Proceedings of the National Symposium on Future Electricity Networks

There is a better way

Michael Wilks, April 2011
**Introduction from the Chair**

The concerns of people about the proposed reinforcements of the electricity transmission network are very widespread and very deep.

This is not just nimbyism, these are decisions that have an impact on the landscape for 50, 60, 70 years and what appears to be the assumption from National Grid is that technology which was considered appropriate 70 or 80 years ago is sustainable, right, for the 21st century. I don’t think that’s a view that is very widely held by the populations who are going to live with consequences of that.

We have learnt a lot about some of the alternatives. There have been serious questions raised about the cost of these alternatives - which may be less than some people have suggested in the past. I think there are some new technologies which could be harnessed to advantage.

I personally also have a real difficulty understanding why, now that we realise we have to move to low carbon forms of electricity generation (most of which are more expensive than the old high carbon forms), we accept that the cost of the actual generating process requires some sort of subsidy, but we do not yet accept that new transmission capacity which clearly is needed should be treated in the same way. There is a real irrationality there and I and the other MPs are concerned about this and we are very grateful to work in close cooperation with our colleagues in local government as well.

There is an opportunity, given that we are going to renew or increase a lot of our transmission capacity, to do so in a 21st century, sustainable way and it will be scandalous if some convoluted regulatory structure, or the short sightedness of the companies responsible for this, means we fail to do the right thing by the next three or four generations. The concerns exist, the alternatives exist, the opportunity is now with us and I hope that all of us make sure we seize this very real opportunity.

Tim Yeo MP
Acknowledgements

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- David Mercer, Construction Manager, Major Works, National Grid
- Richard Smith, Future Transmission Networks Manager, National Grid
- David Walker, Offshore Development Director, ScottishPower Renewables
- Paul Hipwell, No Moor Pylons
- John Foster, Suffolk & Essex amenity groups
- Tom Luff, Head of Network Delivery & Access, Department of Energy & Climate Change
- Iain Morgan, Senior Regulatory Economist, Ofgem
- Colin Johnston, Corporate Account Manager, Siemens Energy
- Steve Aughton, Business Development Manager, Siemens Transmission and Distribution Ltd
- Allan Provins, Senior Consultant, eftec

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Disclaimer

These Proceedings are based upon the issues discussed at the Symposium, though any conclusions drawn and views expressed in the document are the opinions of Suffolk County Council, and it should not be inferred or implied that these are the opinions, conclusions or findings of all of the attendees.

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Abstract

In December 2010, Suffolk County Council produced a paper which called for a new approach to the development of the electricity transmission network; one that responded to the contemporary pattern of electricity generation and consumption and one that had sustainable development at its core. Specifically the concerns identified fell into three categories:

1. The lack of an overarching strategy behind the development of the onshore & offshore electricity transmission network

2. The legislative framework does not support sustainable development

3. The regulatory regime supports investment in infrastructure over operational alternatives

The National Symposium on Future Electricity Networks sought to draw together key stakeholders to explore these issues in further detail and ultimately to persuade policy makers to revisit the respective legislative, regulatory and policy frameworks, and so facilitate the delivery of a transmission network that befits the 21st century.

This paper begins by summarising the current drivers of the development of the electricity transmission network and then examines in more detail those issues identified above and considers the prospects for their resolution.

The paper concludes with a summary of the main concerns raised at the Symposium.
Drivers of change

“Well quite simply, the existing grid is in the wrong place”

John Foster, p26

Affordability and security of supply have been the basis of electricity industry policy and regulation “for pretty much as long as it has existed” (Richard Smith, p5). However, over recent years climate change, and specifically EU targets on renewable energy generation and the Government’s own targets on greenhouse gas emission reductions, have driven the sustainability agenda into a prominent role in the policy making framework. This has latterly been extended to the regulatory framework, through amendments to the Electricity Act 1989 by the Energy Acts of 2004 and 2008. The consequence of this is that a fundamental shift in the nature of electricity generation is required, moving from carbon-intense forms such as coal and gas to new low carbon sources.

Over the next decade 25% of the existing power stations will close and we will see indigenous supplies of UK gas fall to 25% of the level we have seen in the past. Modelling by National Grid suggests that by 2050 power generated by combustion of coal and gas in stations (lacking carbon capture and storage (CCS) technology) will fall to zero. This energy gap will be bridged by a combination of new nuclear build (predicted to be 30GW), wind and other renewables (47GW) and CCS (25GW). Crown Estates actually estimate that there is an offshore wind resource of potentially 50GW that could be harnessed (Richard Smith, p7).

Evidently these new sources of electricity display a fundamentally different spatial distribution to what we see today. Indeed with potential for around 90% of future generation capacity to be offshore or coastally located (John Foster, p26), this is a real challenge for a grid that was chiefly designed to transfer electricity from the coal fields of the north to population centres in the south. What is needed now is a grid that can respond to flows which vary in direction, but also in time.

