FACTORIZING STRATEGIC AND SUSTAINABILITY CONSIDERATIONS INTO ENERGY SECTOR REGULATION: A CASE STUDY OF DEVELOPMENTS IN THE UK OFFICE OF GAS AND ELECTRICITY MARKETS (OFGEM)

Michael Grubb, UK Office of Gas and Electricity Markets, 020 7901 7344, michael.grubb@ofgem.gov.uk
Jenny Mills, UK Office of Gas and Electricity Markets, 020 7901 7000, Jennifer.mills@ofgem.gov.uk

Overview

This paper, for the applied Case Studies workstream, explores the impact of growing attention to strategic and sustainability concerns in UK energy policy. These concerns let not only to the fundamental policy change of UK Energy Market Reform, but also expanded the legal mandate of the energy regulator (Ofgem) and led it to change the structure of its Impact Assessment in ways which may have wider reverberations. The UK is widely seen as a pioneer of market liberalisation. Consequently these developments may be of widespread interest as a case study of the potential tensions between competitive electricity markets and strategic and the sustainability concerns surrounding the energy sector, and ways in which these may be resolved.

The paper serves both as a historical account and an analysis of the driving issues, and the policy results that have emerged. The concluding part of the paper reflects on the new challenges raised.

Contents

Overview........................................................................................................................................1
1. Context .........................................................................................................................................2
2. Ofgem’s internal responses ...........................................................................................................3
3. On monetization and aggregation: the high-level structure of Ofgem’s IA framework ............4
4. Ofgem’s Strategic and Sustainability Assessment ........................................................................6
5. Next steps ......................................................................................................................................10
6. Conclusions .................................................................................................................................10
1. **Context**

In the 1980s and 1990s the UK was widely known for pioneering liberalisation of its electricity system. The UK regulator was initially established with a primary duty to promote competition, which was subsequently amended to protecting the interests of consumers. The main focus remained to deliver consumer protection, optimise markets, maximise the benefits of competition and drive out inefficiency.

The UK enjoyed big reductions in energy costs after privatisation – aided by the arrival of gas power generation during an era of cheap fossil fuels - but doubts grew also over the extent to which price reductions reflected in part inadequate investment. Concerns grew not only about environmental issues but the overall security of the system, as supply margins steadily eroded. The 2000s saw growing tensions between the government and the renamed Office of Gas and Electricity Markets (Ofgem), as public and longer term concerns around energy grew.

The Energy Act of 2004 introduced a duty to ‘have regard to the need to contribute to the achievement of sustainable development.’ Proposals to give the regulator an explicit primary duty relating to either security or the environment did not succeed, but four years later the 2008 Energy Act ‘clarified’ Ofgem’s primary duty to protect consumers as meaning “to protect the interests of both existing and future consumers.” In effect, this achieved the same thing: it gave the regulator an explicit duty to consider the longer-term implications of energy sector developments. The short-run benefits of competition in cutting costs could thus no longer be considered as the only metric: impacts on investment, and through this security and the environment, also needed to be considered.

Under the Energy Act 2010, additional legislation emphasised that the interests of consumers include their interests in the reduction of emissions of greenhouse gases and in security of supply. These changes underlined Ofgem’s important and developing role in shaping the future of gas and electricity industries in a sustainable manner.

In parallel with these developments, in 2009 the UK Government Economics Service (GES) undertook a review of the Economics of Sustainable Development. It concluded that, whilst social cost benefit analysis was appropriate in most cases, certain circumstances required other specific tools. These circumstances arise when policy options have "large, non-marginal or irreversible impacts; on taking social impacts into account more systematically; or on dealing more transparently with the consequences for future generations” (GES 2009). The GES Review highlighted a number of critical assets and social impacts to be considered in this context.

