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# REGULATING THE NEW ENERGY PARADIGM

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We are entering a new paradigm. Not only does delivery of the net-zero emissions target and the objectives of the European Green Deal require a step change in behaviour but the legacy of the COVID19 pandemic will also place a priority on building an economy fit for the future.

We cannot rely on previous approaches to provide solutions to these new challenges. This is especially true for the policy and regulatory framework that governs the energy system. The energy system is approaching two major tipping points. Separate parallel systems are increasingly interconnected with electricity becoming the dominant connecting vector; and system operators now need to dynamically adjust both supply and demand to maintain system stability rather than relying purely on supply.

The European Commission must recognise the new issues facing regulators and propose a way forward. **The analysis presented in this paper identifies four fundamental issues and sketches out potential solutions**:

- Making choices about the pathway to net-zero.

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- Making the most of new sources of competition between infrastructures.
- Defining future need in administered markets, especially where this involves consumer purchasing decisions.
- Ensuring equitable cost and benefit given the threats to vulnerable consumers.

Establishing an independent technical expert – which we call for convenience the 'Clean Economy Observatory' – would be an important step in helping regulators resolve difficult trade-offs. In addition, new regulatory thinking and political guidance is required.

## The new paradigm

### Challenges to the existing paradigm

Market liberalisation has emerged over the past three decades as the preferred way to organise and finance national energy systems. The EU internal energy market project, which has sought to ensure energy flows freely across the EU without any technical or regulatory barriers, has been based on this common model. It is also widely adopted elsewhere.

Market liberalisation seeks to minimise the role of government, and the regulators who act on their behalf, with only two key responsibilities remaining:

- Isolate those aspects of the industry that are natural monopolies and regulate these activities to drive efficient operation and investment.
- Administer energy markets to create prices that reflect the value of the product to consumers. The requirement to administer markets arises from the need to ensure real time balance of supply and demand and to overcome limitations in consumer metering.

However, the evolution of technology and the requirement to decarbonise the energy system is challenging this model and demanding that governments adopt a more proactive stance. The key drivers of change are:

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1. *Decarbonisation*: Achieving internationally agreed targets for the reduction of greenhouse gas emissions has already required major changes in the way energy is produced and consumed and these changes are set to continue. Most importantly, a large proportion of electricity must be produced from renewable sources whose output cannot easily be adjusted to meet the demands of consumers.

2. *Digitalisation*: The change from analogue to digital technologies is only just beginning in the energy industry, opening opportunities for the use of advanced information and communication technologies which have the potential to revolutionise all aspects of system and market operation.

3. *Decentralisation*: Key renewable energy technologies need to capture disperse natural sources of energy (solar and wind) and, therefore, are geographically spread. Also, the decarbonisation imperative increasingly requires changes in the way individual consumers use energy and this has spurred the development of small-scale energy production and control technologies, These factors have reversed the trend in previous decades to achieve economies of scale through a highly centralised energy system involving large facilities such as power stations and storage systems.

4. *Democratisation*: The increasingly active participation of consumers in the energy system has begun to blur the lines between producers and consumers and even between consumers and citizens. The term 'prosumer' has come to represent consumers who also produce and sell energy and there are many community-owned energy schemes whose interests are entirely local. The progressive involvement of all energy consumers in the energy transition is also raising broader issues of social equity and justice in a way that has not been seen before.

**From natural monopolies to competition between infrastructures**: it is now no longer easy to identify natural monopolies since numerous cross-sector trade-offs exist which effectively establish competition between infrastructures. For example, consumers increasingly have a choice between heating homes with electricity or gas which can place very different requirements on the respective networks. Also, investment in the built infrastructure can offset the need for network development or other energy system assets. In addition, new dedicated

networks, such as those for heat, CO2 or zero carbon gases, have the potential to become key parts of the energy system.

**From energy system evolution to energy system transformation:** A second consequence of the changes underway is the rapidly increased requirement for investment and the fact that these investments must be made against a background of huge future uncertainty. The perception of the extent of the risk to future earnings means that finance for these investments can only be obtained at high cost, if at all, and governments have increasingly been required to introduce mechanisms to de-risk future earnings (e.g. capacity mechanisms, feed in tariffs, obligations, grants). In effect, they are taking over the role played by consumers in driving investment through market processes.

