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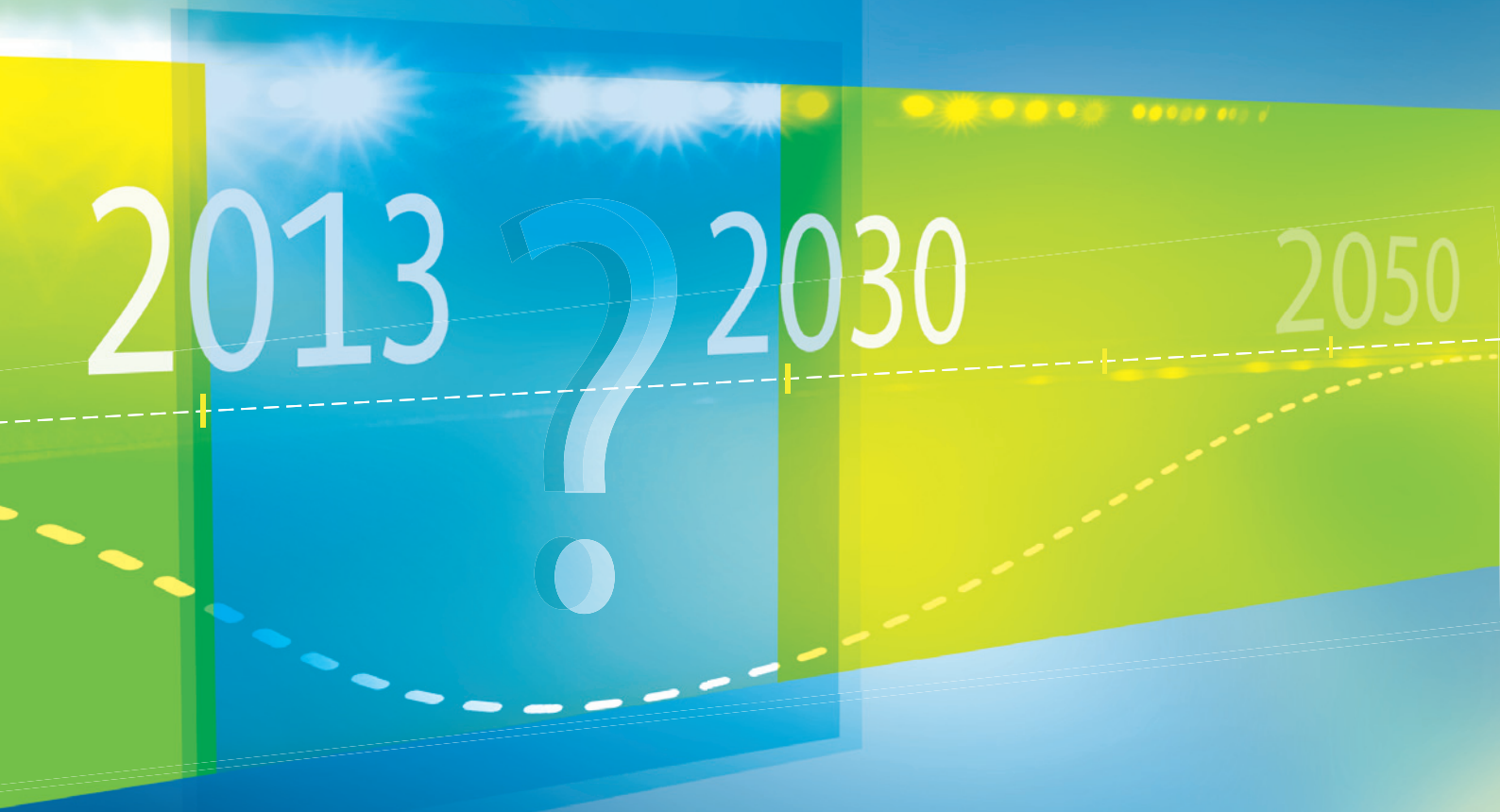
ELECTRICITY FOR EUROPE

POWER CHOICES RELOADED: EUROPE'S LOST DECADE?

KEY MESSAGES



POWER CHOICES RELOADED:
EUROPE'S LOST DECADE?