In 2012, the Organisation for Economic Co-operation and Development’s (OECD) Environmental Outlook to 2050 also underlined the growing strains and risks associated with a number of strategic trends, and the difficulty that countries have in handling these appropriately with traditional analytic tools (OECD 2012). Moreover, in 2012 the OECD also published a report stating that National Regulatory Agencies (NRAs) should “assess economic, social and environmental impacts (where possible in quantitative and monetised terms), taking into account possible long term and spatial effects” (OECD 2012b).

All this reflected a broad context of concern about issues which, it was perceived, competition only provided a partial answer, and for which the formal methodology of monetised social cost-benefit analysis was proving inadequate. This paper traces how the UK energy regulator responded to these concerns.
2. Ofgem’s internal responses

Within Ofgem, a defining point was its Project Discovery (2009), which reached the unsettling – for everyone - conclusion that the existing UK electricity market structure could not guarantee security and could not deliver the scale of low carbon investment required. The findings were simultaneously lambasted from different camps as heresy, or derided as Ofgem finally “discovering the real world.” The government had been procedurally uneasy about Ofgem intruding into what it saw as a policy domain, but conceded the substantive conclusions – leading directly to the government developing the UK Energy Market Reform legislation, which radically changes the economic structure of the UK electricity system, and which entered into law in December 2013 (Newbery 2012; DECC, 2013).

Ofgem’s then Chief Executive, Alistair Buchanan, had come from the business sector. He later expressed an impression that initially, whatever questions he asked in Ofgem were given the same answer – competition. This uniformity of thought he found increasingly unconvincing. After Project Discovery, he commented that Ofgem had “left the safe harbour of theoretically-driven ‘Austrian’ economics” – but found the waters on the wider ocean choppy and far more complex to navigate.¹

Ofgem underwent internal changes, setting up a Division of Sustainable Development charged in part with reflecting the second half of its primary duties - ensuring that the concerns of future consumers are represented at the table of regulatory decisionmaking. One of its first tasks was to examine whether expanding the definition of consumers to include “future consumers” had implications for Ofgem’s framework of Impact Assessment – the formal structure used to assess the implication of potential decisions - which is the main focus of this paper.

In view of this wider context and the organisation’s newer duties, in 2011 Ofgem took the view that it was necessary to develop a systematic approach to assessing strategic and sustainability issues in its decision making. Specifically, regulating for a future energy system needs to consider the likely scale and direction of investment, and its compatibility with environmental concerns raises complex long term issues with substantial uncertainty. Also the complexities implied by increasing proportions of intermittent renewable generation have structural consequences, and implications for diversity and security need assessment.

A number of general tools for sustainability assessment exist, and have informed Ofgem’s work. However, as different sectors face different issues, the organisation deemed it appropriate to develop a tailored framework specific to its responsibilities and the characteristics of the energy system.

Analysis of the issues at stake – and practical experience - led to the conclusion that attempts to aggregate the interests of present and future consumers (and potential trade-offs) through aggregate monetised cost/benefit appraisal was unworkable and potentially obscured rather than informed good decisionmaking. In this, conclusions were similar to the UK governments own review of the economics of sustainability (DEFRA 2010).

In the case of Ofgem, which regulates a sector of exceptionally long timescales, strategic concerns, and with high environmental impacts, this led to to a substantial development of its Impact Assessment framework. Following a 2-year process of research and consultation, in July 2013 Ofgem’s Board agreed a major restructuring of its Impact Assessment framework into three broad categories: aggregate monetised assessment; distributional analysis of impacts on present consumers; and a strategic and sustainability assessment. This latter component includes specific

¹ Alistair Buchanan, Ofgem Chief Executive, 2003 – 2013, Personal communication with the lead
tests to bring greater consistency and transparency to Ofgem’s treatment of long term, complex and often qualitative issues, and is the main focus of this paper.

3. On monetization and aggregation: the high-level structure of Ofgem’s IA framework

The natural desire of regulatory economists is for a framework in which costs and benefits are monetised and aggregated to inform consistent and efficient tradeoffs. Ofgem’s existing decision-making process laid stress on this, supplemented by other factors. In practice, through a two-year process of deliberation and consultation, we concluded that a viable and transparent process in fact needs to comprise three elements: a monetised CBA, distributional analysis, and explicit consideration of strategic and sustainability factors.