There was no contention over the need to respond to the threats of climate change and it was accepted that with that comes a need to reinforce the transmission network. Indeed this opportunity to develop the transmission network, if done in a progressive way, was seen as a potential boon to economic growth and sectoral development in the UK (Paul Hipwell, p31).

However there was considerable disquiet by many delegates over the continued support given to a regulatory regime that “can only lead to the progressive expansion of the pylon network” (John Foster, p26). The next sections explore the interrelated weaknesses of the current legislative, regulatory and policy frameworks.
The lack of an overarching strategy behind the development of the onshore & offshore electricity transmission network

“We have had a very persuasive account of the strategic shift which is needed in generation but we do not get the same strategic approach to the issues around transmission”

Peter Gregory (delegate), p34

The Department of Energy and Climate Change (DECC) asserted that “the precise location of new electricity generation is often quite difficult to predict” (Tom Luff, p41), yet DECC’s own National Policy Statement (NPS) for Nuclear Power Generation clearly sets out the locations for future nuclear development. Furthermore, in the case of offshore wind development, developers are required to enter into contractual agreements with the Crown Estate to deliver a specified amount of electricity from each allotted zone; for example for the Norfolk Zone, won by a ScottishPower-Vattenfall joint venture, the obligation on the developer is to deliver 7200MW to market (David Walker, p15). There is therefore actually a very clear vision of the geographic distribution of a significant proportion of future low carbon energy generation, which of course is the key prerequisite to coordinating network development.

Assumptions on future geographic distribution of generation have been made in the past. To help guide thinking on what new electricity network might be needed in order to transition to a low carbon economy, DECC and Ofgem set up the Electricity Networks Strategy Group (ENSG) and it produced a Vision for 2020. It was stressed this Vision is not the view of Government, but it is “the best overview we have got available to us” (Tom Luff, p43). While the industry may view this as a “coherent look” (David Mercer, p32) the report has received substantial criticism both at the Symposium; “blinkered” (John Foster, p28) and elsewhere, particularly in evidence given to aid the Energy and Climate Change Committee’s report on Future Electricity Networks.

The Vision has a very unclear status; DECC’s view is that “it is certainly not a Government plan or programme. It does not pre-empt the planning process in any way. It should not be read as assuming that any individual project referred to in the Vision will be constructed” (Tom Luff, p43). However it was on the back of this report that Ofgem previously released over £1bn of funding to the transmission companies outside the current Transmission Price Control Review for ‘anticipatory works’.

Although sentiments in DECC’s recently revised Draft Overarching National Policy Statement for Energy accord with DECC’s statement above, the NPS also states that “the need for any overhead line of 132KV has been demonstrated in principle” which on the face of it seems entirely contradictory to the view that the ‘Vision’ is ‘for
information only’. The NPS also therefore seems to make overhead lines the “default choice” for applicants seeking consent from the Infrastructure Planning Commission (IPC) (Paul Hipwell, p24). This does not appear to align with the ambitions of the new price control mechanism, RIIO, to stimulate innovation.

A further point of debate is that because the ‘Vision’ is not deemed to be a plan or programme it does therefore not require a Strategic Environmental Assessment. This would have required not only a full environmental appraisal, including cumulative impacts, (the ‘Vision’ gives only cursory attention to environmental issues), but would also have necessitated an assessment of alternative (potentially more coordinated) options for network development. Environmental Impact Assessments are critical to evaluate and mitigate the impacts of specific projects, but are not the correct vehicle for assessing the environmental impact of a strategy as a whole. Their scope is likely to be limited to detailed alignment issues, rather than a broader appraisal of the most appropriate framework for network development.

Another fundamental issue is the apparent lack of tie in with strategic planning of the offshore network despite the obvious synergies between the two. It is clear that in the future the nature of reinforcements required for the onshore network are going to be significantly driven by offshore development. However, we are yet to see a strategy that seeks to respond to the redistribution of generation and demand in any other way than to continue to reinforce the historic onshore network. It would appear that this is largely a consequence of the emerging offshore regulatory regime.

National Grid is the owner and operator of the terrestrial high voltage transmission network in England and Wales and operator only in Scotland. Offshore, the arrangements are different with the assets being owned by the developer or Offshore Transmission Operator (OFTO), but operated by National Grid. This arrangement is in place to create “contestability” in transmission, which aims to reduce the costs of bringing offshore electricity to market through introducing an element of competition to network construction (Richard Smith, p11).

However the Symposium heard that, in reference to the offshore regulatory regime,

“...the way it is designed just now, it forces you down the point to point connections so while we might like an integrated network the way it is currently set up it is probably unlikely that is going to happen...therefore I would just challenge is that an efficient way forward?”

David Walker, p20

The development of the offshore grid has received even less independent scrutiny than that of the onshore network. National Grid, by virtue of a special condition of its Electricity Transmission Licence is required to produce an Offshore Development Information Statement (ODIS) which must be updated annually⁹.
The purpose of the ODIS is “to present some views on how we [National Grid] think that the offshore network might develop” (Richard Smith p11), however this is restricted to identifying “potential economic and co-ordinated options”. It is very much aimed at highlighting efficient means of developing the offshore grid and it principally does this through minimising point to point connections.

