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REPORT
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Re-energising Europe
CUTTING ENERGY RELATED EMISSIONS THE RIGHT WAY

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WWF is one of the world's largest and most experienced independent conservation organizations, with over 5 million supporters and a global network active in more than 100 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by: conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

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What is needed to deliver sustainable energy, particularly before 2030? This report studies the options for decarbonising the EU's energy system, with particular reference to the European Commission's Energy Roadmap 2050

What is needed to deliver sustainable energy, particularly before 2030?

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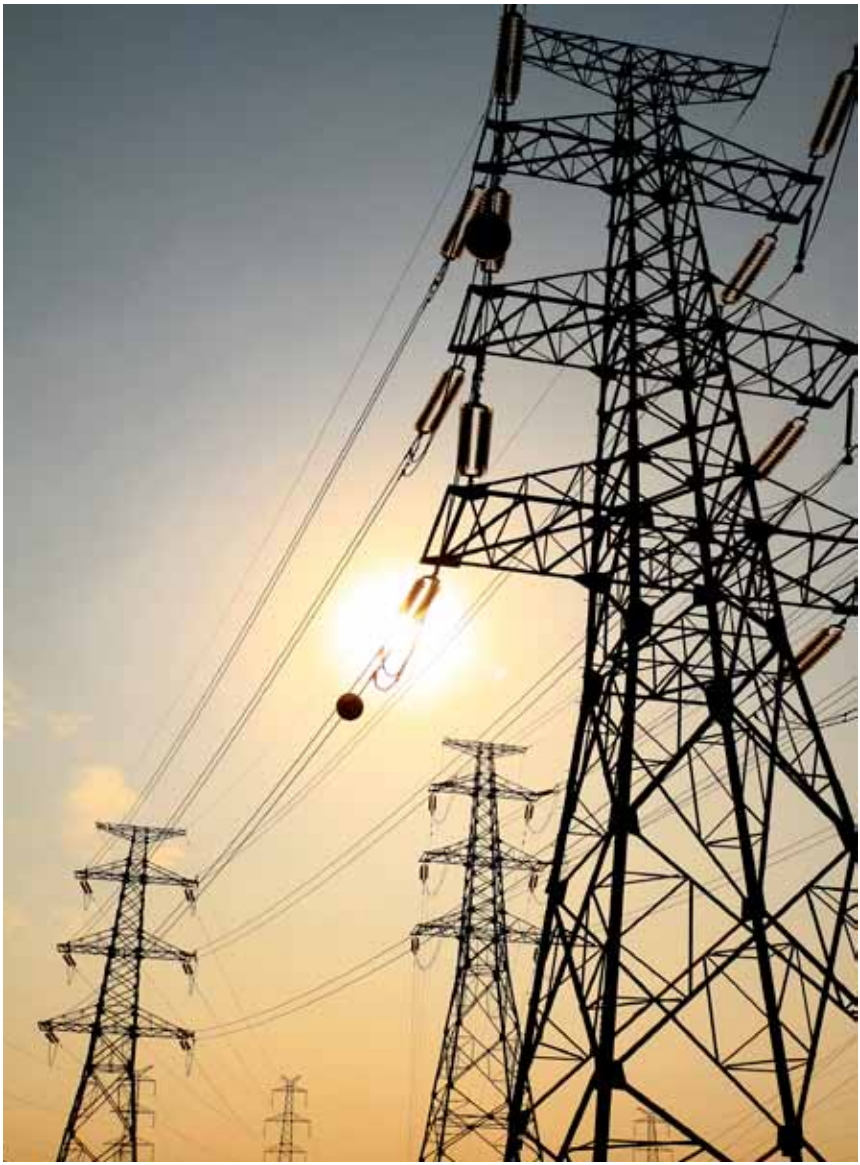
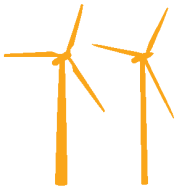


To make an adequate reduction in the EU's energy-related greenhouse gas emissions, our efforts have to be increased.

INTRODUCTION

The EU is committed to reducing greenhouse gas emissions to 80-95% below 1990 levels by 2050[1]. Although existing measures to deliver the 20-20-20 climate and energy package[2] are having a positive impact, **without further action they will only cut greenhouse gas emissions by about 40% by 2050[3].** To make an adequate reduction in the EU's energy-related greenhouse gas emissions, **our efforts have to be increased.**



WITHOUT FURTHER ACTION, EXISTING MEASURES WILL ONLY CUT GREENHOUSE GAS EMISSIONS BY ABOUT 40% BY 2050

In this context, the European Commission's Energy Roadmap 2050 (the Roadmap), adopted in December 2011, *"explores the challenges posed by delivering the EU's decarbonisation objective"*[4]. The Roadmap presents five decarbonisation scenarios, each of which "achieve an 80% reduction in greenhouse gas emissions implying some 85% decline of energy related CO2 emissions [by 2050]"[5].

Launching the Roadmap, the European Commission called on Member States "to start now to debate how their energy mix will look like in 2050"[6]. Given the stakes, this debate must be as informed as possible. **WWF is committed to playing its full role in the work that lies ahead.** Using a detailed analysis of the Roadmap's decarbonisation scenarios by CE Delft for WWF's European Policy Office, we consider how to put the EU on the best path towards a sustainable energy system.

This report is produced with the aim of improving politicians' and civil servants' understanding of the challenges we face, and how to overcome them.

Why more analysis is needed

While the Roadmap presents different decarbonisation scenarios, it does so within a narrow range. It misses the opportunity to test the wider boundaries of decarbonisation options and, thereby, add to our understanding of their maximum potential and resilience. Instead, each Roadmap scenario can be considered as a variation on a central theme.