In common with the Government Economic Service review, we concluded that it was ultimately not helpful to rely principally on monetising key factors around longer term impacts. This is partly because of numerous uncertainties that cascade over time, to an extent that makes monetisation highly subjective.

Security and climate change are obvious cases. Assessments of security depend heavily upon judgements about the likelihood of extremes, their severity, and the range of response options which might emerge; regulators then estimate an assumed ‘value of lost load’, which in practice varies considerable between different countries / regulators, and may also (as in the UK) also vary between different classes of consumers.

Climate change is even more thorny, it’s numerated NPV impacts in reality should compound:

- scientific uncertainties about the pace of change and likelihood of extreme events
- social judgements about the ability of societies to prepare for them ( “dumb farmer” vs “clairvoyant farmer” debates)
- numerous complexities in evaluating market and non-market impacts across the many levels of scientific uncertainty and potential scenarios of climate change
- issues of distributional ethics about how to weight impacts of our emissions on different countries (and how we would like them to weight their impacts on us)
- economic and intergenerational ethical debates about the appropriate discount rates.

The result is that after two decades of debate, economists have not remotely converged on estimates of the ‘social cost of carbon’. A huge range of views, perspectives and possibilities still evident in the most recent report of the IPCC (2014), which have hardly narrowed from the suggestion of Downing et al (2005) that the social cost of carbon is likely to be somewhere between 10 and 1000 $/tC. A more compact review of the debates, including those within the US economics community which led to a recent upward revision of the estimate used by the US government, is given in Grubb (2014), Chapter 1. The bottom line is the same: any monetised estimate of the social cost of carbon hides a wealth of assumptions.

Ultimately, Ofgem concluded that alongside the official UK government ‘social cost of carbon’ projections (which rise to £70/tCO2 by 2030 and continue rising thereafter), Ofgem needed a set of discrete indicators about the longer
term implications of decisions. The potential trade-off between these and the potential costs to present consumers ultimately involves political judgements.

Stochastic modelling may not help. In theory, increasingly complex modelling can be used to inform a monetised CBA approach to these issues. However with longer timescales also tends to come more uncertainty, more complexity, and greater relevance accorded to environmental and other sustainability dimensions. Trying to monetise all these factors involves increasingly arbitrary assumptions and growing sensitivity of results to these assumptions; this increase in complexity may be in practice almost unmanageable to monetise in any well-grounded and objective way. This tends to diminish transparency, and/or risks neglecting factors that may be important but are hard to monetise. The message from Ofgem’s Executive and Board was that the trade-offs involved can be obscured rather than illuminated by over-reliance on monetisation techniques.

Secondary guidance underpinning Ofgem’s duties also emphasised that Ofgem has a responsibility to consider distributional impacts of its decisions, most notably on vulnerable customers, and on the regions of the UK. By definition, these are not represented in monetised aggregate estimate of impacts.

The classical response on both these dimensions – broadly, those involving intragenerational and intergenerational weightings - is that any decision carries an implicit valuation, because of the trade-offs involved: the assumed implication is that it is better to make this explicit, and ensure that decisions operate to a common metric of (for example) assumed social cost of carbon.

One important limitation of this argument is that, in practice, decisions are often not fungible and comparable on the basis of purely monetary expenditure. For example, the regulatory decisions that will determine whether or not the UK invests tens of billions of pounds in offshore transmission and generation infrastructures are not fungible with choices over whether or not a power company operates a gas or a coal plant. The latter unquestionably should, in principle, factor in a monetised social cost of carbon if markets are to be efficient. The former decision depends more fundamentally on whether the UK electricity system makes strategic investment, yielding a common good, required to exploit its biggest domestic zero carbon resource in delivering the deep mid-century emission reductions specified in the UK Climate Change Act (2008). The argument in this regard is considered more fully through analysis of the structure of different domains of economic processes, in Grubb (2014), Chapter 2.

