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**EU ENERGY SYSTEM
DECARBONISATION POLICY
BREAKING THE LOGJAM**

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The objective to achieve net zero emissions of greenhouse gases by mid-century places even greater importance on rapidly decarbonising the energy system. Avoiding a potential ‘decarbonisation logjam’, where uncertainty over the future prevents investment in important infrastructure, must be a key priority for both the new European Commission and member state governments.

A focus on deploying renewable power generation and developing options to tackle more challenging issues is no longer enough. Continuing to keep all options open will both be costly for the consumer and gamble away critical time in protecting EU citizens from the impacts of climate change. Instead, it is necessary to make some long-term infrastructure commitments that are based on our current best view of the least cost pathway to net zero.

This note sets out how to make progress despite future uncertainty, thereby resolving the future for gas and prioritising energy efficiency. It proposes a new delivery model designed to avoid wasting money by rigorously targeting infrastructure spend, maximising the value of ‘just transition’ support, ensuring



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a high value research and innovation agenda, and, above all, retaining a laser focus on improving the lives of citizens during the transition.

The delivery model involves three core functions: technical expert body, system architect and delivery bodies, operating at EU, member state and local levels. The system architect and delivery functions can be docked onto existing institutions, but since the technical expert requires independence a new “Clean Economy Observatory” would be most likely to bring success.

A new EU climate law – the Climate Framework Directive - would provide the most appropriate home for much of the necessary legislation. In addition, the ‘decarbonisation package’ that is planned to support the decarbonisation of the gas sector presents an opportunity to introduce some of the important changes.

Context

The EU has made significant reductions in greenhouse gas emissions and 2017 levels were 22% lower than those in 1990¹. This is mainly due to improvements in energy efficiency (new product standards and improved production technologies) and changes in fuel mix (coal and oil-fired power generation replaced by gas and renewables). This has been the easy part of the decarbonisation journey. While Europe needs continued progress in these areas (e.g. phase out of remaining coal-fired power plant) it also needs to tackle more difficult challenges ahead.

The goal of net zero emissions by mid-century translates into the following priorities for 2020-2030: significant progress on decarbonising transport and heat sectors (residential and industrial) and near completion of decarbonisation of the power sector. Substantial changes in the transport and

¹ Greenhouse gas emission statistics – emission inventories <https://ec.europa.eu/eurostat/statistics-explained/pdfscache/1180.pdf>



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heat sectors are essential to fully grasp the opportunities presented by the decarbonised power sector by then². The challenge is that they will require individual consumers to act: change how they travel, upgrade their properties and use energy more efficiently and flexibly. Policy makers must know what changes people need to make, how to ensure they make these changes, and have an energy system infrastructure in place that can accommodate the resulting shifts in energy demands; and do all of this in a way that is socially, economically and politically acceptable.

There is a risk that uncertainty over the future prevents investment in important infrastructure, leading to a damaging ‘decarbonisation logjam’. Equally damaging, the EU may revert to pursuing investment in traditional energy infrastructure that will not be required in a net zero future. The recent energy policy conversation has focussed on the impact these issues will have on the future requirements for gas and its supporting infrastructure. **The EU now needs to move forward by making the choices that break the ‘decarbonisation logjam’ – including moving away from support for traditional infrastructure where it will obstruct the least cost pathway to net zero.**

The upcoming year presents opportunities to bring about this change. The new European Commission is expected to present a ‘decarbonisation package’ aimed at ensuring markets are ready to support the transition of the gas sector towards a decarbonised world and it is in the process of evaluating the legislation that identifies priority infrastructure (“TEN-E regulation”). The Agency for the Cooperation of Energy Regulators (ACER) presented its recommendations for the European energy sector, and particularly in the gas sector, beyond 2025 with a view to identifying where legislation needs to change.³

It is important that there is consistency across all energy policy initiatives, including cross-cutting policies such as the allocation of funds in the EU budget and the identification of innovation priorities in the Horizon Europe framework. The European Commission President designate, Ursula von der Leyen, has indicated that she will propose an EU Climate Law in the first 100 days of her term in office. **Apart from providing the legislative home for a net zero**

² Cf. the potential on cumulative storage capacity potential by electric vehicles and heat pumps to flatten the daily demand curve in archetype “Spain” and “Germany” countries illustrated in European Climate Foundation (2019), **Towards fossil-free energy in 2050**.