Despite these evident deficiencies, the original liberalisation narrative remains unaltered. Regulators continue to focus on creating unbiased competition in markets whose boundaries no longer represent the competitive potential, and to plan networks largely independently. Also, governments continue to claim that each new intervention is temporary.

### Towards a new paradigm

The extent of the costs involved in transforming the energy system has always required that investment is focused where it delivers best long-term value to consumers and that resources are used efficiently. The economic fallout from the COVID-19 pandemic will amplify these requirements. **Competition and markets must be refocused on efficiency in the context of long-term value and this requires new regulatory thinking**. Tweaking current approaches is no longer adequate. Instead, it is necessary to shift the paradigm to provide a springboard to address the problems and grab the opportunities presented by the energy system transition.

## Infrastructure choices

The EU has yet to define a pathway to achieve net-zero emissions by 2050, both in terms of overall emissions trajectory and how this might be divided between sectors and member states. However, there is now broad consensus that the power system must be rapidly decarbonised, and action taken to improve overall efficiency and to electrify other sectors where there is no viable alternative means of decarbonisation at scale. In other areas, the way forward is less clear. Examples include the potential role of zero emissions gases, the depth of efficiency retrofits, and the proportion of electricity demand that can be met by variable renewable generation.

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The defining features of the net-zero challenge are not only the extent of the changes required but the rate at which they must happen. We have neither the time nor the money to keep open the option of all potential pathways. Some choices about the future need to be made now to allow deployment to move forward at pace. Other choices can be left open on the basis that the risks are too great and we will be in a better position to decide later.

Most of these choices cannot be made through market processes in which consumers express their long-term energy needs given the extent of the infrastructure transformation required (e.g. the upgrade of buildings, the establishment of hydrogen infrastructure, or the need to upgrade networks to accommodate demands from electric vehicles) [1]. Instead an administered process to make these choices needs to act as a proxy for current and future consumers. It is a major challenge for regulators to make such choices in the face of huge future uncertainty given the inevitability of imperfect forecasts and the risks of landing future consumers with large stranded costs.

Whilst there are risks associated with making choices, the risks of failing to do so are likely to be greater. It will undermine efforts to deliver emissions reductions in line with the Paris climate agreement and the net-zero target and thus to address other emerging energy system challenges[2]. Also, there is the threat that increasingly low-cost solutions such as efficiency and renewable energy will remain untapped.

A new approach is required to break this potential logjam and allow progress to be made whilst managing the risks involved.

## Making choices

There are numerous potential pathways towards net-zero. Many of these will not diverge significantly during the coming decade. Others however will have very different investment and innovation cost requirements over the next few years (see Figure 1). It is important that these 'pathway families' are identified since it may not be possible to justify the expenditure required to retain them all as potential options.

[1] Regulators have always acted on behalf of consumers in committing to cover network operator costs and the choices involved are now becoming far more complicated due to cross-sectoral interactions.

[2] Already energy system needs are changing as a result of climate change, e.g. the number of heating degree days is steadily declining, while the number of cooling degree days rising, shifting strain from gas and heat networks to electricity. (**EEA 2019**).