From these debates, Ofgem concluded that its overall IA framework needed to be structured into three main categories (Figure 1):

*Monetised aggregate CBA* + *Social & distributional impacts* + *Explicit consideration of strategic & sustainability issues* = *Impact Assessment*

**Figure 1: High-level structure of Ofgem Impact Assessment Framework.**
The question considered further in this paper is the information Ofgem most needs about the strategic and sustainability implications of decisions, in order to fulfil the organisation’s dual duties to protect the interests of both present and future consumers.

4. Ofgem’s Strategic and Sustainability Assessment

In developing its approach, Ofgem thus took the view that a balance needed to be struck between complexity and transparency. This allows the organisation greater insight into the breadth of issues involved and enables stakeholders to make informed representations on the proposals.

The topics addressed by the Strategic and Sustainability Assessment (SSA) require attention to extended timescales, broadly the period 2020-2050, and beyond where relevant. This ensures that Ofgem considers the interests of future as well as existing consumers.

Studies of technological change and the long-run development of economic systems emphasise how technologies and systems evolve over long periods, in ways influenced by existing capital and investment, infrastructure and institutions. Some kinds of decisions may therefore have enduring consequences, either in terms of learning or capacity, or the overall ‘direction of evolution’ of the system, and exhibit clear features of “lock-in” and “lock-out” of future options. The implication is that such decisions need to be taken with awareness of their consistency with long-run sustainability.

These factors may be particularly important in energy systems, in which there are large uncertainties (as evidenced by the consistently poor history of energy price forecasts), long-lived capital stock, and complex interrelated systems, notably in the interplay between generation and transmission.

The SSA’s extended time horizon makes the assessment largely qualitative, due to the increased uncertainty and ranges of variables which make detailed modelling less practical or robust. The approach is structured around two conceptual ‘legs’, as summarised in Figure 2: assessment of mid-term strategic effects, and assessment of long-run sustainability effects.

![Figure 2: Structure of the Strategic and Sustainability Assessment](image)
The distinction between the two legs is not rigid; in particular, the longer term sustainability leg may also be relevant to (and usefully informed by) analysis of the mid-term strategic factors. Nevertheless, this division provides a useful framework for organising and explaining the analysis. Under each leg, the component analyses feed into specific ‘implication tests’ which relate closely to Ofgem’s core responsibilities, and these are described in more detail below.

Mid-term strategic implications

The first leg applies systematic tests to help determine mid-term strategic implications related to Ofgem’s principal objective and duties. Input components include consideration of optionality and diversity and resilience.

- Optionality is a consideration of specific, realistic options that may be enabled or precluded by a decision. Consideration of optionality helps to ensure that a decision retains as much flexibility as possible to help accommodate future uncertainty\(^2\).

- In the context of the energy system, considerations of diversity and resilience are significant because a diverse system is more likely to foster innovation and be less vulnerable should one part of the system fail. However, diversity may also have less beneficial effects and involve trade-offs, so other influences on resilience should also be considered.

Although numeric methods of calculating diversity and optionality exist, and are encouraged within the framework, a quantified assessment is not always possible, so the considerations noted below can also be addressed qualitatively. Furthermore, the nature of Ofgem’s decisions means that their relative impact, or influence on a trend, is often as useful to consider as an absolute measure.