Introduction

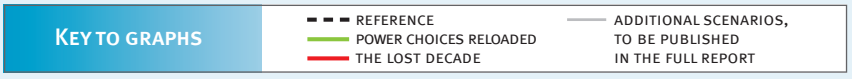
In March 2009, sixty-one Chief Executives of electricity companies representing more than 70% of total EU power generation signed a Declaration committing to action to achieve carbon-neutrality by 2050. The Declaration was immediately followed by EURELECTRIC's Power Choices study, examining how this vision could be made reality along with efforts by other sectors of the economy.

Carbon-neutrality by 2050 requires a radical transition through continuous investment by the power sector into new generation assets, new storage, smart technologies and new grids. To find better technologies and cost-effective solutions, enhanced research and development is necessary. But the case for investment and research in the power sector depends crucially on the strength of the carbon signal that European policy is giving to the economy as a whole.

Today, European policy is not sending a clear signal. Instead it offers several conflicting and contradictory signals. For an investor it is almost impossible to identify a clear path through the regulatory jungle: in painful contrast to the coherent objective of the European internal energy market, we experience a variety of different and not very stable national policies for low-carbon. The EU Emissions Trading Scheme (ETS) – a truly EU-wide harmonised approach – is being undermined by the national implementation of the Renewables Directive and the Energy Efficiency Directive. And not only are these national policies very loosely harmonised at best, but they also strongly influence price formation in the ETS allowances market. This raises a key question whether a strong ETS would be a better way to promote renewables and energy efficiency. Investors are hesitant to take decisions in this policy environment, which they judge to be unsustainable.

This Power Choices Reloaded study revisits EURELECTRIC's 2009 model in light of changing economic and political assumptions. It shows that sooner or later the 2050 goal will require a major reform of the entire European and national framework of low-carbon policies. But it also shows that until the current conflicting and contradictory signals are resolved, investors will avoid the European electricity market. Increasingly this problem is even seen in the supported renewables sector. Meanwhile, the delay while we wait for a policy signal poses a serious threat to security of supply and to the feasibility of meeting climate targets. Crucially it puts at risk the goal of affordable energy.

This key message summary publishes the main results of the Power Choices Reloaded study. Additional detailed variants, shown throughout the graphs in grey, will be published in full in summer 2013.



Key conclusion

Indecision today locks in higher costs tomorrow

Power Choices Reloaded tests several scenarios and sensitivities demonstrating different possible EU policy approaches and regulatory measures. The results give a stark conclusion: an early investment signal is vital in order for Europe to reach its whole-economy climate targets in an economically sustainable way.

In order to explore the consequences of conflicting and contradictory policy signals and delayed investments, EURELECTRIC has modelled a *Lost Decade scenario* which postpones major abatement action beyond 2030. Having postponed action, an extremely steep abatement path becomes necessary to reach the 2050 goal, leading to bottlenecks in equipment supply, price effects due to overheated demand, and stranded assets because of exaggerated investments in redundant capacity.

This "crawl today, sprint later" approach gives results which are clearly nonsensical:

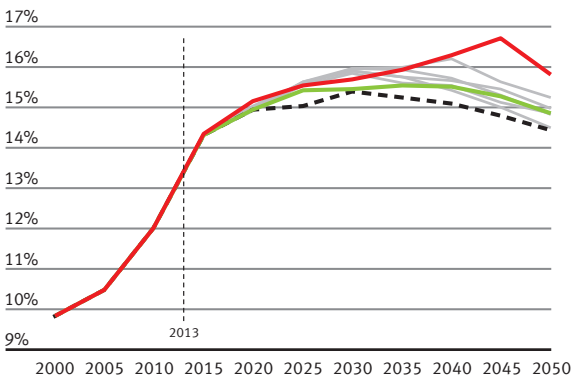
- During 2030-35 the percentage of carbon-free generation (renewables, nuclear and CCS) must increase from 60% to over 80%;
- During 2030-35 the average rate use of thermal generation declines from over 35% to only just above 15%;
- During 2030-50 the load factor of all power generation capacity decreases from over 40% to under 35%.