ODIS is not guidance, the solutions remain “the preserve of the developers and the OFTOs” (Richard Smith, p11). It does not, as DECC suggested, “help[s] ensure these objectives” of coordination and over investment in infrastructure (Tom Luff p43) as it is not in any means enforceable. Although National Grid are required to work with developers and OFTOs to identify where an efficient connection point may be (and this will include a look at the wider network implications), the emphasis is very much on the developers doing their “own surveys properly” and then choosing where to connect to the grid (Richard Smith, p11).

In order to consider how this situation arises, it is necessary to review the process of connection offers.

National Grid has an obligation to provide access to the grid wherever and whenever a generator wishes to do so. Because National Grid is not the owner of the offshore grid, this connection point will always be onshore. The point at which an OFTO or developer wishes to connect their offshore grid to the onshore one is at their discretion. This is perhaps DECC’s point - while it is known where generation will occur, it is not known where it will connect to the grid.

The developer/OFTO’s preferred point of connection will be determined through an evaluation of National Grid’s geographically variable Use of System Charges alongside other key considerations, particularly the capacity available in the network at that point, which in turn determines the nature of any additional reinforcements required and with that the associated level of both consenting risk and security for liabilities.

The key point to make here is that; in making connection offers National Grid can only consider the contracted generation background, despite being aware that other developments in the same geographic area may arise in the future which could necessitate further reinforcement of the network. Clearly this makes economic sense to National Grid as it does not want to overinvest in infrastructure, but this is potentially a real obstacle to the development of a coordinated grid. Under the current arrangements therefore, a situation may arise where National Grid identifies incremental reinforcement of the local onshore network as an efficient solution, whereas over a longer time frame an offshore link could be preferable when one considers likely demands for future transmission capacity and the broader social and environmental impacts of a reinforcement.

It was stressed by National Grid that “the regime today for offshore does not prevent integration” (Richard Smith, p39). Although the lack of strong endorsement was
palpable by its absence, there are understandably significant issues to be resolved in respect of delivering a coordinated offshore network. Clearly there are difficulties in integrating projects that are working to different time scales with different financial backers, with different concerns and while anticipatory works are highly desirable in this regard, the recurring issue is “who's going to pay for [it]?” (Steve Aughton, p54).

The risk of stranding assets, which may occur if future projects do not ultimately come to fruition, is a significant concern for Ofgem, as it is ultimately consumers who will pay for these assets. However, by way of contrast, as mentioned, Ofgem did sanction anticipatory works onshore on a ‘least regrets basis’ following the ENSG report. The situation offshore is slightly complicated by the multiplicity of Transmission Owners, but if the Government is duty bound to deliver targets for renewable energy generation and greenhouse gas emission reduction, not to mention a secure energy supply, there is surely a case for it assuming some of this risk, given that the generation needs to be delivered.

“the optoneering which is very helpful in some ways becomes a bit of a useless exercise if you can never implement it”.

David Walker, p21

The real irony is that ODIS’s Integrated Strategy is openly preferred by National Grid (Richard Smith, p12) and developers (David Walker, p19), and it will also, according to Siemens, shave £8bn off the cost of the development of the offshore network (24% potential savings for customers) and dramatically reduce the extent of onshore cabling required\(^{10}\). However the current regulatory regime remains designed in such a way that “it is actually very difficult to achieve that in practice” and in reality “it is probably unlikely that is going to happen” (David Walker, p19-20).

DECC, recognising that “we need to be proactive in grid development and provide as much strategic leadership as we can” (Tom Luff, p42) reported they and Ofgem alongside stakeholders are going to undertake a joint review of options for the offshore network and consider what additional measures might be required to deliver this coordinated offshore network and how any measures might be actually implemented in practice\(^{11}\).

The Government was urged to take lessons from other regimes – in particular Germany where they have taken very much a planned approach to the delivery of the renewable targets by controlling both the delivery of windfarms and the supporting offshore and onshore networks. The companies in Germany that are responsible for that work were reported to work in a very coordinated way and indeed are under legal obligation to deliver to a certain timescale under the threat of financial penalty, a system that should be investigated for implementation in the UK (David Walker p21).
The aforementioned Government review is very much welcomed, though it is unclear if this will address the absence of a strategic spatial plan for electricity transmission network infrastructure onshore and offshore. While the planning system does of course retain a key role in shaping the future of our electricity networks – indeed it is, as National Grid acknowledges, not their role but that of the planning system to be final arbitrator on balancing competing interests (David Mercer, p10), it is currently hampered both by the absence of a Development Plan complemented with a Sustainability Appraisal, and by the limited ability of the current Infrastructure Planning Commission and future Major Infrastructure Planning Unit to explore alternatives to the schemes put before them\textsuperscript{12}.