³ ACER (2019), **RECOMMENDATION No 02/2019 OF THE EUROPEAN UNION AGENCY FOR THE COOPERATION OF ENERGY REGULATORS** on the regulatory response to the future challenges emerging from developments in the internal gas market



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emissions target, a climate law would provide the most obvious vehicle to ensure a consistent framework for infrastructure choices.

This briefing note sets out what is required to align EU energy policies with the net zero target and how this can be incorporated into the EU agenda.

Challenges

Delivering a citizen centred transition

There are some significant challenges that the EU must address if it is to ensure coherence between the policy agenda and the goal of net zero emissions. **Net zero can only be delivered cost-efficiently through the mass deployment of efficiency, low carbon heating (and cooling) and smart measures in buildings⁴.**

The European Commission has traditionally focused on large infrastructure projects with pan-European significance. There will be a temptation to continue funding such infrastructure without recognising the big changes in consumer behaviour that need to occur.

Instead, it is necessary to rapidly learn how quickly the already built infrastructure can be upgraded and the way this will affect future energy demands, including the extent of demand flexibility. One important challenge is that there is no clearly preferred way to decarbonise heating and a mix of measures will inevitably be required. This will result in different approaches being adopted both between and within member states.

Delivering mass deployment of measures in buildings and addressing the geographic diversity in the technology solution involved will require a local citizen focus that has been difficult to achieve at EU-level. **This citizen-focus means identifying the opportunities to improve individuals lives as the energy system transition proceeds – through cheaper living and reduction of energy poverty, better air quality and more comfortable homes.** This will strengthen democratic legitimacy and foster markets in low carbon products and services that will support sustainable economic growth on the journey to net zero.

Choosing the locally or sectorally most effective solution

Unfortunately, different approaches to energy system decarbonisation will require very different infrastructure investments at local, national and EU-levels.

⁴SEE RAP (2019), **Drivers of increasing energy consumption in Europe and policy implications:** “[B]etween 2010 and 2016, weather corrected space heating consumption has barely changed” while efficiency progress in industry has helped offset growth in economic activity.



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The power networks will need to be upgraded and new storage provided to support widespread deployment of electric heating (and cooling). Some regions or sectors may choose to adopt zero emissions gas or liquid fuel, and these would require new infrastructures and modifications to appliances⁵. The sustainability of these gases and fuels is not self-evident and their overall potential is limited⁶, so a pan-European approach is necessary to ensure these resources are focused where they have highest value. **It will be too costly to cater for all potential approaches everywhere and there is a real risk that the EU wastes money on low value infrastructure investments, reducing scope to invest where needed and undermining confidence in EU budget management.**

Maximise the value of ‘just transition’ support

Decarbonising the energy system will have different costs and social impacts across the EU. It is appropriate that the EU recognises these differences and provides help where needed to ensure a just and fair transition. However, allocation of EU-level funds through, for example, the Cohesion Fund should be targeted on overcoming the challenges of individual members states or regions in achieving a cost-efficient energy transition and must avoid being used for fossil fuels or extending the lifetime of business models that are not compatible with a net zero pathway. **The EU needs to move beyond allocating money on an arbitrary basis and should ensure this is based on a clear understanding of the investments required and accompanied by expert advice on where this support can be spent most effectively.**

Ensure a high value research and innovation agenda.

