



E3G

Delivering a Zero Emissions Power Sector

Policy Challenges

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About E3G

E3G is an independent, non-profit European organisation operating in the public interest to accelerate the global transition to sustainable development.

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.

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Delivering a Zero Emissions Power Sector: Policy Challenges

Summary

- > Amid much discussion by stakeholders and policy-makers, there is considerable confusion about what needs to be delivered and by when, yet this seems an essential requirement to engender momentum into the political process.
- > This issue is clouded by the strong 'optimism bias' from advocates of a particular technology and from policy makers who assume that their policies will inevitably deliver the desired outcomes. Yet all experience of deployment projects for new/complex technologies suggests that these are plagued by cost and timescale overruns. It is crucial to recognise the risk that policies might fail to deliver desired outcomes.
- > Delivering transformational change in power sector policy therefore seems to depend critically on a broad acceptance that 'carbon targets are too important to miss' and enough money needs to be invested to leave only a small residual risk of failure.
- > We cannot afford to put all our 'eggs' in one delivery 'basket'. The challenge is therefore to create a roadmap which drives forward a range of technical options and does not at this stage exclude the possibility of any longer term low carbon fuel mix.
- > The policy landscape across the EU is complex and the potential need for reform is significant. While the ability to drive through key changes will depend on the political opportunities that arise, clearly action at EU level is needed to reinforce the future carbon constraint and associated carbon price; mandate delivery of energy efficiency targets; fund energy efficiency deployment strategies; identify and fund new strategic interconnectors with potential to access significant renewable energy resource; fund smart grid pilot projects; and establish common framework for regulating networks to deliver smart grid. Action by key Member States could provide: deployment strategies for energy efficiency; reform of the regulatory framework to deliver smart grid; and reform of the electricity wholesale market to drive forward investment in low carbon generation.

Context

Creating a virtually zero emission EU power sector by around 2030 will require transformational change:

- > Climate science suggests increasing urgency in the need to reduce carbon emissions;
- > It is widely accepted that the power sector will play a key role in decarbonising the overall economy: the crucial technologies are already available to create a carbon free power sector and this, in turn, will create electrification options to decarbonise other sectors;
- > Current momentum behaviour appears to be a long way from that required to deliver a zero carbon power sector over the necessary timescales and some major changes will be needed to the market and regulatory framework.

E3G has initiated a work programme to drive forward this agenda. The first stage of this project has involved reviewing the currently available research and writing an ‘hypothesis’ paper with the aim of engaging a small group of stakeholders who are close to the policy debate. This has enabled E3G to challenge the assumptions set out above, elaborating the nature of the problem and identifying where change might be needed.

This paper sets out the high level conclusions of this initial engagement process and the key questions and issues it has raised. The paper will be used as a vehicle for wider industry engagement in order to identify next steps for the E3G power sector work programme.

Lessons Learnt

Discussions have been held with a range of interested parties including utility companies, equipment manufacturers and policy makers. The key conclusions are listed below:

- > There is general acceptance of the three assumptions outlined above and it does not seem useful to spend time and effort on their further validation. However, further investigation of the extent of the shortfall between momentum behaviour and that required to deliver a zero emissions power sector might be useful in informing the policy debate.

- > There is broad agreement that delivery of a zero carbon power system will involve three key elements:
 - Migration towards zero carbon generation
 - Significant improvements in the efficient use of energy
 - Major changes in the network infrastructure and the way this is operated
- > Most thought appears to have been given to the first of these points and the need for some form of power sector market reform is now widely accepted. However, there is little evident consensus on what action might be required.
- > There is a widely held view that delivery of power sector decarbonisation should be driven at Member State level rather than by the EU. This seems to be due to the belief that the mechanisms involved will differ significantly from one Member State to another.
- > There is a widespread reluctance to discuss the changes in terms of a move away from the market and towards central planning or regulation. Instead, people seem much more comfortable discussing options to bolster the carbon price signal and de-risk investment.

Overall, there seems to be a general interest in engaging in this debate and in helping to shape the policy agenda going forward.

