



# A New EU Energy Technology Policy towards 2050: Which Way to Go?<sup>1</sup>

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## Highlights

- Market actors are calling for a post-2020 energy technology policy framework *now*. As a result, the policy is likely to be negotiated in a time of fierce global competition in clean-tech markets, financial crisis and institutional frictions in the EU. To contribute to the debate and to assist DG ENER to prepare a new Communication on ‘Energy Technologies in a future European Energy Policy’, our THINK report discusses a renewed EU energy technology policy towards 2050.
- A first possible policy path would be to extend the 2020 policies to 2030 and 2050. From this reference case, departures in two major ways are possible. Policy path 2 would rely on a strong carbon price signal and technology-neutral support to innovation. In contrast, an alternative policy path 3 would depart from a weak carbon price signal and technology targets.
- A multi-criteria evaluation shows that no single policy path is clearly superior to another. Therefore, a renewed SET Plan should allow for all possible future policy paths. Priority technologies that are key to achieve 2050 objectives and/or can help to support green growth within the EU should be identified based on a *comprehensive approach across sectors*.
- But not only the policy context is uncertain. There are also other possible futures not yet recognized in the EU Energy Roadmap 2050. First, *shifts in paradigm of EU energy policy* away from decarbonization and in favor of competitiveness or supply security might call for strong technology support. Second, *technological revolutions*, such as a global shale gas revolution, could result in the “rational” price of carbon falling extremely low.
- There are several reasons that justify some directed technology push, instead of building fully on technology-neutral support to innovation. Pushing energy efficiency enhancing and enabling technologies thereby offers a no-regret strategy in any future setting and dominates other push strategies in terms of implementability and robustness. Creating options for technology breakthroughs has to be a main pillar in any future SET-Plan.

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1. Topic 9 of the EU's FP7 funded project THINK.  
The project report is available at: <http://think.eui.eu>.

## Background

There are huge challenges for policy makers if the EU climate policy goal of reducing greenhouse gas (GHG) emissions to 80-95% below 1990 levels by 2050 is to be reached. Moreover, the current period of austerity has imposed tight constraints on national budgets and has forced governments to rethink fiscal policies. Some Member States have recently abandoned several expensive energy policies, mostly those promoting clean energy technologies. In light of these changes, there is no doubt that a new and more stable energy technology policy design for the post-2020 period is needed. It is, however, not clear how exactly this new policy should address limitations of the current 2020 framework while, at the same time, taking into account the fierce global competition in markets for clean technologies. Market actors are calling for a new technology policy framework *now*, and so the policy will likely be negotiated in a time of financial crisis and institutional frictions in the EU.

There is certainly a *need for public support*. Policy intervention is required to correct market failures originating from environmental and innovation externalities, to account for capital market imperfections and to fully exploit international trade opportunities in clean technologies. Policy intervention, therefore, can be motivated by both market failures and strategic industry and trade policy issues. There further is a *need for EU involvement* to coordinate market failure corrections between Member States and to combine national forces.

### The role of the SET Plan will depend on the context of carbon pricing

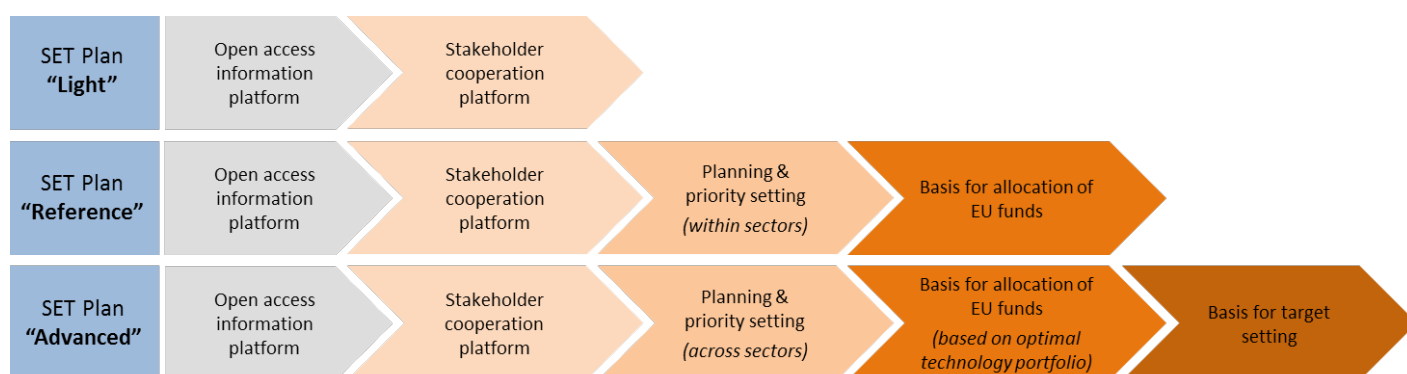
To capture the broad spectrum of policy options, we introduce three possible future pathways for an EU energy technology policy. Departing from a **reference case**, i.e., the improvement