Power Choices Reloaded shows that this *Lost Decade scenario* can be only illustrative: these changes could not happen at such speed in the real world. The increase in carbon-free generation alone indicates an unsustainable development curve, with renewables losing ground until 2030, lacking technology learning curves and supply chain build up, and then suddenly taking off.

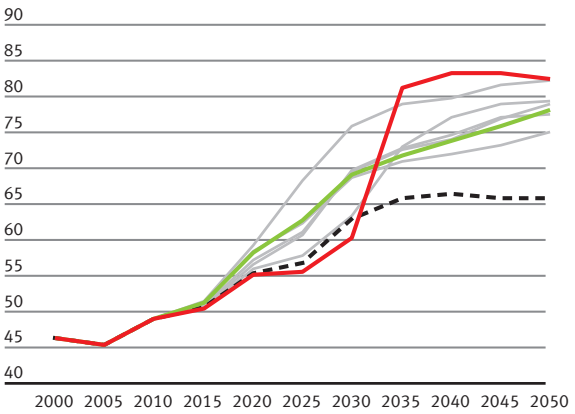
EURELECTRIC concludes that policymakers urgently need to recognise that severe cost differences will result from delay. These differences emerge towards 2030, but have been locked-in far earlier. In other words, by 2030 Europe will feel the costs of what we have or have not done today. And unfortunately, when that moment arrives we will not be able to turn back time.

In contrast, if a steady signal is given today, there are several plausible policy paths to 2050.

Energy system costs as % of GDP, billion €$_{2010}$



Carbon free generation (%)



Policy recommendations

An early investment signal is vital in order for Europe to reach its whole-economy climate targets in an economically sustainable way, therefore:

- EURELECTRIC calls on the EU institutions to urgently agree an ambitious, firm, long-term, economy-wide greenhouse gas reduction target for 2030 up to 2050, in line with the European Council goal.

Cost-efficient policies are essential, therefore:

- Ensure the completion of the internal energy market;
- Make the ETS the main policy instrument for driving investment choice in CO_2 reduction, including for driving the expansion of mature renewables and energy efficiency through a carbon price signal;
- Fix the ETS by an early revision of the linear reduction factor in line with a 2030 target;
- Support the development of infrastructure, including for intelligent grids and transport electrification.

All technologies need to be available, therefore:

- Ensure demonstration of carbon capture and storage (CCS);
- Recognise a continued role for nuclear power;
- Continue RD&D and incentives for early deployment of not-yet-mature renewable technologies.

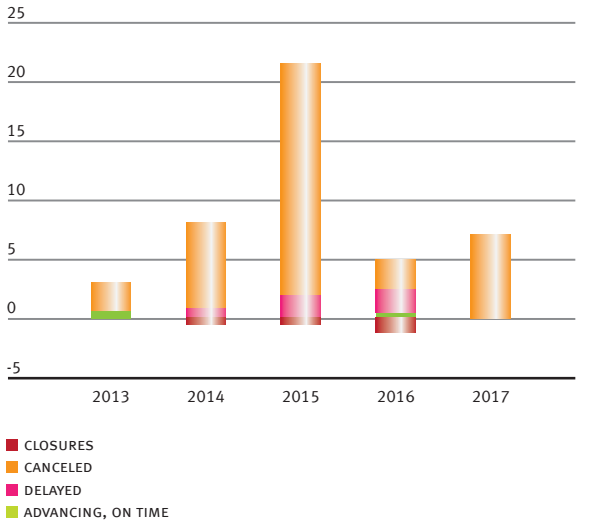
Then and now from Power Choices to Power Choices Reloaded

The 2009 Power Choices study confirmed that:

- Carbon-neutral power in Europe by 2050 is achievable at a reasonable long-term total energy cost. The technology-neutral *Power Choices scenario* has the lowest accumulated costs of the carbon-neutral policy options;
- The major CO_2 reduction in the power sector occurs beyond 2020 because investment decisions taken today will result in lower carbon emissions over the next decade;
- All power generation technology options are needed, together with robust electricity and carbon markets and policies to foster energy efficiency;
- A paradigm shift is needed on the demand side: intelligent electricity systems should replace direct use of fossil fuels.

