

# Science for Environment Policy

## Low-carbon technologies are key to meeting EU emissions targets

**While energy-efficiency gains** are needed to lower Europe's greenhouse gas emissions, low-carbon technologies are also crucial if we are to meet ambitious EU emissions targets in the long term, new comparative research concludes.

The European Commission's [Roadmap for moving to a low-carbon economy](#) indicates that a cost-effective transition to achieve the EU's 80 to 95% greenhouse-gas-reduction objective by 2050 would require a 40% domestic reduction compared to 1990 as a milestone for 2030, and 80% for 2050. To achieve these reductions more efficient use of energy and investment in cleaner [energy](#) infrastructure are predicted to play important roles.

Energy-economy models developed to identify the most cost-efficient ways of reaching emissions targets have shown that there are a number of possible options available to policymakers. However, it is often complex to compare or combine results from these models due to differences in their underlying assumptions. This study used specialised 'decomposition' techniques to compare results from 10 energy-economy models which analyse different ways of achieving the Roadmap's milestones<sup>1</sup>. In this way, the researchers were able to identify conclusions that were consistent across all models, rather than those that were specific to a single model.

The researchers considered four different scenarios characterised by various combinations of energy-efficiency improvements and emissions reductions. These were either default energy-efficiency improvements or ambitious energy-efficiency improvements combined with emissions reductions of either 40% or 80% by 2050. Thus, access to more energy-efficient technology was either assumed to be high and therefore efficiency could play a larger role in emissions reductions, or it was assumed to be relatively lower and so efficiency would contribute less.

They then examined the relative importance of energy efficiency and decarbonisation (defined as the reduction in emissions per unit of energy produced) on emissions reductions over time. Finally, the researchers examined results on both an economy-wide basis (i.e. considering all sectors together), and focusing on the contributions of different industrial sectors. The comparisons between the scenarios highlighted the move to low-carbon technologies as the primary driver in meeting the most ambitious emissions targets. These results show that, although energy efficiency is important, especially in the short term, it is wise to invest in the development of new technologies that drive decarbonisation.

Examining the results over time, the researchers found that most models, regardless of scenario, showed that increasing energy efficiency provided the most emissions reductions in the short-to-medium term (2020-2030) compared to 2010 levels. However, in the long run, the models projected that a transition to low-carbon technologies would become increasingly important, even if ambitious improvements in energy efficiency were assumed.

The economy-wide results showed that, while reducing emissions lowers economic growth compared to a non-mitigation scenario, this impact can be relatively modest. In fact, the 'affluence effect' – the increase in emissions that is often seen as GDP rises over time – can be offset by increased energy efficiency and low-carbon technologies.

The researchers also examined how individual industrial sectors could contribute to emissions reductions. They categorised the sectors as: agriculture, commercial, energy-intensive industry, non-energy-intensive industry, transport, electricity and 'others'. The electricity sector was projected to contribute the most to decarbonisation.

For the transport and energy-intensive industries, emissions reductions come in the form of increased energy efficiency and reduced economic output as, currently, there is a lack of viable low-carbon alternatives. Technology improvement and innovation are therefore particularly important.



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<http://www.worldscientific.com/doi/abs/10.1142/S2010007813400046>

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1. The main results of the Energy Modelling Forum model comparison underlying this study are free to view here:  
<http://www.worldscientific.com/doi/abs/10.1142/S2010007813400010>