and extension of 2020 policies to the 2050 horizon, we identify two other possible directions for future policy. **Policy path 2** departs from a *strong carbon price signal* and will mainly involve technology-neutral support to innovation. In this path, after having delivered its initial push, the SET Plan as an instrument to prioritize among technologies and projects ceases by 2020. From that point, it would rather function in a ‘light’ version as a platform for open access information exchange and stakeholder coordination and cooperation. In this form, the SET Plan would preliminary become a tool that supports innovators’ and investors’ decision making and that could help to attract private funds. In contrast, an alternative **policy path 3** departs from a *weak carbon price signal* and technology targets. Directed technology push prioritizing certain technologies would play a major role to enforce these targets. In this path, an ‘advanced’ SET Plan would also be a tool to determine an optimal portfolio of low-carbon technologies and research activities across sectors and would then also provide the basis for target setting and an optimal allocation of public (and especially European) funds.

Today it can be doubted that, based on the current scheme and the currently determined emission cap, carbon prices in the magnitude of those reported in different EU Energy Roadmap scenarios and those needed in policy path 2 can be implemented.<sup>2</sup> Nonetheless, design improvements have the potential to make the EU ETS a stronger policy instrument: The future ETS design should aim to include the highest possible base under the scheme and broaden the impact of the common carbon price, while also aligning non-ETS carbon prices.

**No policy path is clearly superior to another.** A multi-criteria evaluation of these policies (see Table 1) shows that, whereas price signals are in theory the most cost-efficient way to achieve climate goals, in practice the signaling effect of carbon prices might not be strong enough. Policymakers face considerable

Figure 1: Role of the SET Plan in different possible future policy paths



Source: Own depiction

2. Carbon prices in the underlying simulation exercises (between 234 €/t and 310 €/t) are determined such that 2050 targets are reached, assuming equal prices/values for ETS and non-ETS sectors.

**Table 1: Summary of the evaluation of policy paths**

Criterion	Evaluation
Climate-effectiveness	Assumption that decarbonization objective <b>can be reached under all policies</b> .
Green growth	<b>Path 3 is best able to enhance green growth</b> due to the strong role of directed technology push and the possibility to explicitly support domestic European firms. In contrast, <i>path 1</i> has a lower ability to enhance green growth and <i>path 2</i> has growth potentials only in the longer-run, due to the high carbon price, that, however, also attracts non-EU made abatement products.
Robustness to EU financial crises and institutional difficulties	<b>Path 3 is the most robust</b> option with sectoral targets providing stable investment signals. The ability to account for different national technology push programs and to adjust the burden of decarbonization among Member States is only given in this policy path. In contrast, <i>path 1</i> does not present adequate remedies, yet. <i>Path 2</i> is not robust to financial crises or institutional frictions, too, due to the lack of the ability to account for Member State heterogeneity.
Cost-efficiency	<b>Path 2 is the most cost-efficient solution</b> . Abatement costs across all sectors and abatement channels are minimized when implementing one common emission price. In contrast, <i>paths 1 and 3</i> suffer from weak carbon price signals.
Implementability	<b>Path 1 is most easy to implement</b> , as implementation efforts are low and subsidiarity compatibility is given. In contrast, <i>path 2</i> is not fully feasible as the implementation of a scheme with one unique and high enough carbon price covering all GHG emissions would pose severe political difficulties. For <i>path 3</i> , implementation barriers mainly relate to achieving an agreement on sectoral targets and the related burden sharing among Member States.

difficulties in implementing ‘high-enough’ prices and in including all GHG emissions into the scheme. Technology targets and directed push, on the other hand, have a relatively larger potential to enhance green growth and to give (even if biased in magnitude) strong signals to investors. Moreover, technology targets could account for different national technology push programs and could adjust the burden of decarbonization between Member States. In times of economic and institutional crises, these burden sharing and cooperation mechanisms increase the robustness and implementability of technology support. However, Member States are typically reluctant to give too much power to the EU and defining sectoral targets will also cause problems related to the subsidiarity issue.