Power Choices 2009 also emphasised that, to achieve this objective, strong and immediate policy action was required to favour low-carbon technology choices through carbon and electricity markets, energy efficiency, and cost allocation.

Developments in coal, gas, and oil plant pipeline since January 2012 (GW)



Source: IHS CERA, December 2012

What has changed since 2009?

Since November 2009, when the first results of Power Choices were presented, we have seen:

- Slow progress in the UNFCCC climate negotiations;
- Recession;
- Slow progress in European market integration and infrastructure development;
- Postponed investments;
- Rapidly changing national energy policies and global energy markets;
- Slow progress on the demonstration of carbon capture and storage (CCS);
- Continuing development of technology costs.

In the meantime the European Commission has issued roadmaps looking at the 2050 horizon for the whole economy, for energy and for transport, asking for further input from stakeholders.

Société Générale saw electricity demand drop 2.7% in 2011 compared to 2010, and despite a colder year, 2012 saw unchanged demand. Meanwhile Eurogas saw total gas demand down 2.3% in 2012 in addition to a 10% decline in 2011.

What's new in 2013?

Power Choices Reloaded updates the 2009 Power Choices study with a focus on:

- The impact of recent regulatory and economic developments on the sector's path to carbon-neutrality by 2050;
- The short-term (2020) and long-term (2050) impact for the sector of possible changes in the climate policy framework;
- Raising awareness of the difficulties in investing in this period and the crucial importance of enabling early investments;
- Ways to promote better coherence between the various energy and climate policies.

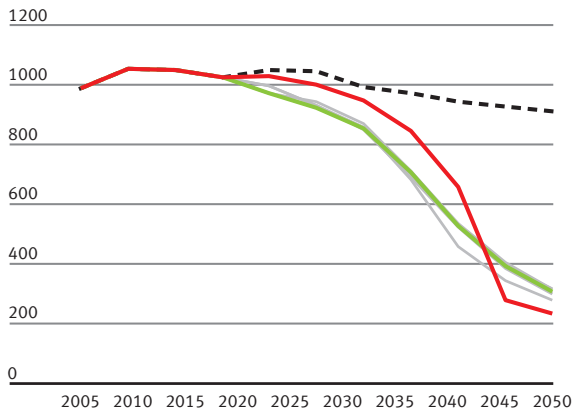
In taking a whole economy and long-term view, this study does not answer many additional important questions about market design or technology evolution. Nonetheless, the results highlight the importance of robust grid development (in transmission capacity and distribution), technology improvements, and bringing renewables into the market.

Key results
energy system costs in the economy

The power sector contributes most abatement until 2050. Starting with emissions of 350g/kWh in 2010, the sector will deliver about 10g/kWh in 2050 in the *Power Choices Reloaded scenario*. This will happen through continuous investment.

Reaching the whole-economy 2050 goal requires a significant share of final energy use to switch to electricity, notably in the transport sector, thus delivering emissions reductions and efficiency improvements.

CO_2 emissions in transport (Mt)



In general a CO_2 price signal is a very powerful tool for all sectors to efficiently drive low-carbon investment. Nonetheless this price signal needs to be complemented by bottom-up policies to drive large-scale investments in infrastructure, both for transport electrification and for grid intelligence, as well as to remove non-market barriers to energy efficiency.

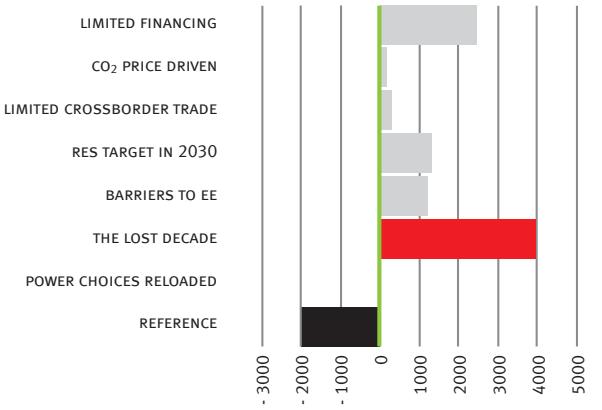
The critical uncertainty is time: less ambitious climate goals will lead to much higher follow-up costs beyond 2030. By calculating energy system costs based on capital cost for investment, purchases of primary fuel, investment costs for direct efficiency measures and non-CO_2-costs[1], the Power Choices Reloaded study shows that:

- Overall energy system cost in the economy reaches a plateau and then decreases long term – except in the *Lost Decade scenario;*
- By 2020 overall energy system cost in the economy is effectively the same in the *Power Choices Reloaded scenario* as in the *Reference scenario*. After reaching a plateau, the overall energy system cost in the *Power Choices Reloaded scenario* will decrease;
- In contrast, in the *Lost Decade scenario*, energy costs trend in only one direction: increasing costs of energy. The *Lost Decade* entails 5.5 billion €$_{2010}$ additional cumulative costs by 2050. It is 1.4 percentage points more expensive than the *Power Choices Reloaded scenario* by 2050, reaching 16.7% of GDP – i.e. over 50% higher than in 2010.

In short, the *Lost Decade* is the worst of all worlds: expensive in the beginning, and drastically more expensive in the end.

Power Choices Reloaded is the scenario that fulfils the European climate agenda and keeps costs at the lowest possible level.

Diff. of Cumulative Energy system costs excl. auction and disutility from PCR scenario (bn €$_{2010}$)



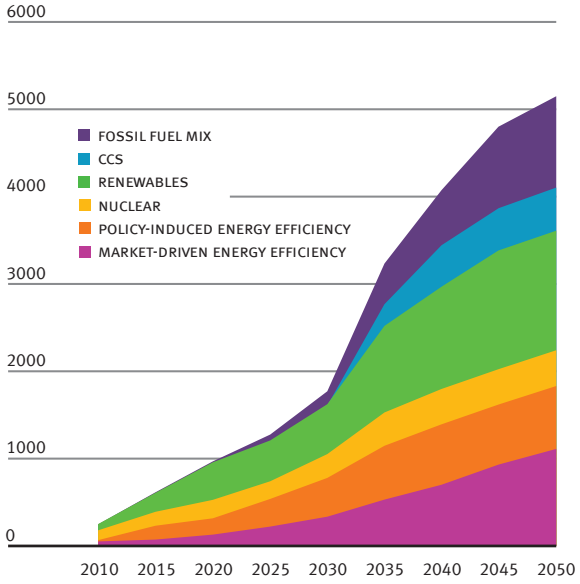
In the *Lost Decade scenario* the major abatement has to be achieved between 2030 and 2040, reducing emissions from 3,987Mt to 1,519Mt – an annual abatement of roughly 250Mt. However, average abatement over a ten year period in the EU-27 has been 51.7Mt p.a. (1990-2000), 6.5Mt p.a. (1995-2005), and 37.1Mt p.a. (2000-10). And even as an exceptional result of the financial crisis, the highest annual reduction so far achieved in the EU was 385Mt in 2008-9 (in 2009-10 emissions increased again by 141Mt). These figures make clear the scale of the challenge which would result from the *Lost Decade scenario*.

[1] Auction payments and disutility are excluded. The concept of disutility will be elaborated in the report in more detail.

Key results
power sector

Specifically in the power sector, the *Power Choices Reloaded scenario* shows that the ETS can support strong renewables and energy efficiency development in combination with complementary policies to reduce market barriers for end-users, for grid development and for innovation.

Energy CO_2 Avoided in Mt relative to 2005 - Lost Decade

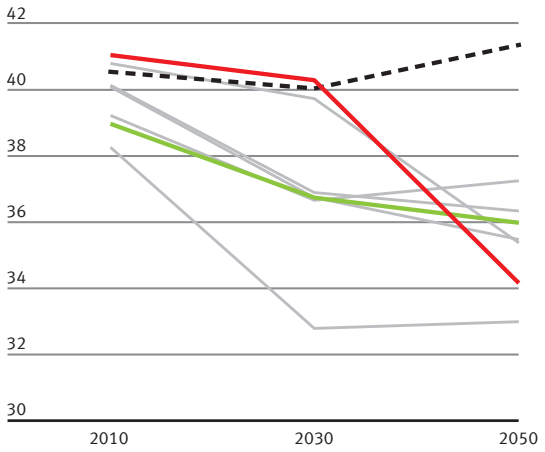


In the P*ower Choices Reloaded scenario* this signal enables all abatement options to play an important role: the major share of abatement stems from renewables, cumulatively responsible for 32%, while policy-driven energy efficiency has a share of 21%, and market-driven energy efficiency a share of 18%.