There is currently no mechanism by which a strategic overview is being taken to evaluate the most sustainable way of transmitting electricity from the known future sources of generation to the known future demand centres. The absence of a spatial development plan is in stark contrast to the principles underpinning the rest of the planning system, which is predicated on the process of evaluating the merits of a given proposal within an agreed spatial planning framework. In its absence, decisions will continue to be taken on an \textit{ad hoc} basis without proper cognisance of proposals emerging elsewhere. The likely consequence of this is that incremental development of the onshore electricity network will continue. Development Control cannot function effectively without a Development Plan. Indeed it is this principle that saw the Energy & Climate Change Committee conclude that ratification of the NPSs should await the designation of the National Planning Framework\textsuperscript{13}.

Planning issues are further complicated by the fact that proposals for overhead lines, underground cables and subsea cables are potentially all governed by different planning regulations – the NPSs, permitted development and marine regulations respectively (Paul Hipwell, p24)

\begin{quote}
\textit{“a long term view is absolutely required in our view, around strategic network planning and also investment as well”}
\end{quote}

David Walker, p21

Government has already accepted that there is a need for greater leadership in offshore co-ordination and as such has established the Offshore Transmission Coordination Advisory Group. It is hoped that this Group will also bridge the false dichotomy between onshore and offshore network planning which seems to have emerged as a consequence of the different regimes within which they operate. It would seem logical to align and integrate the work of this group with a review of that undertaken by ENSG for the onshore network, if the full benefits of coordination are to be realised.
The legislative framework does not support sustainable development

“...the balance between cold economics...and the environment...was never fully reconciled. They are uncomfortable bedfellows in that Act”

John Foster, p28

As decreed by the Electricity Act 1989 (as amended by the Energy Act 2008), the principal duty of Ofgem is to protect the interests of existing and future customers. The Energy Act 2010 clarified that these interests are to be “taken as a whole”, though specifically mentions a secure and lower carbon electricity supply.

Ofgem, must also, in accordance with amendments to the Electricity Act 1989 by the Energy Acts of 2004 and 2008, “contribute” to the achievement of sustainable development. Although there is Social and Environmental Guidance issued by DECC to Ofgem, it does not clarify how this contribution to sustainable development, which itself is not defined, is made and measured. This Guidance, and indeed the lack of clarity over the respective statuses of Ofgem’s duties, were both criticised in DECC’s recent Ofgem Review: Call for Evidence.

The General Duties of Licence Holders, such as National Grid, have remained unchanged since the 1989 Act, which directs them “to develop and maintain an efficient, co-ordinated and economical system of electricity distribution”, while also having “regard to preservation of amenity”. Again there is a question about the relative of importance of this ‘desirable’ compared to the primary duties.

Ofgem stressed at the Symposium the importance they afford to their duty to contribute to sustainable development and that it would be a key tenet of the new price control RIIO (Iain Morgan, p70). It would appear that the revised legal framework within which they operate permits sufficient scope to address an issue that the regulator has not been required to prioritise in the past. However, it remains to be seen how deliverable Ofgem’s laudable ambitions are, given that the duties of the regulated companies have not been amended despite successive legislative updates to the Electricity Act 1989.

“The Coalition Government is committed to Sustainable Development”

Defra, 2011

In recently reviewing the 2005 Sustainable Development Strategy, the Government has reiterated that the achievement of sustainable development requires equal consideration of social, economic and environmental needs and that this integrated way of thinking needs to be “mainstreamed” across all Government departments.
Sustainable development encompasses much broader objectives than that of productive efficiency - which has underpinned electricity network development in the past. While efficiency is concerned with avoiding wastage of scarce resources, sustainable development also encompasses goals around equity and distribution in outcomes, around economic development, around protection of the natural environment, and all are equally weighted.

Through Cost Benefit Analysis (CBA) it is possible to “explicitly account for environmental and social impacts as part of our investment decision making process” (Allan Provins, p62). CBA is a tool that allows the weighing up of the costs and benefits of a particular action and establishes which option generates the greatest net social wellbeing, and thus can provide a better understanding of the range of impacts of a given proposal.

The costs and benefits that are traded off in CBA are not just the typical financial items such as construction and maintenance costs, but also the positive and negative impacts such as visual disamenity and other environmental and social impacts. By attributing a monetary value to all the associated costs and benefits of a given option it is possible to evaluate alternatives in a more holistic way. Environmental economists have developed a number of tools for this purpose and these are introduced below, after a brief introduction to the key concepts in this field.

The quality and quantity of market and non-market goods together generate wellbeing; that is they confer economic value for a variety of reasons, either through ‘use’ or ‘non-use’ values;

- **Use values** may be direct or indirect; that is they involve direct consumption of a good or service, for example timber harvesting, versus indirect, for example climate regulation.

- **Non-use values**, in the case of the natural environment, relate to the satisfaction that is derived from simply conserving something for the sake that it exists, or in the knowledge that others can benefit from it now or in the future.