Knowledge gaps exist with all decarbonisation pathways and performance improvements from some existing technologies will be essential to achieve a cost-effective energy system transition. The support that the EU can provide through the research and innovation framework is, therefore, an integral part of the policy landscape. However, it will be extremely risky to invest all these funds in promising but disconnected projects. Instead, **research and innovation funds should be targeted on solving well-defined problems related to the main decarbonisation challenges⁷ and delivering high value technology improvements. This, in turn, requires an understanding of what needs to be**

⁵ For example, a complete conversion of the German gas grid to 100% hydrogen would cost about €45bn. Marcogaz (2019), **HYDROGEN ADMISSION INTO EXISTING NATURAL GAS INFRASTRUCTURE AND END USE**, Presentation at the 33rd Madrid Forum

⁶ E3G (2018), **Renewable and decarbonised gas – options for a zero emissions society**

⁷ In the area of energy, they may relate to elements of solving the challenges of seasonal storage, regulatory innovation for large scale behavioural change, heavy duty transport, industry decarbonisation.



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achieved. The adoption of mission-oriented innovation as part of the Horizon Europe framework is an important step in this direction.

Aligning the policy agenda with the requirement to achieve net zero emissions must, therefore:

- > Focus on supporting a citizen-centric transition,
- > Support locally or sectorally most effective solutions through well targeted infrastructure spend,
- > Maximise the value of ‘just transition’ support,
- > Ensure a high value research and innovation agenda.

Pathways to net zero

Managing uncertainty to protect consumer and citizen

It is not possible to be certain on aggregate which infrastructure investments will turn out to have the lowest costs and create the best value for energy consumers. This will emerge over an uncertain and long-term future and often is locally specific. New technologies may render infrastructure obsolete and stranded or deployment expectations may not be fulfilled. However, we can afford neither the time, nor the money, to keep all options open and significant long-term investment decisions must be made over the coming decade. In particular where clarity over what option is or is not consistent with climate neutrality, **a failure to make these decisions will render certain decarbonisation pathway options much more expensive or even eliminate them as a possibility.** For example, continuing to expand fossil gas infrastructure where the future conversion to alternative gases is extremely uncertain will divert funds from definite infrastructure priorities such as efficiency and electrification.

Active management of uncertainty uses the best available current information to identify those choices that need to be made now and those where it is important to retain options going forward⁸. **These decisions should be based on a single, internally consistent and up-to-date analysis of current and future technology including costs and deployment potential and their associated uncertainty.** Importantly, it must fully recognise the potential benefits of upgrading the built infrastructure and prioritise actions that directly improve the lives of citizens – for example those in line with the ‘efficiency first’ principle.

⁸ In the language of real option theory, it is necessary to retain those options that have high future value and close those whose value is low or negative.



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Science-based, independent analysis as input to political choices

This independent analysis would also be crucial in helping to define the framework within which both individual energy consumers and member states/regions choose how they use energy and the nature of the associated infrastructure and energy mix that is required. **The current framework that requires consistency with an open and integrated internal energy market must now be augmented to ensure the actions of individuals and member states are consistent with the Paris Climate Agreement and the pathway towards net zero targets.** The analysis would identify the point at which individual technologies or approaches cease to be compliant with achieving net zero emissions and would provide the basis for imposing regulations or standards to limit their use.⁹

Such regulations or standards help provide industry and investors with certainty over the future use of unabated fossil fuel combustion and signal the size of the market opportunity for alternative technology solutions. Ultimately, they would apply to all carbon emitting technologies whose emissions cannot credibly be offset through carbon capture. Whilst several member states have already set phase out dates for coal-fired power plants, the Netherlands has also decided to phase out unabated fossil gas by 2050¹⁰ and it is expected that all member states will need to adopt similar policies. The biggest challenge to meet this objective involves the future of gas in heating. To address this, the Dutch government is putting in place a programme combining bottom up innovation and local pilots with national policy guidance on the overall trajectory and financial incentives to encourage improvements in energy efficiency and the deployment of low carbon heating systems.

Undertaking the analysis of current and future technology pathways would be an extremely important and potentially controversial task. It must be free from the influence of short-term political pressures and vested industrial interests.¹¹ This suggests independence from current institutions and requires a high degree of technical competence. The current energy system infrastructure planning processes involves ‘bottom-up’ assessments of future needs by network operators, co-ordinated by the ENTSOs. Whilst these organisations do have access to considerable technical expertise relating to traditional power and gas network operation, this is not balanced by similar knowledge of demand side

⁹ As for example already done with a ban on single-use plastics or emissions for combustions plants.

