe, with limited backup generation, was technically feasible without endangering system reliability and at a cost that was not substantially higher than the cost of other pathways to decarbonise the power sector**, as long as Europe invests in interconnection infrastructure to connect the different national grids (see section 4 below).

Illustrations at member state level

The great environmental, economic and energy security potential offered by renewable energy was well reflected in the UK's Offshore Valuation Report. This report, recently

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prepared by the UK's Department of Energy and Climate Change (DECC) and various players in the energy industry, showed that **by just using 29% of the UK's practical offshore resource, the UK could install an offshore renewable energy capacity of 169GW that could enable the UK to become a net exporter of electricity by 2050, creating 145,000 UK jobs in the process and generating £62bn of annual revenues to the UK's offshore renewable energy industry.** The report found that the UK could even become a net exporter of energy by using 76% of its practical offshore resource to deploy offshore renewable energy. These assumptions were based on a high level of electricity demand by 2050, envisaging a 74% increase in electricity demand by 2050 (which is much higher than our proposed scenario), implying that if the UK was successful at substantially reducing its demand for energy, an even smaller amount of the UK's offshore resource would have to be used to make it an electricity or energy exporter**15**.

3. Investment in grid infrastructure is the cheapest way to guarantee the reliability of the EU's energy system and effectively manage the variability of wind energy at EU level

We believe that the building of more interconnection infrastructure between European grids is absolutely key in helping to decarbonise the power sector. The European Climate Foundation's Roadmap 2050 study found that **the building of interconnection between European states was the cheapest and most efficient way of dealing with the variability of renewable energy**, by in particular helping to spread that intermittency over a much wider geographical area.

The report also found that with better interconnection infrastructure between European states, the level of backup generation in an energy system with a high volume of renewable energy would actually be very limited. In particular, the report concluded that **in an European electricity system with 80% renewable energy, backup plant would only need to operate with a load factor (i.e. a utilisation rate) of 5%, increasing to 8% in a 100% renewable energy system.** This low level of backup generation could be met for example by a limited number of plants equipped with carbon capture and storage technology if the technology is proven or by efficient gas-fired combined heat and power plants.

4. New nuclear power stations are not necessary to decarbonise the power sector in a safe and reliable way.

The ECF's Roadmap 2050 study shows that as long as the right levels of investments are made in new renewable energy and interconnection capacity and that the EU is successful in achieving its aspirational energy efficiency targets, new nuclear and coal CCS plants "**are not essential to decarbonise the power sector whilst safeguarding system reliability"**.

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15 The Offshore Valuation Report: A valuation of the UK's offshore renewable energy resource, 2010, http://www.offshorevaluation.org/downloads/offshore_valuation_exec.pdf

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The construction of new nuclear power stations is extremely complex and particularly expensive. In particular, the World Nuclear Industry Status Report 2009**16**, commissioned by the German Federal Ministry of Environment, Nature Conservation and Reactor Safety, makes clear that **"while many industries experience declining costs as they move out of their technological learning curve, the nuclear industry continues to face steadily increasing costs on existing construction and future cost estimates"17**. In particular, the same report refers to the May 2009 nuclear investment cost estimate update by the Massachusetts Institute of Technology (MIT), which doubled an earlier estimate from $2,000 to $4,000 cost (excluding financing) per installed kilowatt. The flagship EPR project at Olkiluoto in Finland provides a very telling example of the extreme cost and timing difficulties faced by the nuclear industry. It is estimated that the project is more than three years behind schedule and at least 55% over-budget, reaching a total cost estimate of €5 billion ($7 billion) or close to €3,100 ($4,400) per kilowatt.

In addition to the cost and timing complexities associated with building a large number of new nuclear power stations, there is also a significant shortage of a skilled workforce to deliver the growth in nuclear power contemplated by some European governments. In particular, the World Nuclear Industry Status Report 2009 points out that the "lack of a trained workforce and massive loss of competence are probably the most difficult challenges for proponents of nuclear expansion to overcome"**18**. It is very telling that this problem will include countries such as France, which probably has the strongest base of nuclear civilian competence, where 40% of EDF's nuclear staff is set to retire by 2015.

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16 The World Nuclear Industry Status Report 2009, Mycle Schneider, Steve Thomas, Anthony Frogatt, and Doug Koplaw, April 2009. Report commissioned by the German Federal Ministry of Environment, Nature Conservation and Reactor Safety, http://www.nirs.org/neconomics/weltstatusbericht0908.pdf.

17 http://www.nirs.org/neconomics/weltstatusbericht0908.pdf, see page 7.

18 http://www.nirs.org/neconomics/weltstatusbericht0908.pdf, see page 6.