

PROJECT SUMMARY

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.

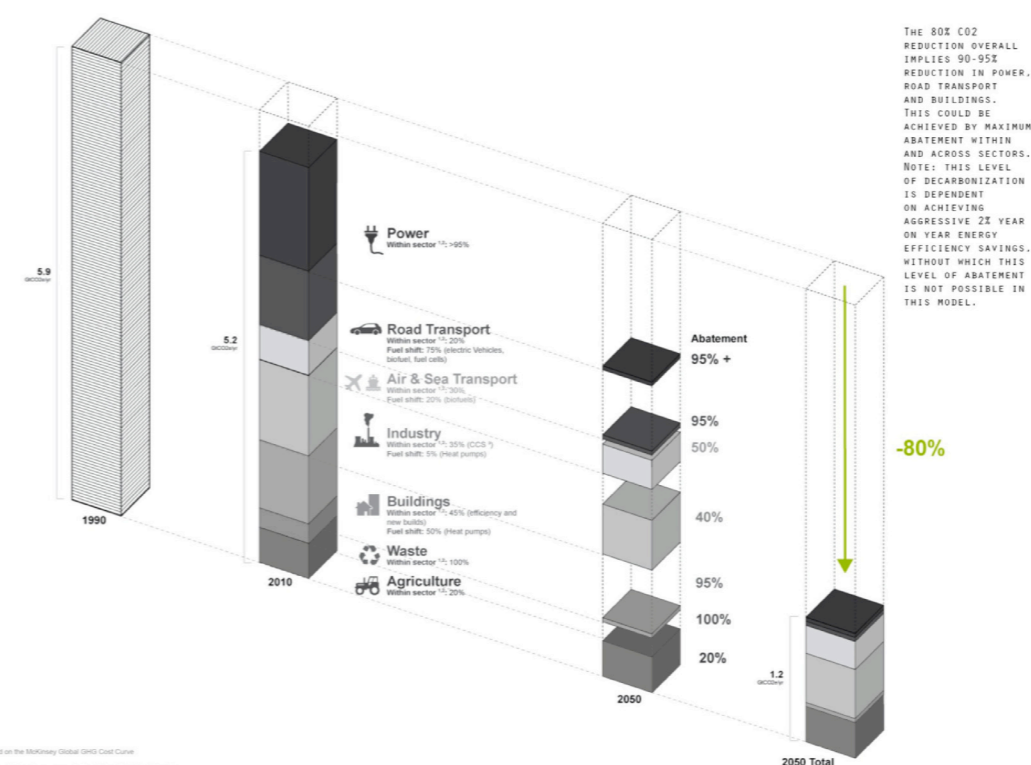
The project is based on extensive technical, economic and policy analyses conducted by leading organizations in the field: Imperial College London; KEMA; McKinsey & Company; Oxford Economics; the Office for Metropolitan Architecture; The Energy Research Centre of the Netherlands (ECN), E3G

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.

80% CO₂ EMISSION REDUCTION



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.

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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.

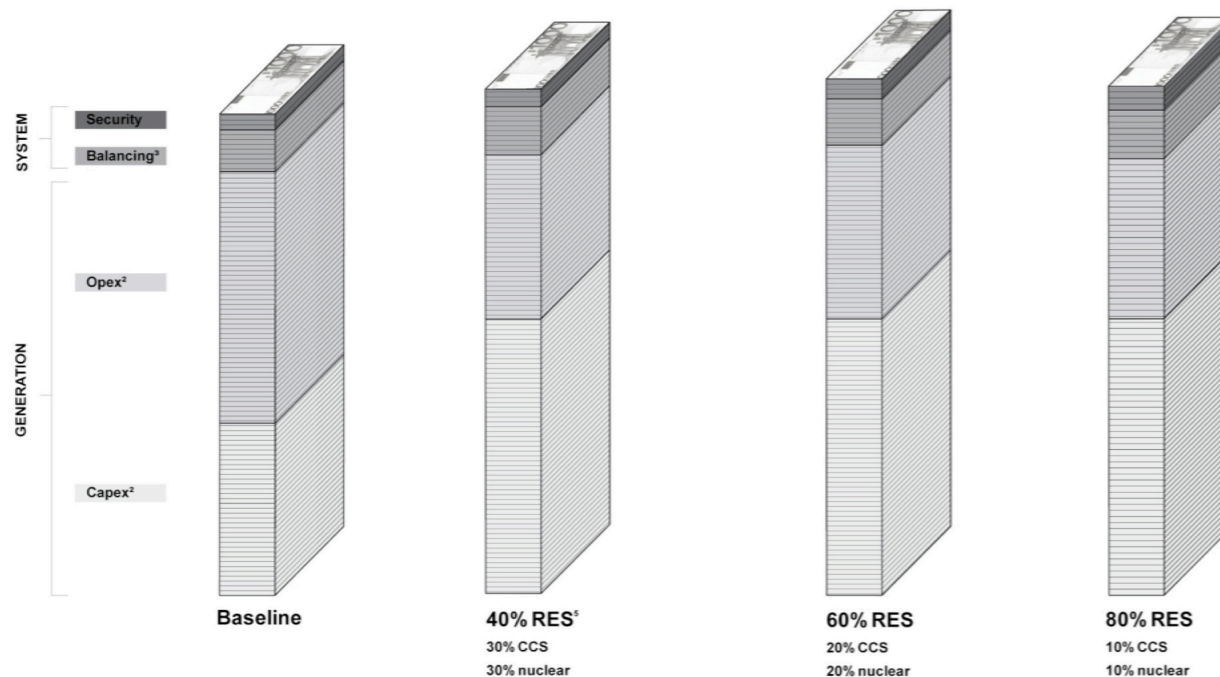
Roadmap 2050 shows that existing policy frameworks can be adapted to support decarbonisation of the European power-sector, but that an holistic approach is needed, with rapid action at both regional and national level required.

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.

COST OF ELECTRICITY

THE HIGHER CAPITAL COST IS OFFSET BY A LOWER OPERATIONAL COST.

Average new built CoE from 2010 to 2050¹. EUR/MWh (real terms)



¹ Weighted average based on the CoE in each 10-year time frame (2010, 2020, 2030, 2040, 2050)
² Generation only
³ Cost related to non-optimal plant use, system dispatch cost for secure operation, running backup plants, storage losses, reserve and response cost
⁴ Transmission and additional generation opex as well as fixed opex for transmission and backup

SOURCE: Roadmap 2050 Technical Analysis