As a result, the Roadmap overlooks the **rewards** that could be reaped from the more ambitious options of 95% emissions reductions and a scenario that combines high renewable energy generation and high energy savings. By heeding the four key lessons below, we show that it is possible to take the Roadmap scenarios a step further while also reducing the **risks** that they face:

ENERGY SAVINGS ARE THE KEY ENABLER FOR DECARBONISING THE ENERGY SYSTEM

1. Energy savings are the key enabler for decarbonising the energy system;
2. Now is the window of opportunity for increasing renewable energy generation;
3. New electricity infrastructure can be 'no-regrets', but the case is less clear for gas;
4. Aiming for 95% decarbonisation from the start is a game-changer.

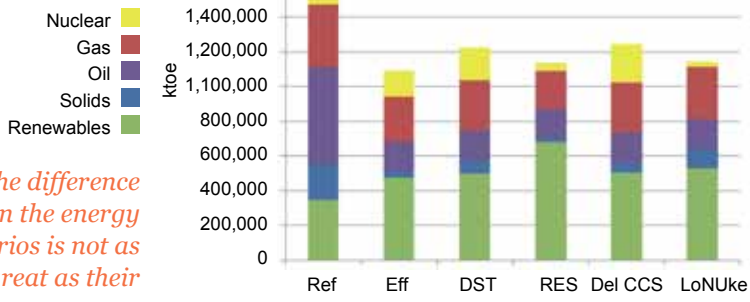
The limited scope of the Roadmap scenarios:

The key technologies for decarbonising the EU's energy system form the basis, nominally at least, of differentiating the five scenarios presented within the Commission's Roadmap:

1. High energy efficiency (High Eff);
2. Diversified supply technologies (DST);
3. High renewable energy sources (High RES);
4. Delayed Carbon Capture Storage (Del CCS); and
5. Low nuclear (LoNuke)[7].

However, it should be noted that in terms of energy mix in 2050, the difference between the energy scenarios is not as great as their names suggest:

Figure 1: Total primary energy demand by fuel – 2050 (Roadmap Scenarios)



The difference between the energy scenarios is not as great as their names suggest.

* Acronyms Ref, Eff, DST, RES, Del CCS, LoNUke see page 31

One of the Roadmap's clearly stated aims is to address the uncertainty that is identified as a major barrier to energy sector investment. The similarities between the Commission's roadmap have helped to achieve this - leading to the valuable identification of 'no-regrets' options for energy sector decarbonisation - in Presidency conclusions from the Council of the European Union[8]:

- Improving energy efficiency;
- A higher share of renewable energy; and
- New, flexible infrastructure development to integrate renewable energies[9].

However, it must be noted that broad acceptance of the three no-regrets options has been reached at the expense of exploring more ambitious levels of energy efficiency and renewable energy as was done in *the WWF's global "Energy Report"*. An important step towards correcting this would be the development of a **combined high renewables and high efficiency scenario.** This option is discussed further on.

All the European institutions, and particularly the European Council, must take the need to save energy much more seriously.

THE FOUR KEY LESSONS

Energy savings are the key enabler for decarbonising the energy system

The risk of not achieving energy savings is significant, and needs to be addressed much more effectively than is currently the case. In the event of failure, it must also be mitigated by zero-carbon energy sources if overall decarbonisation targets are to be met.

Our first recommendation:
All the European institutions, and particularly the European Council, must take the need to save energy much more seriously. The inadequate outcome of the Energy Efficiency Directive cannot be repeated if the EU is to achieve its decarbonisation goals.

AT CURRENT RATES OF ENERGY SAVINGS IN EUROPE, NONE OF THE COMMISSION'S DECARBONISATION SCENARIOS WILL ACHIEVE 85% ENERGY-RELATED EMISSIONS REDUCTIONS

Reducing energy consumption through energy savings and efficiency has long been the strategy legislators proclaim as the first line of attack in the battle to cut emissions. However, it has also historically underachieved - not least because of a lack of the kind of policy support that has, for example, been essential to delivering more energy from renewable sources.

Indeed, at current rates of energy saving in Europe[10], none of the Commission's decarbonisation scenarios (which assume energy savings of between 16 & 20% by 2030 and of between 32 % and 41% by 2050) will achieve their target of 85% energy-related emissions reductions.

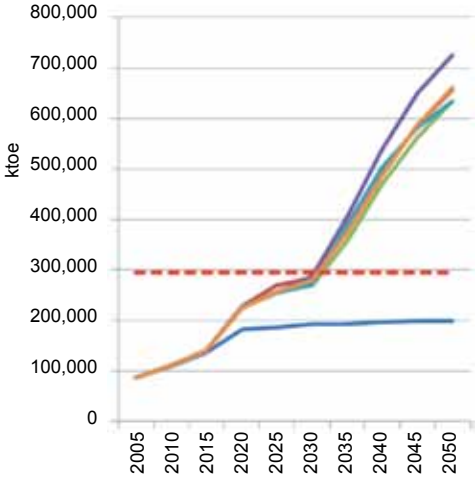
The potential consequences are enormous. Remaining within the CO2 cap implied by an 80-95% emissions cut means that every extra unit of energy demand caused by a failure on efficiency would have to be generated from zero carbon sources. Our analysis illustrates the extent to which this reality has consequences that reverberate throughout

the scenarios[11], and demonstrates the need to give serious consideration to mitigating the risk of failure to deliver energy savings.

For example, successfully cutting overall energy consumption means that each scenario should have sufficient quantities of sustainable biomass available in 2050[12]. However, when savings are not delivered, the additional demand needs to be supplied by low carbon energy sources, such as sustainable biomass, the supply of which is limited. In fact, if final energy demand does not deviate from the Reference scenario, biomass demand in the decarbonisation scenarios exceeds sustainable supply as early as 2030[13,14].