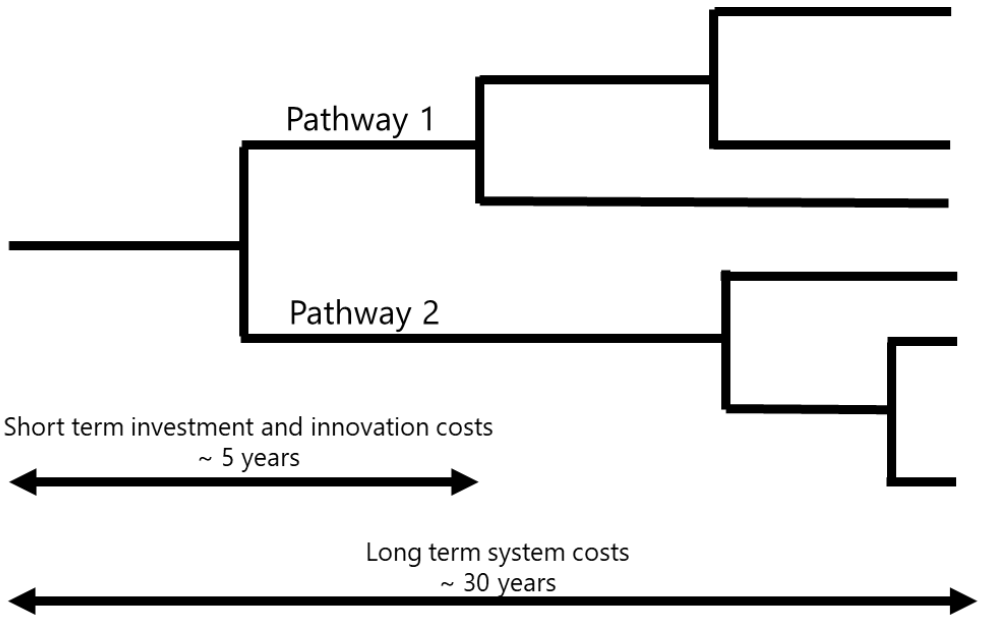


*Figure 1 Pathways to Climate Neutrality*

The value of retaining pathways depends on the comparison between the short-term costs and the long-term value. Short-term costs will tend to be low if they primarily involve innovation and demonstration projects, although there may be an increased risk of non-delivery. They will be higher if major infrastructure investments are required and this also increases the risk of asset stranding.

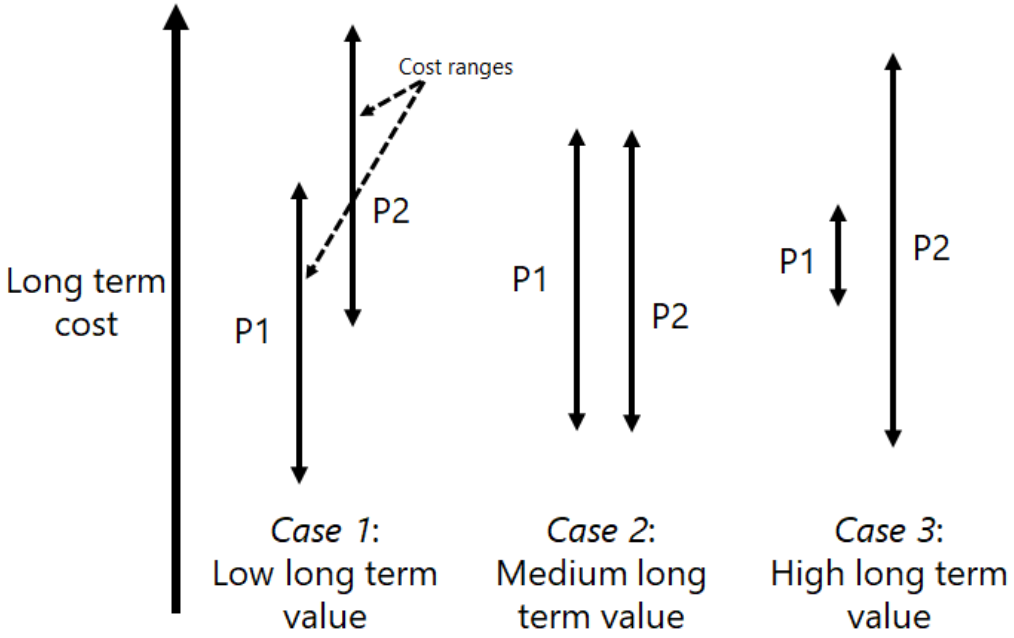


*Figure 2 Comparison of long-term value for two pathways (P1 and P2)*

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The long-term value is uncertain and will depend on the extent to which the options present the opportunity for significantly reduced costs or provide a hedge against delivery failure and high costs in other pathways. Figure 2 illustrates three cases with different long-term value. The decision to retain the option of both pathways depends on the comparison between this value and the additional costs. For example, in Case 3 there is high value in retaining both options since P2 presents the potential for low costs whilst P1 provides a hedge against a failure of P2 to deliver.

Examples of potential pathway choices include:

- Efficiency upgrades for all properties versus efficiency upgrades for easy to access properties only.
- Power system flexibility primarily provided by thermal power plant versus power system flexibility primarily provided from other sources.
- Maintaining gas network for (inter)national transmission of hydrogen/biogas versus local hydrogen/biogas usage.