Emerging Technical Frame

Most stakeholders are able to articulate a view on what a zero carbon power sector might involve. However, they seem to fall into two distinct camps:

1. The 'green' lobby focuses on a move towards a 100% renewable electricity system delivered through a combination of local, decentralised sources of renewable power and the bulk transport of renewable power from major remote sources such as North Sea offshore wind, concentrated solar power in the Mediterranean and biomass from Eastern Europe. This vision critically depends on the development of a 'super-smart' EU grid. Network infrastructure therefore forms a key part of the overall vision.
2. The 'security of supply' lobby tends to focus on a diverse mix of low carbon generation sources involving renewables, nuclear and fossil plant with CCS.

This vision tends to be less dependent on major infrastructure development, which tends not to be elaborated.

Both of these camps accept the need to dramatically improve energy efficiency. However, the security of supply lobby tends to be less confident about how much can be achieved.

There is, therefore, considerable confusion about what needs to be delivered and by when and yet this seems an essential requirement to engender momentum into the political process. In particular, it is unclear which investments are common to both visions and at what point must we choose between them. This issue is clouded by the strong ‘optimism bias’ that pervades the debate, both from advocates of a particular technology and policy makers who assume that their policies will inevitably deliver the desired outcomes. However, all experience of deployment projects for new or complex technologies suggests that they are plagued by problems which lead to cost and timescale overruns.

There will, therefore, always be a risk that policies will fail to deliver desired outcomes and the more we spend, and the more options we hold, the lower this risk will be. Delivering transformational change in power sector policy therefore seems to depend critically on a broad acceptance that ‘carbon targets are too important to miss’ and enough money needs to be invested to leave only a small residual risk of failure. This in turn leads to the conclusion that we cannot afford to put all our ‘eggs’ in one delivery ‘basket’ and it is important to retain a variety of technical options until such time that delivery capability is more certain.

The challenge is therefore to create a roadmap which drives forward a range of technical options and does not at this stage exclude the possibility of any longer term low carbon fuel mix.

Role of the EU and Member States

The EU has been active in the energy policy arena and has implemented a series of important interventions. In particular:

- > A framework to cap overall emissions of CO₂, including burden sharing between sectors, and a trading scheme between large emitters to allow them flexibility in meeting the target

- > A requirement to produce 20% of all energy from renewable energy sources by 2020
- > The introduction of wholesale and retail competition and the unbundling of network assets from energy companies
- > Funding to promote technology development including, for example, CCS.

The current view of the European Commission appears to be that these interventions provide the right framework to drive forward decarbonisation and that it is now primarily up to individual Member States and the private sector to implement the policies necessary to deliver the desired outcomes. Indeed the diversity of circumstances across Europe suggests that very different local solutions will be required and this also seems to be the view of many industry players.

However, it is important to challenge this view on two counts:

1. Is the energy policy framework established by the EU adequate to address the climate challenge? In particular:
 - a. Does the EU ETS in its current form provide the best vehicle to price carbon?
 - b. Is the liberalisation agenda still relevant?
2. Are there any additional measures which are important to driving change which are best introduced centrally at the EU level? For example:
 - c. Should new mandates be introduced to compel Member States to take certain actions?
 - d. Can co-funding be provided for key investments to incentivise action on the part of Member States?

Indeed, there are a number of positive advantages associated with policies set at an EU level. Although the legislative process can be lengthy and fraught, once in place, new laws are extremely difficult to overturn. Also, EU-wide application of laws can enable greater ambition since it reduces the ‘free-rider’ concern which may constrain action taken at Member State level. It is therefore appropriate to consider where action may be required at EU level and where it should be taken by Member States.

Key Issues to Address

Energy efficiency

The policy challenges associated with improving energy efficiency are highly relevant to the issue of power sector decarbonisation since:

- > They create a major uncertainty about the volume of electricity which must be produced and delivered.
- > It will likely be necessary to prioritise between investments to promote energy efficiency and those to decarbonise electricity production or upgrade the networks, and current evidence suggests that investments in energy efficiency will often present the least cost and highest benefit option.
- > The key rationale for liberalising energy markets has been to introduce competition into energy supply and, since this has fundamentally changed the risk profile for investment in generation¹, it is important to understand whether a competitive retail market helps or hinders measures to improve energy efficiency.