Figure 2: Biomass demand compared to sustainable production ceiling when all scenarios have the same final energy demand as the reference scenario

Without energy savings, biomass supply runs out.



* Acronyms Ref, Eff, DST, RES, Del CCS, LoNUke see page 31

Biofuels are the main tool for transport decarbonisation envisaged by the Roadmap. Due to the limited decarbonisation alternatives in the transport sector, a shortage of biomass supply would be most keenly felt in this sector. Recent studies on the sustainability of many of the currently used biofuels have concluded that biofuels from agricultural commodities are often not sustainable, and

that the potential of sustainable feedstock for biofuels may therefore be primarily limited to residues and waste without alternative applications. This would clearly impact the potential supply of sustainable biofuels in the future.

Mitigating this risk requires as early a move as possible towards the other main decarbonisation options for transport – reducing travel demand, modal shift, and electrification. Electrification in particular requires early action if it is to play a significant role in decarbonising the transport sector, and this action must be taken as quickly as possible.

Now is the window of opportunity for boosting renewable energy capacity

Reliance on carbon capture and storage (CCS) and Nuclear power to decarbonise the EU's energy system carries significant non-delivery risks. These risks can be minimised by increasing the proportion of renewables in the energy mix, as well as by ensuring the delivery of energy savings.

Our second recommendation:
The European Commission should ensure that the size of the window of opportunity is properly understood, along with an assessment of the effort needed to fill it with renewable energy capacity. This knowledge will be key to the successful delivery of renewable energy in Europe.

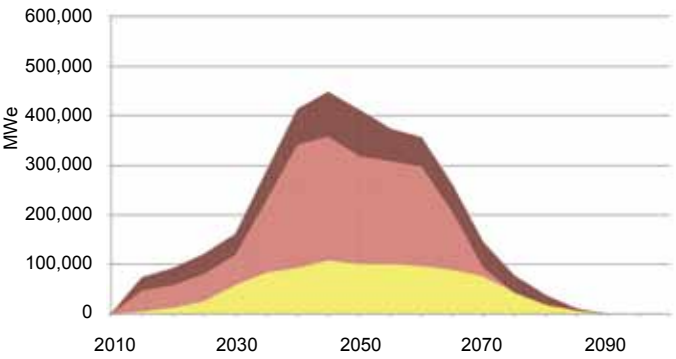
In all but one Roadmap scenario, the EU will still be dominated by fossil fuels and nuclear power in 2050. Even in the high renewables option, a significant proportion of all power will come from unsustainable sources.

Now is the window of opportunity for boosting renewable energy capacity.

Figure 3:
DST Scenario - Total new fossil fuel /nuclear capacity in operation, as envisaged by Roadmap scenarios (any capacity built before 2010 or after 2050 not considered)

Coal - new
Gas - new
Nuclear - new

Diversified supply technologies (DST) scenario

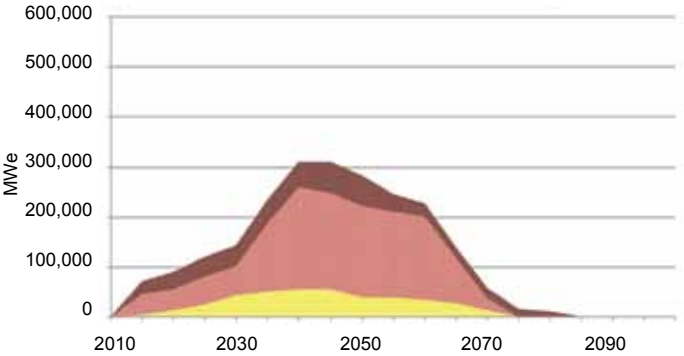


Scenarios envisage significant fossil fuels and nuclear building programmes.

Figure 4:
High RES Scenario - Total new fossil fuel /nuclear capacity in operation, as envisaged by Roadmap scenarios (any capacity built before 2010 or after 2050 not considered)

Coal - new
Gas - new
Nuclear - new

Renewable energy sources (RES) scenario



While the Roadmap acknowledges that CCS technology may never be successfully commercialised, it also states that, *"for all fossil fuels, carbon capture and storage will have to be applied from around 2030 onwards in the power sector in order to reach the decarbonisation targets"*[15]. Therefore all of the Roadmap scenarios face the significant risk that CCS will not become comercially viable. In the event that fossil fuel capacity built after 2030 cannot be fitted with CCS, it will either all have to be replaced by another non-greenhouse gas emitting energy source or Europe will be left with an unacceptable amount of unabated fossil fuels. Either situation would be extremely difficult to manage.

By envisaging this dependence on CCS, the Energy Roadmap is already sending signals to industry to invest in this technology. Despite the limited progress made so far, CCS continues to absorb significant amounts of public and private time and investment in order to try and ensure its as yet uncertain delivery. While this report supports the need for some research and development spending on CCS, particularly on those heavy industrial processes where it will be hardest to replace fossil fuels, greater investment should be made into the development and expansion of renewable energy, energy storage, electricity infrastructure, and energy efficiency.