These important decisions represent an existential threat to many business interests. The choices made will depend critically on the assumptions adopted which will be highly uncertain. It is vital that the assumptions are not influenced by vested interests that would seek to ignore inherent risks. For example, network operators currently have a central role in defining the future need for their assets. Similarly, decisions must reflect latest understanding of technology costs and deployment potential and be updated continuously to reflect progress and learning. These requirements do not fit well with existing institutions or processes for infrastructure planning. A new approach is required.

High quality analysis will be essential (see Box 1). This requires a new independent body with a balance of expertise across the various infrastructure and technology options in addition to deep social and behavioural insight. This body – which we call, for convenience, the 'Clean Economy Observatory' - would provide advice to the relevant executive body with the necessary democratic mandate to make important decisions. Instructions can be passed to system architects, regulators and innovation bodies either to invest to retain the option of several pathways or to focus on the efficient delivery of a subset of the potential options available. The Clean Economy Observatory would need to

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constantly update assumptions given latest technology developments and learnings from deployment activities. This would enable the advice to be regularly updated such that instructions can be adapted as events unfold.

**Box 1: Designing an analysis process to support pathway choices**

High quality analysis depends critically on unbiased assumptions about the technology and infrastructure choices available. **This, in turn, requires a balance of expertise.** There is no advantage in possessing a detailed understanding of one part of the energy system, for example power system operation, if there is only superficial knowledge in another, such as consumer behavioural trends.

Another source of bias arises from making assumptions about deployment mechanisms since these can significantly affect costs of capital. It would be discriminatory to differentiate between those investments that currently benefit from a regulated income stream (e.g. networks) and those whose income is at risk from changes in future demand or policy (e.g. efficiency retrofits). **It is, therefore, important that the analysis process does not pre-judge the delivery mechanisms that will be adopted by regulators.**

The analysis cannot proceed based on objective technological and behavioural assumptions alone. Firstly, **a fair comparison of pathways requires that they all must meet the same set of imposed constraints** – the overarching political objectives. These would include ensuring the safe and secure operation of the energy system and, importantly, the requirement to reduce overall emissions in line with the net-zero target. Secondly, **it is necessary to define the trade-off between long-term benefit and short-term cost**. Figure 2 suggests an approach that values the optionality provided by different pathways (real option analysis). Other approaches exist, such as minimising the maximum long-term cost or the weighted average across scenarios. These different approaches can give rise to very different recommendations. Therefore, they represent an important political choice that should not be left to those undertaking the analysis.

This new 'pathway choice' process does not diminish the role of traditional regulators. Instead, it provides the strategic guidance that allows them to proceed in their duties to protect the interests of consumers whilst supporting the need to move forward at pace and in line with net-zero objectives. However,

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the evolving nature of the energy system means that there are many complex issues remaining for regulators to address.

## Market definition

### Promoting competition in a transforming market

Regulators[3] will struggle to optimise a market if its shape and scope is fundamentally changing (e.g. coupling of sectors or consumers as new sources of system flexibility). This suggests they must be given guidance about the nature of the future energy system to avoid risk-averse judgements that delay progress towards net-zero and free them to focus on efficient delivery mechanisms that protect the interests of consumers in line with their statutory objectives.

Most regulators have the objective to promote competition wherever possible. Competition has proved to be a powerful engine of innovation, driving cost reductions and delivering many benefits to energy consumers. For example, the dramatic reductions in the costs of wind and solar power generation have accelerated with the advent of competitive auctions for feed-in-tariff support[4].

The increased integration of the energy system now presents the opportunity for competition between technologies and infrastructures that were previously considered separately. This integration spans sectors, geographies and runs along the value chain. The potential exists for regulators to broaden the scope of markets to embrace these new sources of competition. However, these markets will not emerge organically through the interaction of buyers and sellers, and it is necessary for regulators to administer market rules. This presents challenges since it is extremely difficult to design markets that are neutral towards technologies which often have radically differing cost structures.

This challenge has been seen in the design of electricity capacity mechanisms which tend to implicitly favour power generators compared with demand reduction or response. For example, the UK capacity auctions are held 4 years in advance to reflect the construction time of combined cycle gas turbines, include a 'refurbishment' option to help existing power plant upgrade, and allow 15 year contracts in line with the payback period required by investors in new power plant.

[3] The term 'regulators' is used to cover all regulatory activities in addition to those undertaken by traditional economic regulators including system planning and market design and operation.