### Implications for a renewed post-2020 SET Plan

A renewed post-2020 SET Plan should allow for all possible future policy paths. It should not exclude the possibility of acting within a certain future context and, hence, should be more focused than the current SET Plan and provide the basis for planning and prioritization among decarbonization technologies. In a first step and similar to the current model, stakeholders

from individual sectors could work together within Industrial Initiatives to identify technological progress and future research needs. In a second step, priority technologies that (a) are key to achieve 2050 objectives, and/or (b) can help to support green growth within the Union should be identified based on a *comprehensive approach across sectors*.

Such targets have to be determined by carefully analyzing the growth potentials of European manufacturers and the degree of competition they face from foreign clean technology producers. Selected technology targets and EU funding of innovation should then be in line with the SET Plan prioritization. Key performance indicators, similar to those already specified in today’s sectoral Technology Roadmaps, shall be used as a tool for monitoring and reviewing the progress of technology development, demonstration and deployment and should become an essential element and contributing factor for funding decisions.

### Not only carbon pricing is uncertain

But not only carbon pricing is uncertain. The EU Energy Roadmap scenarios are designed around a menu of technologies that are essentially well-known. However, 2050 is 37 years from now. 40 years ago, there had not been oil crises, European energy

markets had national structures and electricity generation from RES was close to zero. The optimal portfolio of decarbonization technologies has a very long time horizon, not only looking ahead to the 2050 target, but technological lock-ins will persist even beyond. It is not only this very long-term nature of the problem – also recent developments such as the Fukushima accident influenced possible future scenarios. Another example is the increasing interest in US unconventional gas resources. Whereas the International Energy Agency in its World Energy Outlook 2007 (when the 20-20-20 strategy was adopted by the European Council) did not mention shale gas at all, the World Energy Outlook 2011 is talking about a possible “golden age of gas”.

Hence, there are not only substantial uncertainties regarding viable decarbonization technologies within the context of the EU Energy Roadmap, but there are also possible futures that are not yet recognized in 2050 roadmaps and these raise the need for technology push policies. First, it is not guaranteed that – given the triangle of energy policy goals with decarbonization, security of supply and competitiveness – long-run energy policy will maintain its decarbonization focus. *Shifts in paradigm of EU energy policy* away from decarbonization and in favor of competitiveness might weaken carbon pricing mechanisms, calling for an even stronger technology support. Similarly, a shift in favor of supply security requires a stronger push for decarbonization technologies in order to achieve balanced energy portfolios, as well as a strong push for enabling technologies such as networks to guarantee energy systems which function properly. Second, *technological revolutions*, such as a possible global shale gas revolution, could result in the “rational” price of carbon falling extremely low.

### Implications for European technology push

There are several reasons that justify some directed technology push, rather than relying fully on technology-neutral support for innovation. First, certain low-carbon technologies are key to achieving the transition to a low-carbon economy and there are reasonable concerns that without such support they will not be developed and deployed on the necessary scale and/or on time<sup>3</sup>. Second, European technology push can have its justification as a means to respond to fierce global competition in green-tech markets and to help to keep wealth within the EU. The burden to finance market pull measures is always with consumers and tax payers but benefits can be reaped by both domestic innovators and producers, but also market entrants from outside the EU. In contrast, directed technology push can be designed such

3. This could for instance be the case for CCS. All scenarios of the EU Energy Roadmap contain a substantial part of electricity generation using this technology (between 10% in the ‘high RES’ and 33% in the ‘Reference’ case in 2050) with CCS being viable from 2030 on.

that it favors domestic European players. By explicitly targeting specific technologies, it would also allow policy makers to accelerate technology development and to support industrial leadership. This strategy is promising, especially for high-tech segments or parts of the value chain that cannot be outsourced to low-cost competitors.

Pushing energy efficiency enhancing technologies dominates other push strategies in terms of both feasibility and robustness. Without detailed cost- and technological data, it is not possible to give disaggregated technology-specific recommendations as to what technologies and research activities to push. However, from our analysis we can draw a general conclusion. The prioritization of low-carbon *production* technologies entails high risks of picking wrong winners. In contrast, pushing energy efficiency enhancing technologies is politically feasible: Opposing to a push for production technologies that often would benefit certain Member States in which major suppliers are located, energy efficiency enhancing technologies benefit all industries independent of geographic location and create jobs across all Member States. Such push also is robust with respect to future energy market developments: Consuming less is a no-regret policy and minimizes system interdependences of a directed push.