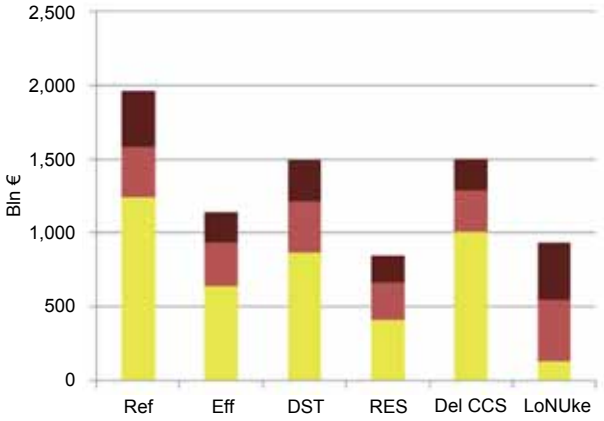
Furthermore, it should be noted that once a scenario assuming future use of CCS is embarked upon, it would be extremely difficult to change track if it becomes clear that CCS will not be commercially viable. Recent research has highlighted the risks of under-delivery of CCS in the European Union[16]. The first step of closing polluting plants would be extremely difficult given the power of the vested interests who will resist shutting down their expensive plants (See figure 5) before they have reached the end of their commercial lives (circa 30 years for gas plant, 45 years for coal plant, and 50 years for nuclear plant).

RECENT RESEARCH HAS HIGHLIGHTED THE RISKS OF UNDER-DELIVERY OF CARBON CAPTURE AND STORAGE IN THE EUROPEAN UNION

The second step of replacing this capacity with zero-carbon generation could be done with either nuclear power or renewables in order to keep overall decarbonisation targets on track. However, repeated delays and cost increases on the next generation of reactors (European Pressurised Reactors) currently being built in Finland and France[17], waning interest in new nuclear power projects in the UK[18], a comprehensive nuclear switch-off in Germany[19], and the growing acceptance that the cost of new nuclear plants has become prohibitive in much of the world[20], make it difficult to envisage more nuclear power filling the gap. Indeed, the whole future of nuclear power was called into question in a special issue of The Economist – 'Nuclear

Power: The dream that failed'[21]. Given the high investment costs and long lifespans of nuclear plants, the financial risk of prematurely closing them is clearly larger in a scenario based on nuclear capacity, compared to a scenario based on RES (see figure 5).

Figure 5: The value of replacement and additional fossil fuelled power plants envisaged by Energy Roadmap 2050 Scenarios



Fossil fuels dependent scenarios have a higher financial risk.

* Acronyms Ref, Eff, DST, RES, Del CCS, LoNUke see page 31

Whilst the value of fossil fuel generation assets in 2050 is high in all of the Roadmap scenarios, the range is also noteworthy, with **around €1.5 trillion of assets in the DST and Delayed CCS scenarios, compared to around €800 billion in the High RES scenario.**

The scale of the risk of stranded assets shown above adds weight to the findings of WWF's global Energy Report[22] that a 100% **renewable energy future is possible,** it saves money, and it is the most certain way to guarantee the transformation of our energy systems in order to avoid the very worst of climate change. Other reports also highlight the scope for, and benefits of, greater ambition on renewable energy and energy efficiency at both the EU and at individual member state level[23].

Therefore, in order to maximise the huge potential for renewable energy in the EU, it is necessary to prioritise its construction over that of fossil fuel and nuclear capacity,

and thereby minimise the threat of relying on generation assets that face significant non-delivery risks. The issue is pressing, because it does not place sufficient reliance on energy efficiency and renewables, the Energy Roadmap 2050 would imply a **major fossil fuel and nuclear plant construction programme** to replace an existing plant that is due to close over the next two decades. These plants could still be in operation, producing toxic waste and pollution, for decades to come.

New electricity infrastructure can be 'no-regrets', but case is less clear for gas

There is no need for any new gas infrastructure beyond that required by the broadly stable share of gas in the energy mix, and falling absolute amount of gas consumption, envisaged by the Roadmap scenarios.

Our third recommendation:
Given the threat of path dependency caused by over-investment in fossil fuel infrastructure, the Commission should revise its 2011 assessment of the level of investment in fossil fuel infrastructure[24] to ensure it is envisaging no more than that needed to deliver its decarbonisation scenarios, including any future iteration of more ambitious scenarios.

New electricity infrastructure is vital if we are to deliver the energy savings and renewable energy that are needed to cut energy-related emissions.

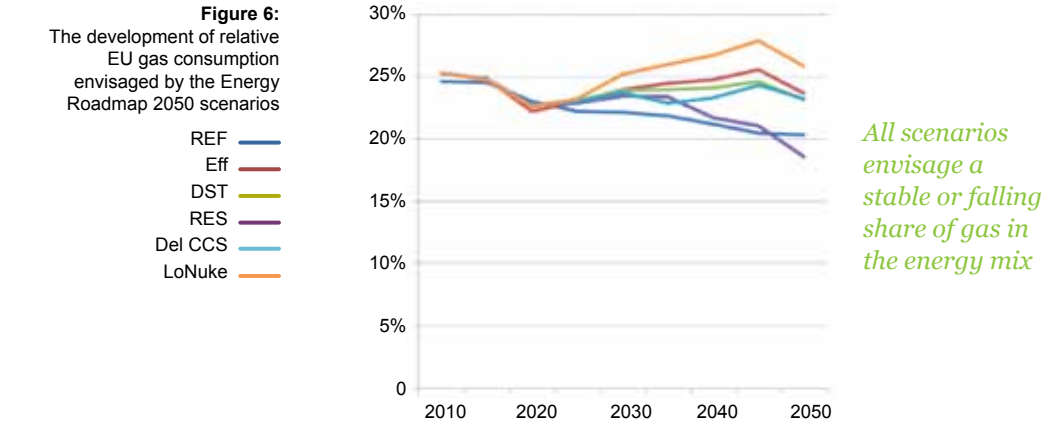
New electricity infrastructure is vital if we are to deliver the energy savings and renewable energy that are needed to cut energy-related emissions. However, many significant stakeholders also make the case for new gas infrastructures to 'balance' variable renewable energy sources[25,26,27].