[4] See for example IRENA (2019), **Renewable Power Generation Costs in 2018**

## Adjusting market design to reflect the new paradigm

Products can meet a variety of energy needs but markets must be designed to meet a fixed set of needs. This will, therefore, tend to benefit those products meeting the specific needs that are the focus of the market design (e.g. provision of firm capacity). This is particularly relevant to investments that reduce energy consumptions and make it more controllable, thereby reducing the need for a whole range of supply side measures (gas/power networks, generation, storage, etc.) which traditionally operate in separate markets.

A trade-off therefore exists between setting a broad scope that maximises the potential for competition against the need to design rules that ensure competition is fair and does not discriminate between products.

Guidance provided by the Clean Economy Observatory can help regulators to resolve this trade-off. It will identify pathways that must be kept open and this will clarify outcomes that must be achieved. In effect, this will replace the need to construct complex market arrangements with their implicit biases to resolve key investment choices. Regulators can then focus on achieving outcomes in the most efficient manner possible. This will include allowing competition between options whose individual success is not critical to achieving net-zero.

Administered markets fall into two broad categories:

- those in which the future need is set by some regulatory body and
- those in which it is determined by consumer behaviour.

In the latter case, the market design challenge involves ensuring free and fair competition in the provision of the product in question. In the former case, defining the need is a critical activity since this establishes the overall demand available to be served by market participants.

## Enabling a fair allocation of risks, costs and benefits of the transformation

### Risks

The key difference between the two categories of market is where the risks of making errors in forecasting future need lies. Where need is determined by consumer behaviour, the risk lies with market participants investing in their ability to serve future customers. In a world of major change and shifting infrastructures (e.g. from fossil gas to hydrogen) market participants may have no or limited ways to manage this risk.

When regulators determine need, the risk is shared by consumers, taxpayers or some subset thereof. Whilst the original objectives of liberalisation was to limit the role of regulators in defining market need to a few essential shared services (mainly network operation), the requirement to attract low cost investment to transform the energy system has seen this approach adopted across sectors and throughout the value chain, for example through capacity markets.

The guidance on outcomes from the Clean Economy Observatory would need to be translated into a set of needs by the relevant regulators (at EU or member state level) and this will require the same high-quality approach to analysis described in Box 1. Processes must be in place to allow this analysis to be adapted as knowledge evolves and this, in turn, requires that the guidance from the Clean Economy Observatory is continually updated.

Fixing future market need is particularly challenging in consumer facing markets where it will depend on individual purchasing decisions. For example, upgrading homes to minimum efficiency standards still requires consumers to agree to the works being undertaken even if grants mean that it is effectively free. In these circumstances, regulators cannot set the need directly but must use other techniques to shape consumer choices (e.g. standards, nudging techniques[5]). Given the geographical diversity of consumers, it is likely that future need in these markets can be defined most accurately at a local level. This is in line with the trend towards decentralisation that has accompanied the energy transition.

### Costs and benefits

A final regulatory challenge associated with setting future market need involves the requirement for fair and equitable allocation of costs and benefits. Whilst often considered a point of policy detail, it is of critical importance in providing a social license for the entire transition.

It is rarely easy to attribute costs directly to those who benefit and sharing costs across consumers will tend to adversely affect the poor for whom energy costs represent a high proportion of overall household expenditure[6]. Where cost allocation is possible, it may restrict the benefits to a subset of society who have

[5] A case study in the UK showed that nudging cut peak electricity by an amount that would have been expected by a 70% increase in peak prices: **https://www.behavioraleconomics.com/using-multiple-social-nudges-to-reduce-peak-energy-demand/**

[6] This has led to calls for the costs of the energy transition to be covered by income tax since this is a progressive rather than regressive form of taxation.

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the confidence to commit to upfront costs. For example, cheap 'dynamic' energy tariffs may only be available to those consumers able to afford the installation of home energy management systems.

The challenge of cost and benefit sharing is also relevant to trans-national infrastructure such as pipelines and power interconnectors where the benefits will not be evenly distributed amongst member states. For example, production of hydrogen in Portugal for consumption in the Dutch market would require large cross-border infrastructure[7]. Benefits would mainly accrue to the Portuguese and Dutch, especially where the demand for hydrogen in transit countries is low. Transit countries may either not support the project or seek very high transit fees. However, where this has been independently identified as part of the highest value EU decarbonisation pathway, the use of joint EU resources to support the project may be justified.