Using this schema, visual amenity would have both a non-consumptive direct use element (personal enjoyment of scenery) and potentially a non-use value (knowing that an iconic landscape, an AONB for example, exists without necessarily visiting it).

Within this framework, goods and services may be either market or non-market – that is their value is recognised in monetary terms and accounted for, or it is not. Timber for example is a market good, however, “you can’t buy a unit of visual amenity down the shops” (Allan Provins, p63) therefore it is a non-market good.

Economic valuation methods give the ability to evaluate the change in the provision of non-market goods in monetary terms and thus allow deteriorations (or
improvements) in environmental and social indicators, that would otherwise be treated as externalities in the decision making process, to be factored in.

We can understand quite a lot about the value of non-market goods if we observe people’s preferences for market goods; that is, we can infer a value for many non-market goods through examination of people’s consumption of market goods – so called *revealed preference* methods\(^{20}\) are used to exploit these relationships in a number of ways:

- **Travel costs method**: the value that people afford to an iconic landscape may be inferred from the time and expenses they are willing to incur to visit it

- **Hedonic pricing method**: house prices not only reflect the characteristics of a property, they also reflect local environmental amenity, so if it is possible to control for these variables, the value of the impact of these environmental attributes can be derived

- **Recreation demand models**: the popularity of a recreational site will reflect its environmental quality.

Where market data is not available, non-market goods can also be valued using *stated preference methods* whereby survey respondents are asked to trade-off monetary amounts with changes in the provision of non-market goods. The two most common methods are *contingent valuation* and *choice modelling*. Overall, both stated and revealed preference valuation methods allow the estimation of *willingness to pay/accept compensation*, which is the monetary measure of changes in the provision of non-market goods. This measure is analogous to the market price values we observe for market goods.

Stated and revealed preference techniques can also complement each other – hedonic pricing for example will only capture the impacts of overhead lines on households in the immediate vicinity. Iconic landscapes in particular are not only valued by those living locally, but perhaps by the nation as a whole. In the case of use values for non-locals this may be derived by, for example, the travel costs method, but in terms of a non-use value this would rely on stated preference techniques.

These techniques are widely used in other disciplines and indeed by other Government departments\(^{21}\) but have had limited application in the field of electricity transmission\(^{22}\).

A hedonic pricing study has been done in Glasgow, which although not necessarily widely transferable, found that house prices depreciated by up to 20% depending on the distance from the overhead line\(^{23}\).
"At the moment you can have a pylon there right past your house and the legislation is such that you will not get a penny of compensation"

Chris Leney (delegate), p71

Clearly, although the empirical research is limited, the evidence should not be ignored. Transmission lines affect house prices and this disbenefit can be readily quantified. The current compensation process does not deal adequately with this and it is a real concern for those whose properties may be affected by new transmission lines. Furthermore, in the absence of a requirement to compensate adequately, the economic evaluation of alternative options becomes incomplete.

A contingent valuation approach used by Day et al.\textsuperscript{24} revealed that respondents sampled from a range of households from 500m to 5km away from transmission lines were willing to make a one-off payment in the range of £60-80 to avoid amenity impacts. They found that willingness to pay declines with distance and that there is no significant difference between whether it is a rural household or an urban household.

“…what White Papers or research have Ofgem commissioned, or at least read and digested, that give evidence that the public is unwilling to put this £1 on to their bill to make sure these lines are undergrounded, because none of this has been referenced so far\textsuperscript{25}

Graham Lamburn, p71

Ofgem responded that “it is fair to say we should look at willingness to pay” (Iain Morgan, p72), but contended that although research does need to be kept updated “the way the regulatory framework is, it is probably something that we should be encouraging National Grid and the other transmission owners to lead on and develop” (Iain Morgan, p71)\textsuperscript{26}.

While this perspective is understandable, as the degree of willingness to pay will likely need to be established on a project by project basis based on local context, there needs to a standard methodology by which this is done which includes guidance on how use and non-use values by the local community and the wider populace are to be calculated. A process similar to this operates in the water industry whereby Ofwat provides instructions to the regulated water companies on using valuation methods. DECC or Ofgem could similarly provide some context specific guidance for the electricity industry applicable to all projects, irrespective of whether the landscape in question is statutorily designated\textsuperscript{26}.

In a further study, Atkinson \textit{et al.}\textsuperscript{27} looked at the design of pylons and whether visual amenity would be impacted less by alternatives to the more common lattice design of
pylons. They found no strong preference between the differences in designs implying little can be done to mitigate the visual impact of a pylon once it is there.

Furthermore, the applicability of the Holford Rules\textsuperscript{28} (which outline current policy on mitigation of new electricity transmission lines), to predominantly flat areas such as the Somerset Moors and Levels, remains open to question (Paul Hipwell, p25). It was also argued that National Parks and AONBs, which receive preferential treatment in the Holford Rules, "don't have a monopoly on natural beauty" - "not just much, just about all" of the British landscape has amenity value and there needs to be a greater recognition of this (John Foster, p27).