Currently, the Commission estimates that €70bn are needed for the construction of gas pipelines, storage, liquefied natural gas terminals and reverse flow infrastructure[28], of which €28bn for import infrastructure[29]. When looking

at the need for such infrastructure, we must consider the demand it is seeking to meet.

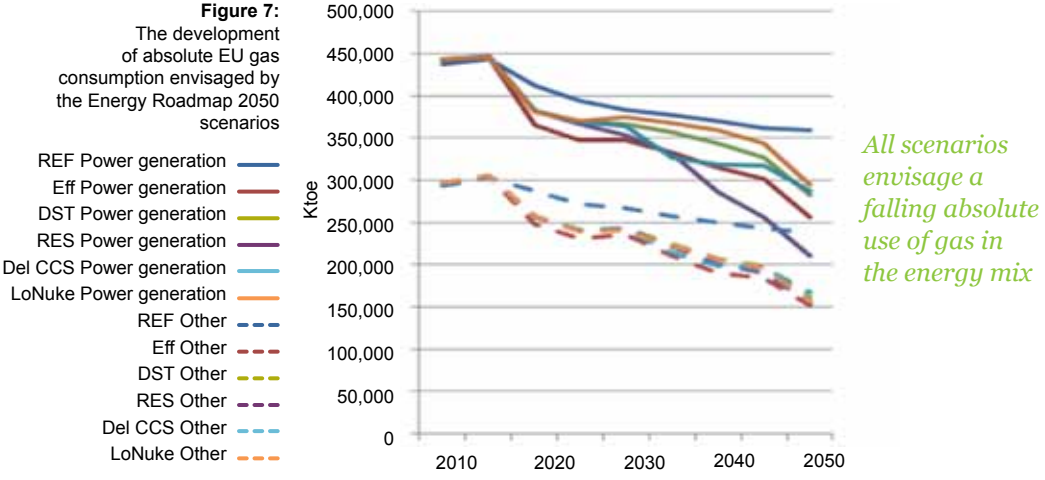
Europe's electricity infrastructure needs to be modernised in order to manage a growing share and absolute amount of electricity, of which an increasing amount will be variable supplies from renewables-generated electricity. By contrast, overall, the Roadmap scenarios envisage a broadly consistent share of gas in the energy mix, and falling absolute amount of gas consumption.

Figure 6: The development of relative EU gas consumption envisaged by the Energy Roadmap 2050 scenarios



All scenarios envisage a stable or falling share of gas in the energy mix

Figure 7: The development of absolute EU gas consumption envisaged by the Energy Roadmap 2050 scenarios



All scenarios envisage a falling absolute use of gas in the energy mix

* Acronyms Ref, Eff, DST, RES, Del CCS, LoNUke see page 31

Both relative and absolute gas consumption falls furthest in the High RES scenario, with absolute gas consumption falling second fastest in the High Eff scenario. However, if fossil fuels are made available cheaply enough (through new import infrastructure or domestic extraction) history tells us that the power generation plant will be built to burn it. Any over-building of fossil fuel infrastructure, beyond that already planned, could therefore lead to the significant regrets of additional greenhouse gas emissions and the opportunity costs of soaking up scarce investment capital that could be directed towards delivering energy savings and renewable energy. These must be avoided by focusing on renewable energy and energy savings.

Aiming for 95% decarbonisation is a game changer

Given the difficulty of delivering higher decarbonisation rates by doing more in those sectors where the greatest residual emissions remain, namely industry and transport, our analysis shows that blockers to decarbonising these sectors only become apparent in a 95% emissions reduction scenario, of the kind not explored by the Roadmap. For example, it is impossible to achieve 95% decarbonisation by accelerating a switch to transport biofuels.

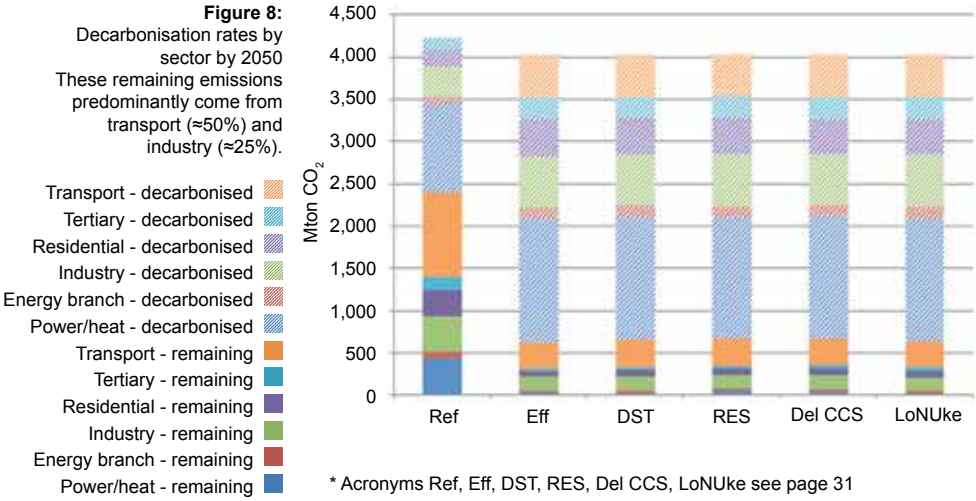
Our fourth recommendation:
The European Commission should develop new scenarios that are capable of delivering 95% emissions reductions.

Each of the Energy Roadmap scenarios *"achieve an 80% reduction in greenhouse gas emissions implying some 85% decline of energy related CO2 emissions including from transport"*[30]. However, the EU's decarbonisation objective is *"to reduce emissions by 80-95% by 2050 compared to 1990 levels"*[31]. It is vital to note the difference between these targets, because unless the decarbonisation scenarios

presented by the European Commission are capable of delivering energy-related CO2 emissions reductions in line with overall greenhouse gas cuts of 95%, the scope for reaching the more ambitious end of the target within the energy sector will have been limited from the beginning.