Evidence from the UK suggests that customers in general will not take up measures to improve energy efficiency on purely economic grounds, despite the often compelling cost benefit. The European Parliament also highlighted this concern in its important 2007 report on the Energy Efficiency Action Plan². The key challenge is therefore to find other means of persuading customers to allow their homes and businesses to be assessed and measures installed.

The range of circumstances prevailing across Europe suggests that deployment campaigns will be run most effectively at a national or local level since different delivery vehicles are likely to be most successful in gaining access to premises. However, two key questions need to be addressed at an EU level:

1. Is there sufficient incentive/requirement for Member States to spend the necessary time and money to trigger a dramatic improvement in energy efficiency? If this is not the case, are such incentives best introduced through new mandatory targets³ or EU co-funding?

¹ In the 'pre-liberalisation' model, generation companies had a captive customer base and investments could be made safe in the knowledge that costs could be passed through to customers and there was no prospect of stranded investments. With competition for retail customers, security of market does not exist and investment risk must be managed at the wholesale level.

² European Parliament 2007/2106(INI)

³ The Commission is believed to be considering this option.

2. Should Member States be allowed to adopt a delivery vehicle which reduces, or even removes, the potential for retail competition? It will be difficult to prove this point one way or the other since the potential for competition to help reduce energy consumption is unknown and will depend on the extent to which innovative products and services reveal new (and as yet unknown) customer benefits which improve quality of life through using less energy.

This is an extremely complex area; however, it seems critical to gain some understanding of the potential for investments in energy efficiency to reduce consumption and, thereby, better understanding of how investment and policy action should be prioritised between this area and electricity production and networks.

Electricity production

Transforming electricity production from high carbon to low carbon sources is central to the creation of a zero emissions power system and this challenge appears to be paramount in the minds of most industry players. This is likely to be for two reasons:

1. The financial investment in generation is currently envisaged to be much larger than that involved in improving energy efficiency or networks, and
2. Generation investments are seen as being particularly risky.

Until relatively recently, generation investments could be made with the confidence that costs could be passed through to a captive customer base, and this is still the case in a number of European energy markets. However, liberalisation and the development of competition in energy retail has increasingly changed this dynamic and the cost risks of generation projects now have to be managed in the financial markets. In reality, the majority of investments in fully liberalised markets have been made by large energy companies with a de-facto customer franchise and the history of truly merchant generation projects is rather chequered. Most commentators therefore seem to accept that a liberalised energy market is only sustainable with oligopolistic market structures and large companies dominating the investment landscape.

Against this underlying conundrum, the low carbon transformation of electricity generation creates two new major issues which magnify the investment challenge:

1. There is huge uncertainty over the future market need given:
 - a. Demand uncertainty
 - b. Uncertainties about the deployment and performance risks of other generation plant
 - c. Changes in load factor and system balancing needs, arising largely from the intermittent nature of some renewable technologies
2. Investment economics will depend critically on a future carbon price which is derived from an entirely administered market and therefore subject to ongoing political influence.

Investors in low carbon generation must therefore justify their investments on the basis of future behaviour by politicians, competitors and regulators – a situation which is entirely without precedent. In particular, investors must believe that prices will increase significantly, yet all empirical evidence points to the effects of competition and the actions of regulators and policy makers actively working in the opposite direction.

The one area where investment momentum is building is in renewables. Here Member States have put in place a variety of direct support mechanisms to significantly reduce the risk on future revenues and thereby make these projects bankable. However, the price of this success is that renewables investment has been effectively ‘carved out’ from the generation market with capacity and volume targets set by policy makers rather than determined by the decisions of market players.

This raises a fundamental question about the generation market. Is it possible to trigger the necessary step-change in low carbon investment through refining and bolstering current market arrangements, or is an entirely new approach required? Four high level options are worthy of consideration:

1. Maintain or reinstate the customer franchise
2. Introduce mechanisms to reinforce confidence in future wholesale prices (e.g. carbon price floors, capacity mechanisms)
3. Introduce temporary investment incentives (e.g. contracts with a central buyer, subsidy) whilst confidence grows in the ability of existing market mechanisms to deliver sufficient future price levels

4. Accept that future price expectations will never provide sufficient incentives and drive forward investment with new direct incentives and subsidy mechanisms

Each Member State is starting from a different place in terms of market and regulatory arrangements and from a different position in the investment cycle. However, the way forward in each Member State must conform to relevant EU legislation, including that relating directly to the energy markets and along with broader provisions such as those relating to State Aids. It therefore seems crucial to establish whether the existing EU legislative package is sufficiently flexible to allow each Member State to drive forward low carbon investments.