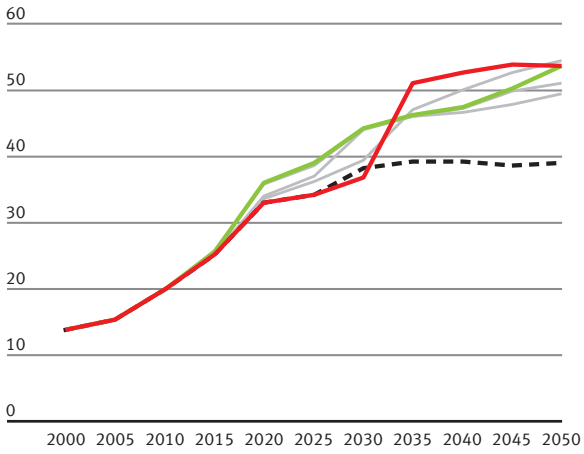
The *Lost Decade scenario* would require an increase from 1,500 TWh annual renewable energy production in 2030, to 2,000 TWh by 2035. Meanwhile this late surge in renewables growth would need to go hand-in-hand with a radical reduction in the share of coal-fired and gas-fired electricity from 22.8% in 2030, to 14.5% by 2035 – while, in contrast, the *Power Choices Reloaded scenario* indicates a slight increase in gas-firing from 20.1% to 20.7% in the same period.

The *Lost Decade scenario* entails multiple revolutions. Far more plausibly, the *Power Choices Reloaded scenario* shows a transition which can be managed as an evolution – enabling technology learning curves, supply chain build up, and investor confidence. This scenario requires an annual abatement of roughly 100 Mt: still an impressive figure, but feasible.

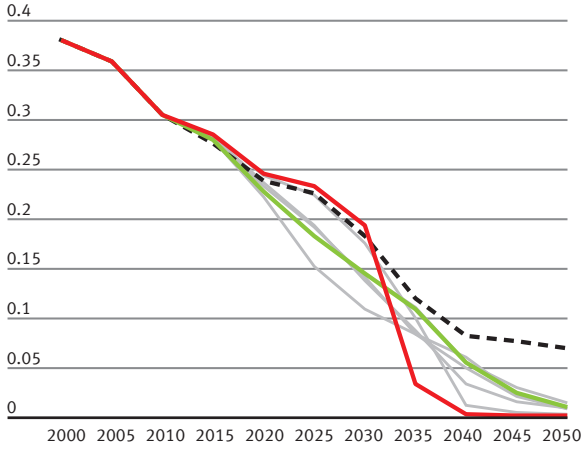
Average Load Factor of Thermal Capacity (%)



Share of RES in the EU electricity mix (%)



Carbon intensity of power and heat production (t CO_2 / MWh)



Scenarios and sensitivities

The EURELECTRIC Power Choices Reloaded study uses the PRIMES energy model developed and run by E3Mlab of the National Technical University of Athens under Professor Pantelis Capros. The PRIMES model has also been used by the European Commission for its 2050 roadmaps. Data on power plant technology and costs have been provided by our partner organisation VGB PowerTech.

The scenarios include all major emitting sectors in order to give a complete picture.

Reference scenario

The *Reference scenario* models policies which have been adopted and implemented with cut-off date at the end of 2011, but excludes policies currently in the process of announcement or adoption. For the period beyond 2020 additional policies are not considered; instead the long-term consequences of the current policies are simulated. It is assumed that these policies are effectively implemented without major policy failure.

Power Choices Reloaded scenario

The *Power Choices Reloaded scenario* aims for an optimal portfolio of power generation based on an integrated energy market. PRIMES identifies the least cost pathway to the 2050 goal, with switching between different forms of final energy use.

