

# ROADMAP 2050

A PRACTICAL GUIDE TO A PROSPEROUS, LOW CARBON EUROPE  
[WWW.ROADMAP2050.EU](http://WWW.ROADMAP2050.EU)

## Project Summary

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The mission of Roadmap 2050 is to provide a practical, independent and objective analysis of pathways to achieve a low-carbon economy in Europe, in line with the energy security, environmental and economic goals of the European Union. The Roadmap 2050 project is funded by the European Climate Foundation and has created a fact-based analysis that illustrates why a zero-carbon power sector is required and how that can become a reality, in line with Europe's long-term climate and energy security commitments through to 2050.

The project is based on extensive technical, economic and policy analyses conducted by leading organizations in the field: Imperial College London; KEMA; McKinsey & Company; Oxford Economics; the Office for Metropolitan Architecture; The Energy Research Centre of the Netherlands (ECN), E3G and the European Climate Foundation, with the involvement of leading utilities, transmission operators, equipment manufacturers, academics and NGOs.

The roadmap examines several decarbonisation scenarios for the power sector and, based on a back-casting methodology, sets out the near-term implications of this long-term commitment.

The Roadmap 2050 project analysis started in August 2009. Over the 8 months of the project, a vast amount of analytical work has taken place, including specific detailed sessions with industry collaborators on the assumptions that could be reasonably made regarding each technology contributing to the decarbonised scenarios and four meetings of the core reflection group of industry and NGOs.

When the Roadmap 2050 project started, a number of widely shared assumptions dominated the debate on the future of the European power sector. These included assertions that high-renewable energy scenarios would be too unstable to provide sufficient reliability, that high-renewable scenarios would be uneconomic and much more costly, and that technology breakthroughs would be required to move Europe to a zero-carbon power sector. Roadmap 2050 has found all of these assertions to be incorrect.

The project finds that in each of the low/zero-carbon pathways, using 40%, 60%, 80% or 100% renewable energy sources, the future cost of electricity is comparable to the future cost of electricity under the current carbon-intensive infrastructure. Roadmap 2050 also shows that with the necessary investments in energy efficiency and Europe's power network infrastructure, a decarbonised power sector using available technologies can provide the same high level of reliability that consumers enjoy today, in all low/zero carbon pathways.

With the exception of existing hydroelectric facilities, almost all of the power generation capacity required to supply Europe in 2050 will need to be built in the next 40 years. This is a major undertaking regardless of the energy mix, and would pose a massive challenge even in a high-carbon scenario. The key finding of the Roadmap 2050 project is that the challenge is basically the same in either a high-carbon, low-carbon or zero-carbon energy scenario, in terms of overall cost to consumers and the European economy.

What does change significantly is the required level of investment early in the cycle. Capital expenditure on energy infrastructure will need to increase by 50-100% in the next 15 years to deliver

a zero-carbon power sector by 2050. But in that scenario, the overall energy bill for the economy will be heading downward by 2020, and the day-to-day running costs fall fast throughout the period.

As well as studying the technical requirements of the grid and power infrastructure and the economics of the various scenarios, the Roadmap 2050 project has also delivered an analysis of the policy requirements for decarbonisation of the power sector by 2050.

Action before 2015 is a prerequisite for decarbonisation by 2050. Immediate policy development and implementation will need to focus on:

1. Energy Efficiency measures, creating cost savings and reducing demand.
2. Investments in regional grid inter-connection, minimizing back-up supply and load-balancing requirements, plus a broad program of smart grid pilot projects anticipating rapid expansion.
3. Continued and accelerated technology development.
4. Market reform to ensure an effective long-term investment case for business.
5. Laying the foundation for rapid fuel switch to electricity in buildings and transport sectors.

Roadmap 2050 shows that existing policy frameworks can be adapted to support decarbonisation of the European power-sector, but that an holistic approach is needed, with rapid action at both regional and national level required.

The Roadmap 2050 project shows that the benefits of the low-carbon transition far outweigh the challenges and that a commitment now to a systemic low-carbon transformation of the energy sector is ultimately the winning economic strategy for competitiveness and low-carbon prosperity in Europe. Achieving at least 80% greenhouse gas reductions in 2050 based on zero carbon power generation in Europe is technically feasible and fully reliable, including pathways based on very high contributions from renewables, and makes compelling economic sense.



# ENERGY SAVINGS 2050

HOW TO TRIPLE THE IMPACT OF ENERGY SAVINGS POLICIES IN EUROPE  
[HTTP://ROADMAP2050.EU/CONTRIBUTING\\_STUDIES](http://roadmap2050.eu/contributing_studies)

## Executive Summary

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### OBJECTIVES

The Energy Savings 2020 study aims to provide the fact base for a constructive discussion on EU energy efficiency and energy saving policy. To that end, the objectives of the study are threefold:

#### 1. Assess progress towards achieving the 20% target

This first part of the study should quantify the distance to the target in order to verify other findings and strengthen the evidence base for further actions. The results of measuring progress towards achieving a target depend on how this target is interpreted. The original proposal for a 20% primary energy savings target by 2020 was defined in relation to a baseline, but it was left open as to whether this baseline is fixed or not. But the Commission's evaluation from 2008 suggests a fixed baseline, which has not been contested by the other EU institutions and has been used in this report as a useful and measurable target. In order then to assess progress towards achieving the target, the impact of EU energy and climate policies has to be measured. To that end, this study looks at all factors impacting energy use and calculates the effect of actual policy as opposed to other factors.