¹⁰ Holland Times (28 June 2018), **The Netherlands to go completely gas-free in the future**

¹¹ Cf. also **ACER** recommendation for more oversight of ENTSOs due to increasing conflict of interest in context of decarbonisation



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technologies or cost-optimal decarbonisation pathways in heat and transport sectors. **Importantly, it is not focused on individual consumer preferences and how investments in their premises can improve lives directly in addition to providing a valuable system resource. This suggests that a new approach to infrastructure planning is required to eliminate these biases.**

Delivering net zero

Achieving the goal of net zero and overcoming the challenges set out above requires a new architecture to deliver immediate progress and capture the benefits of innovation and learning as delivery proceeds. These functions can, and should, operate at EU, member state and local levels. They might be undertaken by existing institutions or newly created bodies. For example, at EU-level the system architect and delivery functions could sit within existing European Commission structures. The new delivery architecture is summarised in Figure 1.

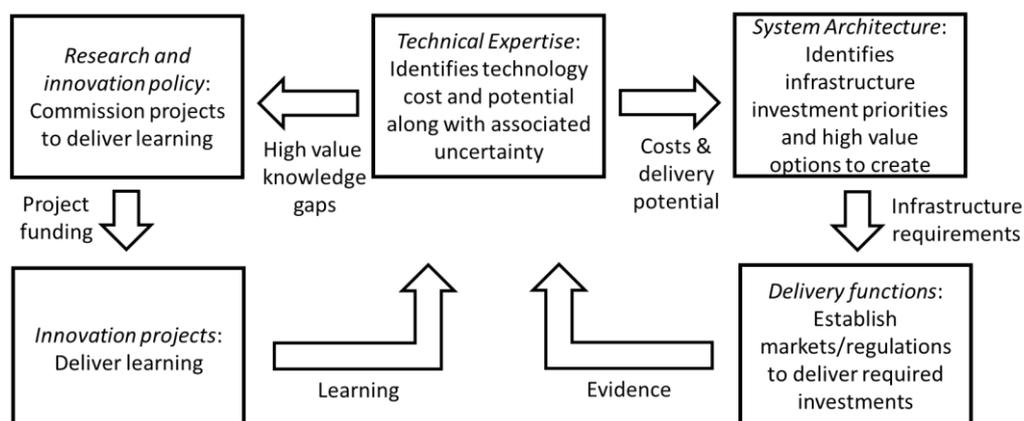


Figure 1: Net Zero Delivery Architecture

Independent technical expert

The EU should establish a ‘Clean Economy Observatory’ that will provide a shared evidence base and be responsible for owning unbiased current views of technology and resource capabilities and costs along with how these will develop in future. This information would be used to guide infrastructure investment decisions and would highlight key cost uncertainties and opportunities for innovation. It would be vital that this function is independent of short-term political pressures and other lobby interests. Some member states may choose to replicate this function at a national level where it would be able to focus on local issues that might affect technology potential, and these may offer valuable input to the EU-level function.



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The Observatory would also be well-positioned to deliver the hitherto unfulfilled recommendation of the High-Level Expert Group on Sustainable Finance to monitor the EU's sustainable finance needs and the associated capital formation to meet those needs¹². The availability and cost of finance will be an important factor in determining technology costs and deployment potential.

It is important to emphasise that the Observatory would not have any executive authority, and this would not represent any transfer of sovereignty from member states to the EU. What it would represent is a significant improvement in the quality and transparency of the information used to underpin infrastructure investment decisions proposed by the system architect described below.

System architect

It is also necessary to establish a function that is responsible for recommending key long-term infrastructure choices and deciding where investments of pan-EU significance are required. This function would need to take a view on the long-term resource mix and would lean heavily on the least cost technical advice provided by the Clean Economy Observatory. This function commits citizens to potentially significant costs – as does the current process to select Projects of Common Interest. **Therefore it is necessary that final decisions are taken by governments to ensure appropriate democratic mandate.** This must include clarity of the choices and trade-offs involved – something which is generally lacking from the current approach based on recommendations prepared by the Transmission System Operators.¹³

Nonetheless robust system operations expertise will be needed that will go beyond the ability of the Observatory. **It could be provided most effectively through the creation of some form of 'independent system operator'**. Such entities already exist in many places, including the US, Chile and Australia. This is comparable to some of the functions currently performed by the ENTSOs, but moves away from a mandate linked to supply side solutions to one that considers system stability in light of new solutions in particular on the demand side.