The scenario:

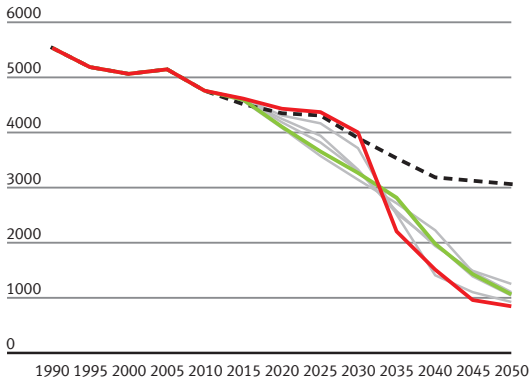
- Mirrors the assumptions in the Commission's energy roadmap *Use All Options scenario*;
- Meets all the 2020 targets, although moderating the assumptions on achieving the 20% energy efficiency target by reaching this goal in 2025;
- Applies only an ETS carbon price in ETS sectors until 2020, but thereafter introduces a uniform CO_2 price signal in all sectors and all EU Member States;
- Simulates policy measures to overcome non-economic barriers to energy efficiency;
- Assumes that key grid or storage infrastructure will be built as planned in line with the needs of the overall electricity system.

Lost Decade scenario

Uncertainty in the policy framework due to conflicting and contradictory signals makes investment both more difficult and more costly. Therefore Power Choices Reloaded introduces a *Lost Decade scenario* to explore the consequences of delay. This scenario uses the same carbon budget as the *Power Choices Reloaded scenario* but adjusts the assumptions to reflect:

- Slower learning effects for offshore wind and CCS;
- Implementation of the ENTSO-E network development plan taking 20 years rather than 10;
- Delays in the deployment of recharging infrastructure for electric cars;
- Delays in second generation biofuel supply;
- Higher risk premiums on power sector capital investment;
- Delays in energy efficiency in buildings;
- Discontinuity in renewables incentives to 2020;
- Limited access to capital due to higher risk premiums for power sector investments.

Total GHG emissions in Mt CO_2-eq



Additional scenarios

Additional scenarios were defined as variants of the *Power Choices Reloaded scenario*. They include:

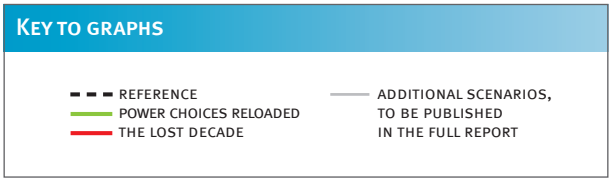
- A *CO_2 Price Driven scenario* which models a marginal cost of abatement throughout the whole economy, but excludes additional targets and specific support policies for renewables and energy efficiency after 2020;
- A *Renewables Push scenario* with a 30% by 2030 EU renewables target;
- A *Barriers to Energy Efficiency scenario* where non-economic barriers are not overcome;
- A sensitivity which limits cross-border electricity trade, due to the assumption that the internal market does not fully develop;
- A sensitivity which assumes that the current difficult financial conditions continue until 2030.

These scenarios are indicated in grey in the graphs throughout this text and will be published in the extended report.

Limits of the model

This project models a single policy objective: emissions reduction, although it also shows benefits in terms of security of supply and air pollution. As in any modelling exercise, the scenarios do not give absolute value predictions but only offer a comparison of different trajectories. The near-term 2030 results are necessarily more robust than the 2050 end-point results.

The PRIMES model is deterministic and simulates a least cost optimised pathway, assuming perfect anticipation and no uncertainties. Consequently, risks from changed expectations for prices and costs, or unforeseen changes in policy, are under-estimated. The model, moreover, takes an optimistic view about the development of storage and of flexible dispatchable power capacities, making it possible to have high shares of renewable energy. Therefore additional research using a model that resolves much smaller time-scales is needed to analyse how an electricity system with a high share of intermittent renewables will work.



EURELECTRIC represents the common interests of the electricity industry at pan-European level. Our current members represent the electricity industry in over 30 European countries, including all EU member states. We also have affiliates and associates on several other continents.

Our well-defined structure of expertise ensures that input to our policy positions, statements and in-depth reports comes from several hundred active experts working for power generators, supply companies or distribution network operators (DSOs).

We have a permanent secretariat based in Brussels, which is responsible for the overall organisation and coordination of EURELECTRIC's activities.

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