For similar reasons, pushing enabling technologies (such as grids, advanced metering or market facilitation via ICT equipment) is a no-regret strategy. As for the technology group discussed above, investments are typically quite domestically labor-intensive. However, for grid infrastructures – as for enabling technologies in general – the appropriate magnitude of investment will depend on the amount and type of renewable energy that enters the power system. The optimal system architecture will also depend on whether we move towards ‘European-wide energy superhighways’ with massive solar energy being imported from North Africa and huge amounts of offshore wind energy being produced in the North Sea, or whether we move instead towards a system of rising local energy autonomy, featured also by widespread demand side management.

The creation of options for technology breakthroughs has to be a main pillar in any future SET Plan. While strategies for technologies close to the market rely on shorter-run benefits like green growth stimuli up to 2020 or 2030, such push strategies have to be accompanied by long-run funding commitments for a wide range of immature technologies that might successfully be deployable after 2030 and towards 2050. As the stage of innovation involves basic research and very early R&D (i.e. projects that entail a low chance of success but a sufficiently high payoff if successful), the argument for *broad* technology funding becomes important. Over time, and as the probability of success increases, funds should become more concentrated. Such funding of potential technology breakthroughs will not lead to

lock-in effects or stranded investments once a modified SET Plan mandates new technology priorities, but would instead be disconnected from future policy paths.

It is then equally important to bring concepts that have been successfully developed in the laboratory to the manufacturing phase and to commercial deployment. European support for (incremental) innovation can help to bridge the “valley of death” and to bring to the market first prototypes of new technologies.

Member States are not homogenous with regards to their technology base and ability to finance. Political considerations, such as who are the beneficiaries of support, will impact on the planning and priority setting for technologies when drafting the SET Plan and the agreements on where funding comes from. On the one hand, there are countries that benefit from relatively low financing cost, available public money and a high consumer willingness to pay for energy policy. On the other, there are countries with rather limited private and public willingness and ability to pay for low-carbon innovation, such as countries currently suffering from the debt crisis. In addition, low-carbon technology bases range from strong low-carbon in-

dustry positions for e.g. wind energy in Germany or Denmark, to countries that do not have any of these or similar technology advantages yet. These differences hamper agreements for a unified approach for technology support. Therefore, designing an energy technology policy top-down is difficult to sustain, which highlights the need for decentralized solutions co-existing with European funding and support schemes.

The future energy technology policy also has to present a reliable and credible framework to investors and innovators, and also to consumers, who ultimately pay for these policies. In this vein, we present “no-regret measures” other than the above being also valid for any future policy (see Box 1). In contrast, there might be certain “regret measures” related to industry and trade policy. Current trade disputes related to clean technologies illustrate the complexity of such policies. There is a fine line between supporting technologies and subsidizing industries. Any industrial or trade policy which favors European players must be debated and designed with care and the grounds for introducing such measures should only relate to environmental or innovation externalities.

### Box 1: Additional “no-regret” measures for any future EU energy technology policy

**#1 – Enable an attractive and stable business environment:** The stability of support policies, in the sense of predictability and transparency, is considered by far the most important factor for investors. Additionally, stakeholders complain about complex and lengthy permit granting procedures as a major barrier to investment and which increases project risk, which, particularly in countries with stressed capital markets, results in rising cost of capital. Recent policy initiatives are promising. Horizon 2020 aims to improve administrative procedures and also the implementation of an EU patenting system in 2014 will substantially decrease costs for innovators.

**#2 – Engage consumers and citizens:** Even where measures to reduce emissions on the consumer side are cost-efficient, various barriers still prevent action (lack of information, high transaction costs especially for small decentralized projects, regulated end consumer prices, etc.). These barriers need to be addressed by e.g. implementing regulatory measures such as minimum efficiency standards for appliances and buildings. Information policies can reduce ignorance and information asymmetries and also can encourage behavioral changes. Energy Service Companies can help to overcome constraints in paying possibly high upfront cost and can substantially reduce clients’ search and information efforts.

**#3 – Spend the available public money wisely:** Experts agree that 2050 is technologically feasible, but that a key challenge will be the mobilization of the required capital. Subsidies are by far the preferred policy instruments to fund clean energy innovation of any type. However, this instrument should only be used as an instrument of last resort. The form of direct public support, considering also e.g. low-interest loans, loan guarantees, public equity and technology prizes, needs to be tailored to the features of each innovation project and to the type of entity best placed to undertake the respective RD&D. Moreover, spending public money wisely also involves a smart design of financing instruments. Furthermore, new funding sources should be considered. Existing fossil fuel subsidies need to be revised and policy makers could take into account a wider use of auction revenues from the EU ETS to fund innovation.