In order to achieve 95% emissions reductions, the EU can only emit 202Mt of CO2 in 2050, between 427 – 468 Mt CO2 less than is currently achieved by the Commission's 85% energy sector decarbonisation scenarios[32].

Figure 8:
Decarbonisation rates by sector by 2050
These remaining emissions predominantly come from transport (≈50%) and industry (≈25%).

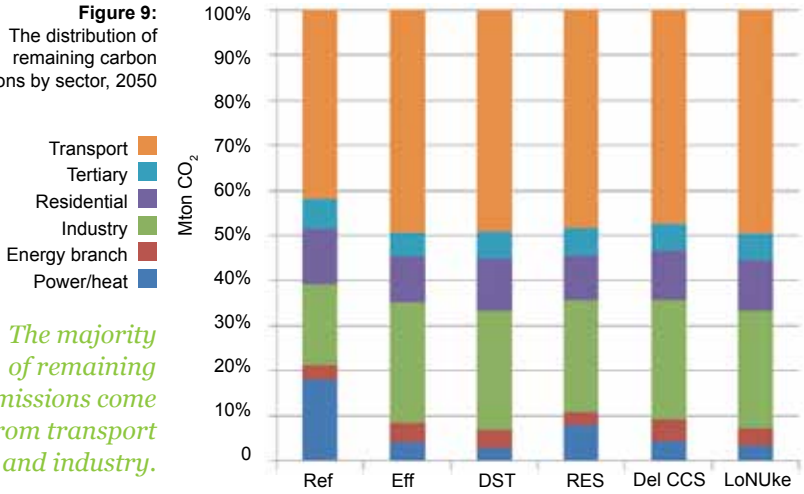


* Acronyms Ref, Eff, DST, RES, Del CCS, LoNUke see page 31

None of the Commission's scenarios deliver 95% emissions reductions.

These remaining emissions predominantly come from transport (≈50%) and industry (≈25%).

Figure 9:
The distribution of remaining carbon emissions by sector, 2050



The majority of remaining emissions come from transport and industry.

* Acronyms Ref, Eff, DST, RES, Del CCS, LoNUke see page 31

These sectors should, therefore, be the focus of efforts to achieve more ambitious reductions than those envisaged by the Commission. Regarding transport, as is noted above, two non-fossil fuel options are considered in the Roadmap: biofuels and electrification (hydrogen meets less than 0.1% of transport demand in the Roadmap scenarios). However, the assumed availability of sustainable biomass[33] is fully consumed in the Roadmap scenarios. This means that any additional biomass demand would, by definition, be unsustainable. Hence, it is not possible to reduce emissions by 95% by increasing biofuel consumption. This leaves electrification as the remaining decarbonisation option. The electrification of transport requires a different set of policy measures from the start, but its necessity only becomes apparent when analysing 95% decarbonisation scenarios. We therefore urge the Commission to explore such possible bottlenecks by considering scenarios that are more ambitious than those presented in the Energy Roadmap.

Only by identifying scenarios that can achieve a 95% cut in energy-related emissions as soon as possible will the EU ensure that all sectors play their full part in cutting overall emissions.

Furthermore, an additional observation of this report is that further decarbonisation of the industrial sector is difficult to achieve using CCS, which is expected to be prohibitively expensive at small-scale sites (where it is not currently envisaged by the Roadmap scenarios). As with transport, the possible alternative of a significant fuel switch to biomass faces challenges because of the scarcity of sustainable biomass. This report's subsequent recommendation is that European policy makers fully investigate the scope for further decarbonisation in the industrial sector through either greater energy efficiency or new technological innovations, such as those identified by CAN Europe[34].

Steel	The Hisarna coke free steelmaking process - able to cut emissions from steel production by 80% with CCS, and by 20% without CCS.
Cement	The use of Magnesium Oxide cement clinker – a new type of cement that has the ability to become a net CO2 absorber
Pulp	A biomass-based by-product can be turned into a gas that can deliver the heat needed for pulp making. When paired with CCS, it can deliver negative net emissions in the pulp and paper sector.

The overriding conclusion of this report is, therefore, that only by identifying scenarios that can achieve a 95% cut in energy-related emissions as soon as possible will the EU ensure that all sectors play their full part in cutting overall emissions.

The High renewable energy sources scenario needs strong support measures for renewables in order to work.

POTENTIAL BENEFITS

Potential benefits of aiming for 95% emissions reductions and 100% renewable energy

This report's analysis of the different options for energy-sector decarbonisation, as presented in the European Commission's Energy Roadmap 2050, has observed:

1. The central importance of energy savings;
2. The reduced risk of non-delivery with renewables compared to CCS or nuclear;
3. The need for caution when investing in fossil fuel infrastructure; and
4. The game-changing nature of aiming for 95% emissions reduction.

These core findings build on the conclusions of WWF's global Energy Report that high levels of energy efficiency and renewable energy, working in conjunction, are the surest way of achieving the high levels of decarbonisation needed in the energy sector. Therefore, **this paper supports the call for the Commission to develop a combined High Efficiency and High Renewable energy sources scenario aimed at 95% decarbonisation**, in order to demonstrate the potential for this approach at the European level.

This paper supports the call for the Commission to develop a combined High Efficiency and High Renewable energy sources scenario aimed at 95% decarbonisation.