---

\(^2\) This is in a similar field to the Real Options approach, but is also relevant where a full application of Real Options is impractical or disproportionate.
### Mid-term strategic effects

<table>
<thead>
<tr>
<th><strong>Optionality</strong> considers the impact of a decision on:</th>
<th><strong>Analysis of diversity and resilience considers the impact of a decision on:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Significant subsequent options created or facilitated by the decision</td>
<td>• Diversity of fuels, technologies, types of players, business models and/or services, including influence of a decision on the trend of diversity, highlighting critical stages of low diversity/substitutability</td>
</tr>
<tr>
<td>• Significant options precluded by the decision</td>
<td>• Other characteristics influencing the resilience of the system including capacity to absorb disruptions, and investor confidence</td>
</tr>
<tr>
<td>• Optionality in timing: risks and benefits of deferring a decision.</td>
<td></td>
</tr>
</tbody>
</table>

### Stress and Security Implications

These component analyses can help to inform assessment of the ‘stress and security implications’, against the following specific tests:

- Security of supply failure in electricity and gas supplies, and consideration of the interactions between the two fuel sources
- Potential risk of extreme energy prices and volatility to a degree which might affect personal security (e.g., winter deaths), even when the likelihood of these events arising may be very small
- UK’s legally-binding energy targets – to ensure that Ofgem’s decisions do not impede the UK’s achievement of its legally-binding national targets, and to assess potential contributions of those decisions to these targets, taking account of the organisation’s legal duties and objectives under both UK and European law.

Figure 3(a) Components of mid-term Strategic leg

### Long-run sustainability implications

Key issues in the longer term include striking a balance between recognition of uncertainty and hence the value of ‘intangibles’ like optionality and diversity, in a framework which also aims to ensure that the energy sector develops in a direction consistent with sustainability concerns. In the UK context this task is simplified by the UK Climate Change Act, which mandates a mid-Century commitment to reduced UK greenhouse gas emissions by 80% and which establishes institutional structures to develop a CO₂ emissions trajectory towards this.

The second leg applies systematic tests to help determine the long-run sustainability implications related to Ofgem’s responsibilities. Optionality and diversity and resilience, as discussed above, can have long-run as well as mid-term implications. Additional input components include consideration of learning by doing and supply chain development, and pathways and lock in, to the extent that these have longer-term, sustainability-related implications.

Learning by doing and supply chain development reflect assessments of the cost reductions and other learning and capacity-related benefits that may occur in the future, related to a decision. Unit costs typically decline with experience, which may lower future costs to GB consumers of developments that incur costs today. The extent to which this occurs may also depend upon the likely extent of GB versus international learning (the latter implying both investment costs and benefits accruing elsewhere – see Annex). As with the diversity and optionality
assessments, where data are available a quantified estimation of the impact of learning rates can be developed to complement the qualitative assessment. This may give a sense of whether benefits associated with future cost reductions are likely to outweigh any additional short-term costs.

Pathway and lock-in analysis is an evaluation of what a decision may imply for the future direction of travel of the GB energy system and, in particular, whether it may ‘lock in’ or ‘lock out’ certain alternatives. This assessment involves an awareness of the intended destination and incorporates consideration of the effects of system inertia. It is particularly relevant to the energy system due to the lifetime of generation and network infrastructure. Pathway lock in can therefore be extremely difficult to avoid, but is not always negative; it only becomes a problem when it may conflict with longer-term goals or lock out potentially superior future options.

<table>
<thead>
<tr>
<th>Long-run sustainability effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis of <strong>learning by doing</strong> and <strong>supply chain development</strong> considers the impact of a decision on:</td>
</tr>
<tr>
<td>- Potential to gain UK experience which can benefit future projects, including risk reduction, learning and skills base etc</td>
</tr>
<tr>
<td>- Avoiding supply chain bottlenecks - the pace of development can be constrained by the capacity/capability of the supply chain</td>
</tr>
<tr>
<td>- Learning rates to inform cost projections in quantified scenarios.</td>
</tr>
<tr>
<td>Analysis of <strong>pathways and lock-in</strong> considers the impact of a decision on:</td>
</tr>
<tr>
<td>- Implications for the direction of travel of the energy system, taking account of the interplay between generation and transmission</td>
</tr>
<tr>
<td>- Relationship of this trend with the ability to adapt to long-run sustainability constraints and wider environmental impacts.</td>
</tr>
</tbody>
</table>

**Natural Asset and Sustainability Implications**

The natural asset and sustainability implications test focuses on the most relevant natural assets for the energy system context, and whether decisions may improve or degrade their condition. The assessments above include consideration of depletable assets, natural / renewable assets and waste (CO2, nuclear). Conceptually this could be considered to be the ‘safe carbon space’, but could also include reference to spent nuclear wastes, and pollutants associated with shale gas.