In addition, it is also important to establish whether there are adequate incentives in place for Member States to pursue the rapid decarbonisation of power generation, or whether it will be necessary to reinforce the overall signal to reduce carbon emissions and/or provide co-funding incentives for key low carbon generation investments.

Networks

Although changes in network infrastructure and operation are seen as vital enablers that will facilitate the transition to a zero emissions power sector, and although this has been the subject of much discussion amongst academics and policy makers, there appears to have been relatively little engagement with this issue on the part of industry and regulators. This is probably largely due to the all consuming focus that has been placed on the need to unbundle networks from vertically integrated energy companies. Despite the vociferousness of the unbundling debate, there does not appear to be any party that would now argue that network investment incentives cannot be created equally well (or better) through a well designed regulatory framework as through the internal investment processes of vertically integrated energy companies. Therefore, driving change in this area primarily involves understanding what needs to be done and understanding what are the changes in the regulatory framework that will bring this about.

The transition to smart grid is widely accepted as a necessary component in building a low carbon power system; however, there appears to be little consensus as to when and how this might happen. The Commission has proposed that the EU should fund a series of pilot projects across Europe with a

view to providing the technical know-how for 50% of the EU grid to become 'smart' by 2020. The key challenge, however, seems to be creating the right regulatory framework that will ensure deployment. A system that focuses on minimising operational spend whilst sanctioning sufficient capital expenditure to meet future power system flows will not deliver a transition to smart grid. Instead, it is necessary to define a new set of network outputs and accept the need to adopt new operational approaches which potentially introduce both costs and risks.

European regulators increasingly work together and share best practise through forums such as ERGEG and CEER. However, they are each acting in line with the statutory objectives placed on them by their national government and it is these which need to be changed to ensure the delivery of smart grid. It is therefore necessary to understand whether existing objectives, such as the 2020 renewables targets, place sufficient drivers on Member State Governments to make the necessary changes to their regulatory frameworks or whether new measures are required.

The EU sees the construction of new interconnectors between Member States as a key element in creating a unified energy market and it has provided funding to support a number of strategic infrastructure projects. However, the construction of major new interconnectors to access remote but substantial sources of renewable energy has not been identified as a strategic priority and individual proposals are emerging in an apparently *ad hoc* manner, notably where sponsored by certain Member States and industry players (e.g. DESERTEC). It seems likely that a more strategic approach to infrastructure development, backed up by the allocation of new EU funds to support such projects, might be useful in creating momentum and gaining interest from the relevant Member States. However, in order to effectively prioritise when funds should be allocated it is important to understand the timescales over which benefits from such investments can be derived.

Conclusions

The policy landscape across the EU is complex and the potential need for reform is significant. However, the discussion above suggests that significant changes can be triggered through:

- > New measures introduced at EU level, and
- > Action by key Member States who are trying to respond to this policy framework.

The ability to drive through changes will depend on the political opportunities that arise, however, the following list illustrates where change is needed:

- > EU level:
 - Reinforce the future carbon constraint and associated carbon price
 - Mandate delivery of energy efficiency targets
 - Provide funding for energy efficiency deployment strategies
 - Identify and fund new strategic interconnectors with potential to access significant renewable energy resources
 - Fund smart grid pilot projects
 - Establish a common framework for regulating networks to deliver smart grid
- > Key Member States:
 - Deployment strategies for energy efficiency
 - Reform the regulatory framework to deliver smart grid
 - Reform of the electricity wholesale market to drive forward investment in low carbon generation

A whole range of activities are needed to both stimulate the appetite for change and help define the appropriate form that the changes should take.

The next stage for E3G is to further engage with key stakeholders and work together to identify where across this landscape it will be most beneficial to spend time and effort in driving forward the agenda.