Regulators are not well-positioned to make such decisions and, where they have specific responsibilities to protect vulnerable consumers, they may decide to cut back on the investment involved. Governments must provide political guidance on the topic of cost allocation to allow investments to proceed at pace.

[7] There is already one cooperation project between the Netherlands and Portugal on hydrogen: **https://econews.pt/2020/02/17/edp-galp-and-ren-are-part-of-the-mega-hydrogen-project-in-sines/**

### Summary of market definition

The previous sections have highlighted a series of challenges faced by regulators that risk obstructing the transition of the energy system at the pace required. The application of best practise approaches by existing regulatory authorities does not appear adequate to address these challenges. The key challenges are set out in Table 1 along with proposed solutions.

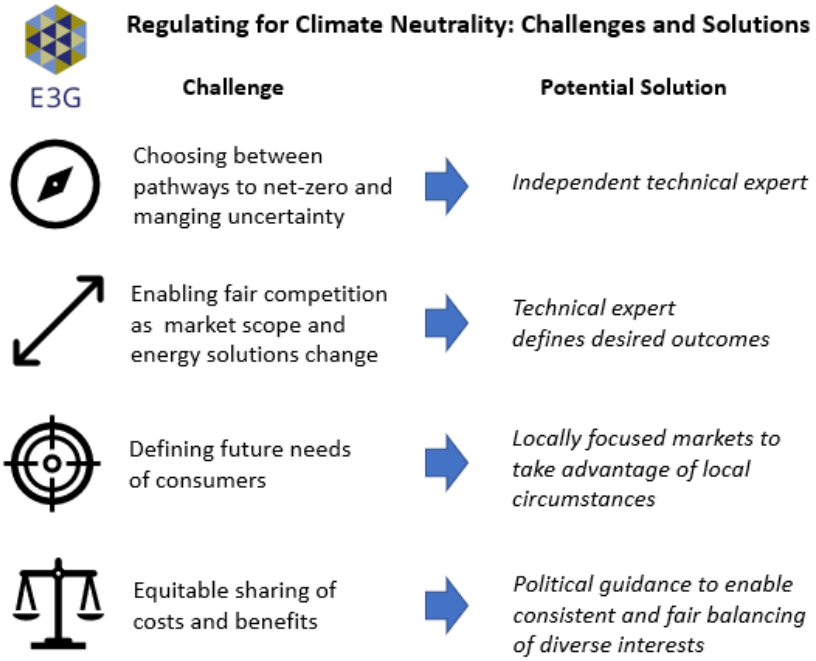


*Figure 3 Key regulatory challenges for climate neutrality*

## Conclusions

The road to net-zero emissions will be challenging and is highly uncertain. There is a risk that resources (both financial and human) are devoted to maintaining current practises when these may no longer be appropriate. This is particularly true of energy system regulation where objectives are evolving and approaches that have been adopted previously are no longer relevant.

The European Commission should recognise the need to establish a new framework for best practise in energy regulation. It must address 4 key challenges:

- Making choices about the pathway to net-zero.

- Making the most of new sources of competition between infrastructures.
- Defining future need in administered markets, especially where this involves consumer purchasing decisions.
- Ensuring equitable distribution of costs and benefits, given the threats to vulnerable consumers.

Establishing an independent technical expert body at EU level – the Clean Economy Observatory – would be a major step forward. Apart from helping regulators to manage the difficult trade-offs that they face relating to infrastructure choices and market definition, it would help drive consistency and efficiency across the EU. Whilst the approach to cost recovery is essentially political, ACER should be instructed to identify a list of options that are consistent with the principles of the single energy market.

Delivering net-zero is a major departure from the previous energy system paradigm. The European Commission must recognise the need to move to a new paradigm with bold recommendations for how regulators can take advantage of the opportunities ahead.

## About E3G

E3G is an independent climate change think tank accelerating the transition to a climate safe world. E3G builds cross-sectoral coalitions to achieve carefully defined outcomes, chosen for their capacity to leverage change. E3G works closely with like-minded partners in government, politics, business, civil society, science, the media, public interest foundations and elsewhere. In 2018 E3G was ranked the fifth most globally influential environmental think tank for the third year running.

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