Importantly, the criticality of natural assets needs to be viewed from both a domestic and international perspective. For example, biodiversity assets can have both location specific and global importance, whereas carbon and methane emissions are globally significant in their effects. Additionally, the nature of energy system and natural asset interactions may change over time (adaptation to a changing climate).

The specific tests Ofgem proposes for understanding the natural asset and sustainability implications include consideration of:

- Consistency with the UK’s 2050 greenhouse gas (GHG) target (interpreted as a 90% reduction in GHG emissions from the electricity and gas sectors) and complementary assessments of:
- Cumulative GHG emission and other finite resource implications, as this is the most fundamental driver of atmospheric impacts and such assessment also helps to protect against unrealistic degrees of ‘backloading’ trajectories towards 2050 and reveal optionality and timing implications
- Interactions of the energy system with environmental assets (such as biodiversity, landscape, land use, water, air quality and soils) and wider ecosystem functioning as appropriate, factoring in consideration of how the energy system will need to respond and adapt to a changing climate

**Figure 3(b) Components of mid-term Strategic leg**

---

3 Consideration of climate risk and adaptation measures helps to ensure flexibility in policy design, identification of
5. Next steps

Although Ofgem has always considered strategic and sustainability issues within its decisions, the SSA framework provides a more systematic and transparent process. In its development, the SSA framework was extensively reviewed by GB government officials, other GB regulators, academics, campaigning groups and industry via a series of workshops, as well as the general public via an open consultation. Improvements were made as a result of that process, and the organisation believes that it represents a robust and consistent method of considering strategic and sustainability considerations in the context of Ofgem’s role. Feedback also suggests that other parties find this approach to impact assessment valuable, and may consider adopting either the framework’s approach or those aspects which are also relevant to their particular sectors.

In order to operationalise the framework, it was adopted by Ofgem’s Board (Gas and Electricity Markets Authority) within its revised regulatory impact assessment (IA) processes in July 2013, and work is proceeding to embed it more fully and develop supporting materials. This includes evidence bases (for example, surveys of the full range of energy scenarios consistent with longer term commitments) which aim to make the qualitative considerations as reliable and consistent as the monetised aspects of the IA.

As indicated, the approach supplements and enhances the monetised cost benefit analysis and distributional impact components of the IA, to ensure that the interests of future consumers are fully considered. Ofgem intends that there should be iteration between the SSA components, and between the other elements of the IA, to ensure that the analysis reveals any relevant interactions and avoids ‘double-counting’.

In that context, it should be emphasised that the SSA represents a neutral framework and does not prioritise one consideration over another, eg future consumers over current consumers. Ultimately, the SSA forms one of a number of pieces of evidence Ofgem considers when reaching a regulatory decision.

6. Conclusions

The UK journey underlines the extent to which energy market structures and their regulation cannot be separated from the wider definitions of objectives and responsibilities, which in turn reflect the state of evolution of the energy system, and wider national political debate. Economic principles which fit one set of conditions and lead to one set of reforms may not be adequate in themselves when conditions or the balance of objectives change.

Market structures and the regulation of them consequently evolve. There is no reason to believe this process of regulatory evolution is at an end. The UK experience may, however, be an interesting topic of study, and instructive for other countries as they grapple with similar challenges.
References


IPCC (2014), IPCC Fifth Assessment, Working Group II: Impacts and Adaptation, Intergovernmental Panel on Climate Change, Geneva / CUP: www.ipcc.ch

OECD (2012a) Environmental Outlook to 2050: the consequence of inaction, 2012: OECD, Paris


*Technical Annexes* on component analyses available on request.