"..sustainability will be a fundamental part of the costs and benefits that should be considered in the business plan in a way that perhaps, at least the perception of different parties was, that it wasn't in the past. But it will be important for stakeholders to work with National Grid and encourage them to develop their plans in that way"

Iain Morgan, p70

Ofgem acknowledge that the previous price control mechanism, RPI-X had some possible limitations, including that it "focussed too much on the debate between the regulator and the regulated company" and that there was a "need to encourage longer term thinking on the part of the networks" (Iain Morgan, p48-49). As such it has sought to broaden stakeholder holder engagement and through its ‘well-justified business plans’ lengthen the control of thought of regulated companies.

The starting point from which the new business plans should be developed was described by Ofgem as;

"what are the customer focussed outputs that we are going to deliver as a network in that time, given the context of the Government policy and the other contexts?"

Iain Morgan, p49

Although Ofgem are unclear themselves on how environmental impact may be measured in terms of an output\textsuperscript{29} there appears to be far greater scope for the wider community, through increased stakeholder involvement, to steer the objectives that they wish to see delivered through the respective business plans. Indeed it would appear that the onus is very much on those interested parties to lobby the individual companies who will then have to justify to Ofgem the final form of their business plan, having considered the views put forward to them (Iain Morgan, p70).

What also remains somewhat unclear is how the respective duties of Ofgem and those of the regulated companies, which do not fully align, will be reconciled when tradeoffs are having to be made in the evaluation of the latter’s business plans.
Ofgem agree that it is the right time to consider a more holistic approach to the appraisal of costs and benefits in business plans, but note that the difficulty in pursuing such an option is that it involves not only the regulatory price control but also the wider policy context (Iain Morgan, p69). There isn’t a mechanism in the regulatory decision making framework to mediate between the interests of one set of consumers and another, so any value judgements that need to be taken will reflect Government objectives (Iain Morgan, p69). On this understanding Government needs to provide very clear guidance to Ofgem on how it should balance the potentially competing objectives of economic efficiency and sustainable development. Ofgem then similarly will need to provide guidance to the regulated companies so there is a clear understanding on the expectations of their business plans in this regard.

There remains a concern however that DECC’s well publicised focus on “secure, affordable, low carbon energy” will in turn mean that Ofgem will concentrate on these objectives, perhaps at the expense of wider sustainable development. Nevertheless it must be remembered that most, if not all, of the forthcoming high voltage electricity transmission line projects will be examined by the Infrastructure Planning Commission’s successor body, the Major Infrastructure Planning Unit.

As directed by Section 104 of the Planning Act 2008 this will be in accordance with the National Policy Statements. The Revised Draft Overarching NPS for Energy (EN-1) states that development consent decisions should “respect the principles of sustainable development”. With this background in mind it would seem pragmatic that the evaluation of the regulated companies’ business plans follows similar principles to those being adopted by the IPC/MIPU. This would provide greater certainty for the regulated companies, for communities and potentially a more efficient planning process, especially if conducted within the framework of a properly appraised spatial plan, as discussed earlier.
The regulatory regime supports investment in infrastructure over operational alternatives

The Energy and Climate Change Committee in 2009 was advised that the regulatory system needed to better encourage operational measures such as the deployment of decentralised energy networks and development of smart grids as an alternative to giving network companies “a licence to massively increase capacity, which might not be necessary”\(^{32}\). That specific debate was not revisited at the Symposium, though the much broader issue of a lack of innovation was a key focus of the day.

“…one of the things that natural monopolies tend to do is not to think about different ways of delivering; it is tending to prefer the safe way that they have used before”

Iain Morgan, p49

It was widely acknowledged that the nature of technologies and the cost at which they are available is a rapidly changing area (David Mercer, p36). It was also pointed out that this trend would be accelerated if it is encouraged to happen through appropriate mechanisms in the regulatory system – the so called "experience curve" (Paul Hipwell, p30).

“The Government is technology neutral...[I]t is important to emphasise we do not promote one technology over the other. We expect the developer to use the developer to use the appropriate technology to suit those circumstances”

Tom Luff, p45

The Government is not however technology neutral when it comes to supporting energy generation technologies. DECC, concerned over “the higher costs of renewable energy projects in less mature or emerging technology areas, such as offshore wind and biomass”\(^{33}\) has introduced banding of Renewable Obligation Certificates to support particular technologies and indeed proposes to review this ahead of schedule\(^{34}\). Given that innovation “is an element of competition that is quite difficult to simulate in regulation” (Iain Morgan, p49), there is a clear case for Government to support some of the emerging transmission technologies.

“Piloting a technology at transmission level can be quite a brave thing to do and out of Ofgem, DECC and other parties it would be very welcome to see an increased push towards being able to do that”

Colin Johnston, p72
Support is warranted on a number of fronts. *The Coalition: our Programme for Government* states “we will deliver an offshore electricity grid”\(^{35}\). This cannot be done effectively without multi-terminal connection, which as Siemens noted “is a new leap in technology…technically possible, it’s just not here now” (Steve Aughton, p55).