#### 2. Provide an overview of existing energy savings potential across Europe

Having established the scale of the shortfall, the report then considers existing energy saving potential, which is cost-effective. These are savings which can be achieved by increasing the energy efficiency whereby the total financial investment costs are lower than the financial savings resulting from the reduced energy consumption. This requires a careful examination of available energy efficiency measures in all sectors of the economy and their related energy efficiency improvement potential and cost compared to the business-as-usual scenario. Doing so will also give an indication of how ambitious the 20% target is, how realistic it is by 2020, and how much it will save the European economy.

#### 3. Look into policy design criteria and features for capturing the existing cost-effective savings potential and achieving the 20% target

With the scale of the gap and the potential to fill it established, the debate then moves on to the policy level. Policies must be designed in such a way as to capture as a minimum the cost-effective energy savings potential contributing to the target. The target itself needs to ensure sufficient commitment, accountability and mobilisation of complementary policies. The report looks into key EU policy design criteria and features to inform that debate.

### FINDINGS

#### 1. A tripling of policy impact is required to meet the EU's 20% energy savings target

Achieving the 20% energy savings target requires around 394 million tons of oil equivalent (Mtoe) of energy savings by 2020<sup>1</sup>. In addition to energy efficiency improvement already included in the

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<sup>1</sup> From projected 1968 Mtoe under the baseline scenario to 1574 Mtoe with the 20% energy savings target. This is an absolute reduction from measured 1800 Mtoe in 2005.

baseline, latest calculations estimate that the 2008 economic recession will have reduced EU primary energy consumption by about 70 Mtoe by 2020, while new policies adopted since the 2006 EEAP are expected to have an impact of 115 Mtoe<sup>2</sup>. This leaves the EU with a savings gap of 208 Mtoe by 2020, requiring a tripling of policy impact to achieve the target.

While current EU energy and climate legislation cover 90% of EU energy use<sup>3</sup>, some policies are performing better than others. The ratio between estimated policy impact and the cost-effective energy savings potential covered by these policies varies from 1/4 for the regulation setting CO<sub>2</sub> standards for passenger cars, 1/3 for the Energy End-use Efficiency and Energy Services Directive to 1/2 for the Energy Performance of Buildings Directive, Ecodesign and Labelling Directives (combined). An assessment of GHG emissions policies, such as the EU Emissions Trading Scheme, found inconclusive evidence on the impact of carbon prices incentives on energy savings. A mix of complementary policies, thus, will be required to overcome the market barriers associated with price signals and private sector investment expectations.

## 2. The 20% energy savings target can be met cost-effectively

Realising all cost-effective end-use energy savings measures (like building insulation, top performing lighting in homes and electric motors in industrial installations) is sufficient – in conjunction with the energy savings impact of meeting the EU's renewable energy target<sup>4</sup> – to close the gap and achieve the 2020 target. Doing so would save EU consumers €78 billion annually by 2020 and potentially reduce EU energy import dependency from projected 62% to 45% by the end of this decade, back to 1990 levels.

However, the scale of the challenge is not to be underestimated: energy saving measures are diverse and spread across all sectors<sup>5</sup>, and will have to be implemented quickly enough to deliver their savings potential on time.

## 3. Binding energy savings target for end-use sectors at Member State level are the most feasible target design option.

The option of introducing a binding energy savings targets for end-use sectors at Member State level is the most compatible with existing EU energy and climate policies, covers the vast majority of identified cost-effective savings potential and ensures national commitment and accountability for achieving the target while providing maximum flexibility for implementation.

A careful survey of the possible approaches to complementary legislation, reinforcing the effectiveness of existing legal structures and achieving the targets, shows clearly that a binding energy savings targets for end-use sectors at Member State level could provide a more structured and coherent framework to a mix of policy measures that will be required to fully capture the cost-effective savings potential in the timeframe concerned.

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<sup>2</sup> 95 Mtoe for energy saving policies and 20 Mtoe for renewable energy policies.

<sup>3</sup> The remaining 10% currently not covered by EU policies are freight transport and losses during transmission and distribution of electricity and heat.

<sup>4</sup> In the Eurostat Primary Energy Method, hydro, wind and solar are accounted as having a 100% conversion efficiency. Therefore, the higher the share of renewable energy in the total energy mix, the more energy efficient the overall economy.

<sup>5</sup> These measures range from insulation and more efficient electrical appliances and heating systems in the built environment, to more efficient engines, aerodynamics and rolling systems in the transport sector and process and supply optimisation and more efficient electrical motors in the industry. The study assumes no additional saving potential on the supply side to those already included in the baseline.

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*The Roadmap 2050 project is an initiative of the European Climate Foundation (ECF) and has been developed by a consortium of experts funded by the ECF. In addition, a wide range of companies, consultancy firms, research centres and NGOs have further supported the preparation of this report. The ECF is the sole author of the Roadmap 2050 report, is solely responsible for its content and will act as a guardian of the content.*

*Energy Savings 2020 is a contributing study to the Roadmap 2050 project.*

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