¹² **Cross cutting recommendation number 3:** Whilst this would entail an expanded functionality from that envisaged by the High-Level Expert Group, there is a close alignment between the objectives of the Observatory recommended in this paper and the requirement to monitor sustainable finance needs.

¹³ For example, ENTSO project testing does not test against demand side solutions to energy security challenges.



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System architecture should operate at EU, national and local levels with the most significant choices being made nationally or locally. Consistency of investment plans would be ensured provided they are all broadly in line with common technology expectations although there will inevitably be different perspectives on infrastructure choices. This may arise as a result of member states wishing to address energy security concerns, promote industrial development or, perhaps, because one region may believe it can deploy efficiency measures much faster than another.

The architecture of the system at EU-level would need to be based on an expectation of the core infrastructure needs across the EU which, in turn, would be derived from the advice of the Clean Economy Observatory. This would provide clarity over where infrastructure requirements included in national climate and energy plans arise from the desire to achieve a least-cost pathway to net zero and where they are the result of specific national policies. Where the Observatory identifies that regional or national pathways to net zero come with higher than average costs this can inform choices over allocation of just transition funding.

A region may wish to adopt an infrastructure choice that is not supported by national or EU-level infrastructure – this could be based on a different view over local potential for a specific solution. **Member states and regions should be free to make such choices on the basis that they will benefit local citizens. The region in question should bear any additional infrastructure costs required in other regions that are necessary to support their system choice.**

Delivery bodies

Delivery of infrastructure investments will require a mix of regulatory, market and fiscal arrangements. Much of this task has traditionally been assigned to energy regulators operating at national level and responsible for protecting the interests of consumers through procuring some services directly on their behalf (e.g. energy networks) and ensuring efficient operation of markets which directly affect consumer costs. Delivery at EU-level has focused on mechanisms to fund infrastructures of pan-EU significance such as the Connecting Europe Facility.

There is no reason why delivery approaches need to be harmonised across the EU or even within a member state beyond the requirement to maintain an open and integrated EU-wide internal energy market¹⁴. However, the net zero

¹⁴ Many investments, especially those that are large and with long asset lifetimes, can only be financed efficiently if future revenues are guaranteed and secured through regulatory or fiscal routes. This money



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objective will require that delivery bodies should be mandated to ensure decarbonisation efficiently proceeds at the required rate whilst maintaining public consent. A decarbonisation mandate for regulators and associated metrics that help track progress towards long-term and medium-term goals thus seem appropriate.¹⁵

Also, it is appropriate that some high-level principles are implemented. For example, equivalent services should have access to equivalent funding mechanisms¹⁶. This is particularly important to ensure that investments in consumer premises have access to the same regulated income streams that are available to network and supply side resources.

System architecture at EU and national levels will provide clarity over those investments that are in the longer-term interests of consumers and where ‘anticipatory investments’ (those whose value depends on anticipated, but uncertain, future demands) are required. The actions of various delivery bodies would be implicitly co-ordinated through the system architecture process and the statutory mandates.

EU-level statutory requirements

There are several EU-level statutory changes that would be required to put this delivery system into place.

- > An emissions pathway to net zero needs to be defined at EU-level and disaggregated by individual member states. Member states would need to adopt this emissions pathway (or one that is faster) into national legislation and may further subdivide the allocation down to regional level.
- > The EU would need to identify standards and regulations to define which investments are compatible with the pathway and which ones are not. This would include end dates for the burning of unabated fossil fuels and efficiency standards for buildings and appliances.

would need to be collected from energy consumers or taxpayers (or a subset thereof). For other investments, operational performance will be key and short-term markets will need to be established to create the right incentives. This will involve prices based on the supply/demand balance with users of the service paying for what they have used.