Furthermore, as has been discussed extensively above, greater coordination offshore does not only, as Chris Huhne MP recently stated, “help secure our energy supplies in a low carbon way”\(^{36}\), it also reduces onshore social, environmental and economic impacts through rationalising infrastructure provision.

“The UK has lost all its indigenous cable manufacturers” (Paul Hipwell, p31). There is a huge economic potential for the UK to exploit opportunities in new transmission technologies.

“…innovation, it’s actually in the title”

John Foster, p28

Revenue using incentives to deliver innovation and outputs (RIIO) will replace the extant RPI-X price control mechanism in 2013. While there was an element of funding for innovation included in RPI-X, there was an admission by Ofgem that the previous regulatory package overall may well have discouraged some innovation at the margin (Iain Morgan, p49). The new business plans will be required to outline how innovation is being delivered by the regulated companies, for example through demonstration that they have considered alternative means of delivery\(^{37}\).

The Symposium was also informed that Ofgem proposed to extend access to the Low Carbon Networks Fund from distribution companies to transmission companies as well.

“We expect these NPSs to be fully compatible with the new RIIO arrangements”

Tom Luff, p44

Concern was expressed that the current National Policy Statements “do not create a level playing field for alternative technologies” due to the IPC having to adopt the starting position that the need for overhead lines has already been demonstrated (Paul Hipwell, p24).

The NPSs also fail to consider the full spectrum of benefits of alternative transmission technologies, for example in house depreciation, tourism impact, preservation of amenity nor are they evaluated on a life time costs basis.

In this context, much reference was made to the study currently being jointly undertaken by the Institution of Engineering & Technology (IET) and energy consultancy KEMA, funded by National Grid;
“The report is intended to provide an objective and independent basis for assessing the overall costs of these different methods for transferring power through Britain’s electricity transmission system. It will also provide an indication of the environmental impacts of the different technologies”.

IET 2011

The study was broadly welcomed but its timing, given that it will be publicised subsequent to closure of the NPS consultations was widely criticised by delegates. National Grid “hope that it will give a firm evidence base where all of us can collectively move forward with” (David Mercer, p10), while DECC “believe that the report will be a general reference document for all interested parties, including the IPC...Obviously, the IPC will open to consider any other information that is presented to it” (Tom Luff, p45).

While the study will provide a useful update to the evidence base, it will only be able to provide very generalised figures – clearly specific site conditions will create significant variability in costs. Furthermore these costs, once translated into project specific figures, will then subsequently need to be incorporated into full CBA so that, as discussed above, the full spectrum of market and non-market impacts of a particular reinforcement proposal can be evaluated. The costs that will be borne out of the IET/KEMA study should only be seen as a single economic input into further analysis.

The Symposium heard presentations from Siemens on the potential for two particular transmission technologies; Gas Insulated Lines (GIL) and High Voltage Direct Current (HVDC).

The particular advantage of HVDC is that transmission losses may be substantially reduced over longer distances. There are two types of DC technology; Classic and Voltage Source Converter (VSC). Classic has a long track record and has principally been used to bulk transfer large amounts of electricity long distances, both underground (5GW in China) and subsea (2GW proposed for the British Western Connector) where there are stable grids at either end.

VSC is relatively new and has been developed to allow connection of unstable grids, hence is ideally suited for connecting offshore wind farms. Currently the maximum transmittal capacity is limited to 1GW. VSC’s comparative advantages include its built in redundancy, black start capability and, because it is modular, it also has a configurable footprint.

As indicated, point to point connections, such as for windfarms, and also (international) interconnections have been successfully demonstrated around the world, but increasingly interest is being focused on multi-terminal connections with a view to enabling the development of a supergrid. Aside from the regulatory/cost
issues as have been discussed at length earlier there are technical issues in interconnection, not only related to cable technology (limited to 1 GW, but “you may get a doubling of capacity” (Steve Aughton, p55)), but also in converter and platform technology.

Supergrids are a step on from ‘simple’ interconnection of windfarms, and create further issues around security of supply, energy trading and standardisation of specifications, i.e. regulatory and political issues that would need to be resolved on a European basis, not just a British one. Purely in technical terms, Siemens reiterated though that they are confident that technology will develop and keep pace with what is required (Colin Johnston, p71-72).

GIL is not a new technology either – Siemen’s oldest installation has been in the ground for 35 years. It delivers high availability and low losses in transmission, comparing favourably with alternative cabling solutions, particularly as the power transfer capacity increases. In comparison to onshore HVDC it also requires a much smaller footprint as cables may be stacked above each other in tunnels.

GIL deployment to date has been relatively limited, with a total installed length of 86km. However its profile is rising with recent installations in Frankfurt Airport, and work is underway in the Three Gorges, China. Siemens also believe that a single length of up to 70km could be achieved without the need for reactive power compensation. As such it is seen as an ideal solution for undergrounding certain sections of line.