In the Roadmap as it stands, the High RES scenario achieves energy savings through the greater use of more efficient generation technologies[35], while the High Eff scenario achieves similar savings by reducing final energy demand. As part of our analysis, we applied the energy mix of the High RES scenario to the final demand of the High Eff scenario. **The primary energy demand of this combined scenario is 8% lower than the**

High RES scenario and 5% lower than the High Eff scenario. Renewable energy and energy efficiency naturally complement each other since the efficiency of each is achieved at different ends of the energy system. The potential of combining more efficient generation with lower final demand must be fully explored in order to determine the extent to which it would reduce both environmental and financial risks, as detailed above.

WE NEED TO DELIVER POST 2020 CLIMATE AND ENERGY ACTION

We must act quickly and comprehensively

So far, limited progress has been made in key policy areas, including:

1. Were the resistance to higher energy savings targets shown by of a number of Member State governments to continue, they would rule out the High Eff Roadmap scenario.
2. The objection of some member states and other stakeholders to supporting renewable energy after 2020 puts the High RES scenario in jeopardy.
3. Failure to fix the EU Emission Trading System so it is in line with 2050 emissions reductions targets and provides the investment signal needed for market-driven growth in low-carbon technologies puts all the Roadmap scenarios at risk.

The EU climate and energy policy community as a whole should urgently start the work needed to gather support for, and deliver, post 2020 climate and energy action.

It is this paper's recommendation, therefore, that given the lack of margin for error in the Roadmap scenarios, as shown by this analysis, the EU climate and energy policy community as a whole should urgently start the work needed to gather support for, and deliver, post 2020 climate and energy action.

Each Roadmap scenario depends on carbon pricing to drive the transition needed to cut energy-related emissions. Additionally, the High RES scenario needs strong support

measures for renewables in order to work. The High Eff scenario requires i) more stringent minimum requirements for appliances and new buildings, ii) high renovation rates of existing buildings, and iii) the establishment of energy savings obligations on energy utilities.

The sooner we start the work needed to deliver on these requirements, the more time we will have to test the robustness of different decarbonisation options, and thereby minimise the risk that critical lessons are learnt when it is already too late to correct them. This risk has to be avoided.

The EU has already identified the right policy options, and the 20-20-20 package focusing on energy efficiency, renewable energy and overall CO2 cuts, put the Union on the right path to cutting the EU's energy-related emissions. However, that work is now under threat because of a loss of ambition. This is causing unacceptable delay that could put the ultimate goals beyond reach.

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CONCLUSION

The case for going to 95% and how to get there

This report has shown that a 95% reduction in energy related emissions cannot be delivered by increasing the use of the decarbonisation tools envisaged by the Commission's less ambitious scenarios. Instead, a different approach is required from the start. The greater challenge of going for 95% decarbonisation from the start means that the risks associated with CCS, nuclear, and the overuse of biomass could not be countenanced; leaving the more reliable options of sustainable renewable energy and energy savings.

Unacceptable risks of climate change can only be avoided if developed countries reduce their greenhouse gas emissions by 40% by 2020 and by 95% by 2050. Achieving this will improve the probability of staying below 2°C warming, and keeps WWF's goal of a 1.5°C maximum within reach[36].

WWF's vision of a world that is powered by 100% renewable energy sources by the middle of this century is achievable[37]. While this transformative effort demands significant investment, delivering it means we would save (globally) nearly €4 trillion per year by 2050 through energy efficiency and reduced fuel costs compared to a "business-as-usual" scenario[38].

With enough ambition and commitment the European Union can lead the world by turning this vision into reality.

[1] European Council, http://register.consilium.europa.eu/pdf/en/09/st15/st15265-re01.en09.pdf, October 2009.

[2] European Council, 8/9 March 2007: By 2020, at least 20 % reduction in greenhouse gas emissions compared to 1990 (30% if international conditions are right, European Council, 10-11 December 2009); saving of 20 % of EU energy consumption compared to projections for 2020; 20 % share of renewable energies in EU energy consumption, 10% share in transport.

[3] European Commission, Energy Roadmap 2050 COM(2011) 855/2, http://ec.europa.eu/energy/energy2020/roadmap/index_en.htm, December 2011.

[4] European Commission, Energy Roadmap 2050 COM(2011) 855/2, page 2, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0885:FIN:EN:PDF

[5] Energy-related CO2 emissions includes emissions from transport sources: Ibid.

[6] European Commission, MEMO/11/914- The Commission's Energy Roadmap 2050, http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/11/914&format=HTML&aged=0&language=EN&guiLanguage=en, 15th December 2011

[7] High energy efficiency (decrease in demand of 41% by 2050 compared to peaks in 2005-06); Diversified supply technologies (No technology preferred and no subsidies given - decarbonisation driven by carbon pricing); High Renewable energy sources (RES in final energy consumption of 75% in 2050, including RES in electricity consumption reaching 97%); Delayed CCS (CCS is delayed, leading to higher shares for nuclear energy); Low nuclear (No new nuclear plants are built (other than those already under construction) resulting in higher penetration of CCS)

[8] Council of the European Union, Presidency conclusions, 18th June 2012, http://register.consilium.europa.eu/pdf/en/12/st11/st11553.en12.pdf

[9] Ibid

[10] The EU's 2020 energy savings target envisages a 20% reduction in primary energy consumption compared to a business as usual case. PRIMES modelling for the Commission put the business as usual consumption rate in 2020 at 1,842Mtoe. The target consumption rate for 2020 is therefore 1,474Mtoe. The Commission's current projection for the EU's primary energy consumption in 2020 is 1,678Mtoe – a saving of around 9% over 15 years from the peaks of 2005-06 instead of the target's 20%. The recently tortuously negotiated Energy Efficiency Directive (June 2020) which is yet to come into force or be implemented has the potential to produce an energy saving of about 15% by 2020. Full analysis is available at http://energycoalition.eu/energy-efficiency-deal-halves-20-target-gap

[11] Failure on energy efficiency has been assessed by applying the level of energy consumption of the reference scenario to each decarbonisation scenario, rather than the level of consumption assumed in the latter (which include considerable energy savings).