¹⁵ Also suggested by ACER in its recent paper referenced above.

¹⁶ Note that ‘equivalent’ does not mean ‘the same’. Funding mechanisms should be designed to meet the relevant investment risk factors for the investment in question. It is not appropriate for investments in energy efficiency to compete in mechanisms designed to incentivise power plant or network construction.



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- > A legislative mandate to establish the independent Clean Economy Observatory responsible for providing advice to the Commission, Parliament and Council as well as member state governments.
 - > It would be necessary to define the new approach to system architecture at EU-level including how to apportion costs where these are at the request of individual member states. However, it is likely that this function could be adequately delivered from within European Commission structures¹⁷. If this is the case, the statutory requirement would involve ensuring that the responsibilities currently vested with the ENTSOs are transferred to the Commission and relevant processes defined including the basis upon which infrastructure investments are funded. ENTSOs would continue to provide system operations expertise as part of a bigger independent system operator.
 - > It should be an EU-level mandate that member states must have in place delivery bodies, generally the regulators, that are responsible for delivering investments that ensure they remain on track with the net zero emission pathway and these delivery bodies must, in turn, be statutorily required to deliver investments in line with the net zero emission pathway. They should also be required to report to confirm that any deviations from the least cost technology pathway defined by Clean Economy Observatory are the result of direct statutory mandate from the member state government and that mechanisms are in place to deal with additional costs or benefits associated with these deviations.
 - > It is not appropriate for the EU to constrain the nature of the regulations and markets adopted within member states and regions beyond the requirement to maintain an open and integrated EU-wide internal energy market. However, it should ensure implementation of some high-level principles of fair competition such as the requirement that equivalent services have access to equivalent funding mechanisms as described above. This may also require a look at energy taxation.

Legislative agenda

A new EU Climate Law would provide the best legislative home for many of these statutory requirements. In the absence of such a law, the proposed Decarbonisation Package and other statutory instruments related to energy infrastructure and innovation would assume more importance. Table 1 below

¹⁷ System design at national or regional level is likely to be more complicated and could require a dedicated system architect function.



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maps the statutory requirements onto the most appropriate legislative vehicle in the cases where an EU Climate Law is, or is not, planned to be adopted quickly.

Statutory requirement	Legislative vehicle (with Climate Law)	Legislative vehicle (without Climate Law)
Emissions pathway to net zero	EU Climate Law	Climate and Energy Framework for 2050 and 2030
Standards and backstop regulations	Various – end dates for unabated gas combustion should be in the Decarbonisation Package	Various – end dates for unabated gas combustion should be in the Decarbonisation Package
Establish independent technical expert body	EU Climate Law	Decarbonisation package
Basis for funding EU-level infrastructure investments	EU Climate Law plus amendments to other relevant regulations such as TEN-E	Individual funding instruments and their basis (e.g. TEN-E regulation, Connecting Europe Facility)
Specific decisions on EU-level infrastructure investments	Various – much of this could be covered in the decarbonisation package and the planned revision to the TEN-E regulation	Various – much of this could be covered in the decarbonisation package and the planned revision to the TEN-E regulation
Statutory requirement for delivery bodies: delivery in line with the net zero pathway and related reporting requirements	EU Climate Law plus revisions to Third Package relating to national regulators	Decarbonisation Package plus revisions to Third Energy Package relating to national regulators
Principles for net zero investment delivery mechanisms	EU Climate Law	Decarbonisation Package

Table 1: Mapping statutory requirements onto legislative vehicle

This table illustrates that an EU Climate Law could be central to the legislative framework and that decisions captured in other legislation could flow from mechanisms enacted by the EU Climate Law. The Clean Economy Observatory is particularly important and early conclusions from this body are required before the decarbonisation package and TEN-E regulation revision can be progressed.



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This suggests that a ‘shadow’ body would need to be established whilst the Climate Law is being implemented to ensure that early advice is available to inform other pieces of legislation.

In the absence of a climate law, or if it is only focused on climate targets, the decarbonisation package must assume greater significance in co-ordinating the legislative framework.

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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