GIL is more expensive to install than overhead lines, but operational and maintenance costs are lower. Losses are also lower, EMFs are lower, wayleave required for burial is narrower and the assets are almost totally recyclable on decommissioning. It is certainly a more sustainable alternative to overhead lines, and it is these whole life costs that need to properly valued.
Conclusion

“if we get this right, the legacy we will leave future generations is one where a vibrant economy is powered by a secure energy system that thrives in a beautiful landscape. That is a legacy to strive for, and for us all to be proud of.”

Paul Hipwell, p31

Sustainability, affordability and security in electricity supply need not be mutually exclusive, but currently the regulatory, policy and legislative frameworks are not geared in such a way to deliver these objectives in tandem.

A number of issues were highlighted at the Symposium;

1. there is a need for a strategic approach to electricity transmission in the same way there is for low carbon generation

2. the current offshore regulatory regime is unlikely to deliver a coordinated network

3. the principles behind the new RIIO price control mechanism were broadly welcomed but there was concern that realisation of its objectives may be hindered by the respective statutory duties of Ofgem and the regulated companies

4. the emerging planning regime, within which most of the upgrades to the electricity transmission network would be determined, is insufficiently flexible to alternatives to overhead lines.

5. cost benefit analysis is a well established tool for explicitly accounting for environmental and social impacts in decision making processes and could readily be used to appraise alternative options for reinforcement of the electricity transmission network

6. there was a need to examine how more support could be given to innovative products and innovation more broadly
Notes

3. See 1
7. Ibid, paragraph 52
8. Paragraph 3.7.10
9. Page 3
11. This has since been announced alongside an invitation to join a Co-ordinated offshore transmission development Stakeholder Community. See: http://www.ofgem.gov.uk/Networks/offtrans/pdc/cdr/Cons2011/Documents1/Stakeholder%20Community.pdf
12. Indeed the IPC was accused of working very much in a “legal tick box way” without any degree of pragmatism (David Walker, p20)
23. CBA does have its criticisms, in particular in its discounting of future costs and benefits. This is particularly relevant when one is considering environmental impacts of a given policy or project as benefits and costs of this nature are often realised over the longer term (25 years plus). In using a high discount rate their value will potentially be underestimated and thus may be disproportionately recognised in the decision making process.
24. Note that further methods such as avertive behaviour and defensive expenditures are used where the benefit from a market or non-market good is directly substitutable, for example bottle water as a replacement for a contaminated water source.
25. For example the Department for Transport has guidance on valuing noise impacts in road schemes. See: http://www.dft.gov.uk/webtag/documents/expert/pdf/unit3.3.2.pdf
26. Ofgem commissioned work on this by effet for the previous Transmission Price Control Review in 2006 but the recommendations were not adopted. See: http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=20&refer=Sustainability/Environment/Policy
29. It was stated by a delegate that for every billion pounds spent on transmission network improvements it would add £1 a year on to a consumer’s domestic bill. This was contrasted with the apparent 30% uplift in consumer bills as a result of subsidising the development of offshore wind generation (Chris Ambrose, p35-36). “Even at higher end of the costs that National Grid are suggesting, the cost per household for each of these major projects is less than one pint of beer” (Paul Hipwell, p30).
30. This is particularly pertinent now that Ofgem, in its decision notice on the next price control (RIIO) has indicated that it expects regulated companies to undertake willingness to pay analysis to inform their well-justified business plans (see para 4.61 http://www.ofgem.gov.uk/Networks/Trans/PriceControls/RIIO-T1/ConRes/Documents1/T1decisionoutput.pdf)
33. DECC have subsequently directed Ofgem not to include a specific output around visual amenity, arguing that such impacts would be evaluated at the point of application determination (para 4.58 http://www.ofgem.gov.uk/Networks/Trans/PriceControls/RIIO-T1/ConRes/Documents1/T1decisionoutput.pdf)
35. Para 2.2.4
37. See 5.
RIIO appears to be far more encouraging of innovation than the previous price control. For example “The Revenue Adjustment Mechanism enables companies to apply for additional funding within the price control period for the rollout of initiatives with demonstrable and cost effective low-carbon or environmental benefits” (para 5.8
http://www.ofgem.gov.uk/Networks/Trans/PriceControls/RIIO-T1/ConRes/Documents1/T1decisionbusplan.pdf)

There does not appear to be a universally agreed breakpoint at which losses from an HVDC cable become less than those of an equivalent length of an HVAC cable. One must also consider the losses associated with converter stations when using HVDC. By way of example, Larruskain et al. (undated) appear to suggest a break point of 850km (excluding converter station losses) (Figure 3, http://www.solarec-egypt.com/resources/Larruskain_HVAC_to_HVDC.pdf) while Negris et al (2006) found that for connecting offshore windfarms more than 70km from the coast using HVDC LCC (classic) resulted in the least losses (http://www.google.co.uk/search?q=HVAC+and+HVDC.pdf). Marketed as HVDC Plus by Siemens.