[12] According to the Commission's assumptions on the supply of sustainable biomass: The Energy Roadmap 2050 takes The European Environment Agency assessment of the amount of biomass that could be used in an environmental sustainable way in EU-25 by 2030 at 295 Mtoe (European Commission, Staff working paper SEC(2011) 1565/2 Part 1 of 2 - Impact Assessment accompanying the document Energy Roadmap 2050

[13] In the event of failure on energy efficiency, this report's analysis assumes that demand equals that in the Reference scenario, and that the demand gap is filled by power sources in proportions equal to those used in each decarbonisation scenario.

[14] Calculation biomass demand with failed efficiency target: final energy demand in all scenarios scaled up to that in Reference scenario. Biomass demand scaled up with same factor, corrected for 70% conversion efficiency for biofuel share.

[15] European Commission Communication, Energy Roadmap 2050 COM(2011) 855/2, http://ec.europa.eu/energy/energy2020/roadmap/index_en.htm, December 2011.

[16] Green Alliance, The CCS Challenge, http://www.green-alliance.org.uk/grea_p.aspx?id=6334

[17] BBC News Europe, Finland's Olkiluoto 3 nuclear plant delayed again, http://www.bbc.co.uk/news/world-europe-18862422, 16.07.2012 at 15.34pm GMT

[18] BBC News, RWE and E.On halt UK nuclear plans at Wylfa and Oldbury, http://www.bbc.co.uk/news/world-17546420, 29th March 2012

[19] The Economist, "The Dream That Failed", Special Issue on Nuclear Power, March 2012: http://www.economist.com/node/21549936
[20] Ibid
[21] Ibid.
[22] The Energy Report; 100% Renewable Energy by 2050, http://wwf.panda.org/what_we_do/footprint/climate_carbon_energy/energy_solutions/renewable_energy/sustainable_energy_report/, 2011
[23] European Climate Foundation, Roadmap 2050 and Power Perspectives 2030, http://www.europeanclimate.org/en/publications; also WWF Germany, Blueprint Germany, http://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/blueprint_germany_wwf.pdf; also WWF United Kingdom, Positive Energy, http://assets.wwf.org.uk/downloads/positive_energy_final_designed.pdf
[24] European Commission, Energy infrastructure priorities for 2020 and beyond, http://ec.europa.eu/energy/infrastructure/strategy/2020_en.htm, 2011
[25] European Commission Communication, Energy Roadmap 2050 COM(2011) 855/2, http://ec.europa.eu/energy/energy2020/roadmap/index_en.htm, December 2011.
[26] http://www.eurogas.org/uploaded/Eurogas%20Roadmap%202050%20-%20Explanatory%20Note.pdf
[27] More flexible infrastructure includes: improvements to both long distance and local electricity grids to integrate renewable generation; more gas infrastructure to help complete the internal energy market and to link to new external gas supplies; and CO2 infrastructure.
[28] European Commission, Energy infrastructure priorities for 2020 and beyond, http://ec.europa.eu/energy/infrastructure/strategy/2020_en.htm, 2011
[29] This import infrastructure is expected to be built half in the EU, and half outside, Brussels, Commission Staff Working Document – Impact assessment accompanying the Commission Communication 'Energy infrastructure priorities for 2020 and beyond - A Blueprint for an integrated European energy network', 17.11.2010, SEC(2010) 1395 final / {COM(2010) 677 final, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2010:1395:FIN:EN:PDF, p33-34 -
[30] European Commission, Energy Roadmap 2050 COM(2011) 855/2, http://ec.europa.eu/energy/energy2020/roadmap/index_en.htm, December 2011.
[31] European Council, http://register.consilium.europa.eu/pdf/en/09/st15/st15265-re01.en09.pdf, October 2009.
[32] European Commission, Energy Roadmap 2050 COM(2011) 855/2, http://ec.europa.eu/energy/energy2020/roadmap/index_en.htm, December 2011.
[33] The Commission assumes that 295 Mtoe of sustainable biomass is available in the EU.
[34] Can Europe, Steel, Paper and Cement: Identifying breakthrough technologies, October 2010, http://www.climnet.org/resources/publications/cat_view/382-publications/370-can-europe-publications/379-generalvarious
[35] Renewable energy sources do not suffer from any conversion losses in power generation (such as heat), unlike fossil fuels.
[36] WWF European policy Office, EU climate change and energy policy, http://www.wwf.eu/climate/
[37] WWF, Ecofys and the Office for Metropolitan Architecture, The Energy Report; 100% renewable energy by 2050, http://wwf.panda.org/what_we_do/footprint/climate_carbon_energy/energy_solutions/renewable_energy/sustainable_energy_report/, 2011
[38] Ibid

ACRONYMS

- Ref: Reference
- Eff: Efficiency
- DST: Diversified supply technologies
- RES: Renewable energy sources
- Del CCS: Delayed carbon capture storage
- LoNUke: Low nuclear

Cutting energy related emissions in figures

100% RECYCLED

100%

WWF has a vision of a world powered by 100% renewable energy sources by 2050

95%

The EU needs to cut its greenhouse gas emissions by at least 80-95% by 2050 (from 1990 levels)

40%

Without further action, the EU will only cut greenhouse gas emissions by about 40% by 2050

€4 TRILLION

By 2050 we could save nearly €4 trillion a year globally through energy efficiency and reduced fuel costs

Why we are here
To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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