

3. Security of Supply in a Competitive Energy Market

3.1 Introduction

3.1.1 The objective of ensuring security of supply is an explicit element of the UK Government's energy policy, along with carbon reduction, tackling fuel poverty and the promotion of competitive energy markets. It also has a high profile in the energy policies of other states and international institutions.

3.1.2 In the case of the UK, the Government looks to the market to deliver the necessary energy infrastructure and competitive sources of energy within the regulatory framework which it sets for the market. This framework is administered by (in Great Britain) Ofgem and (in Northern Ireland) the Northern Ireland Authority for Utility Regulation (NIAUR), as competition authorities⁸; and by the Environment Agency and the Health and Safety Executive in their respective fields of competence. The Government also looks to promote energy efficiency to reduce demand resulting from improved energy efficiency contribute to the UK's security of supply as well as to its climate change targets.

3.1.3 It is still largely on the supply side that the main responsibility falls for matching supply and demand with a minimum of price volatility. There are strong commercial and regulatory incentives in place to ensure this. In a competitive market, if energy companies fail to offer reliable and competitively priced supply, they are likely to lose market share as customers look to alternative suppliers. A further safeguard is provided through regulatory arrangements such as the Unified Network Code in the gas market and the balancing mechanism in the electricity market. These provide for financial consequences, which can be very heavy, where market participants fail to ensure a balance between offtakes and inputs.

8 <http://www.ofgem.gov.uk/>
<http://www.niaur.gov.uk/>

3.2 Dimensions of security of supply

3.2.1 Security of energy supply may be considered in different terms, depending on context:

- **physical security:** avoiding involuntary physical interruptions to consumption of energy (i.e., the lights going out or gas supplies being cut off);
- **price security:** avoiding unnecessary price spikes due to supply/demand imbalances or poor market operation (e.g., market power);
- **geopolitical security:** avoiding undue reliance on specific nations so as to maintain maximum degrees of freedom in foreign policy.

3.2.2 Security of supply risks may be related to only one or to a combination of these dimensions:

- technical problems on an electricity distribution network may cause localised physical interruptions to supply, although price and geopolitical conditions are stable;
- individual technical difficulties need not lead to interruptions, but may cause price rises; for example, the market can offset difficulties with gas production from the UK Continental Shelf by taking gas from more expensive sources such as storage or imports instead;
- supply chain constraints may result in delays in commissioning of appropriate infrastructure – in this case, physical interruptions are unlikely, but prices would again be likely to rise to balance supply and demand;
- geopolitically-inspired interruptions to export from significant overseas producers, or constraints on investment and production of fossil fuels, may cause prices to rise and, if price rises do not lead to supply flowing from elsewhere and/or demand reductions, eventually to fuel shortages.

3.3 Timescales for security of supply

3.3.1 Any of these risks may happen at any time and the difficulty of assessing their likelihood and likely impact increases, as with all discussion about the future, the further forward we look. So too does the range of available investment options, as the lead times associated with the

different types of response and different technologies vary. Moreover, the lead times may themselves shorten as a result of technical innovation. Given the flexibility of the market to adjust over time, then, conclusions about security in the longer term should be drawn only with extreme caution.

- 3.3.2 In the short term, the main concern is the extent to which we can be confident that energy can be delivered when and where it is needed with the infrastructure capacity we have, i.e. the reliability of the mechanisms (both technological and commercial) which convert primary energy sources into energy for use by the final consumer. There may be a particular concern, for example, in the case of wind-powered electricity generation, where the output of the wind fleet as a whole can vary significantly in relatively short timescales. We examine this further in paragraph 9.2.2.
- 3.3.3 In the medium term, the focus is on the availability of infrastructure, the planning process and supply chain issues such as the availability, both within the UK and internationally, of raw materials, machine components and project management and engineering skills. There may be a particular concern, for example, in the case of electricity generating capacity construction projects. We examine this further in paragraph 4.5.4 and subsequent paragraphs.
- 3.3.4 In the longer term, there is a wider range of options open to market participants, including significant capital investment and the development of new technology. Given this, the key concern in this time-frame is likely to be the availability of primary sources of energy. There may be a particular concern, for example, about the long term availability of fossil fuel reserves. We examine this further in the peak oil box at the end of chapter 7.

3.4 Indicators of security of supply

- 3.4.1 Measuring security of supply is primarily about measuring the *risk* (rather than the actual outturn) of involuntary interruptions to supply. The concept of *expected energy unserved* combines possible levels of shortfall (between supply and demand) with their probabilities, to give a probability-weighted amount of unserved demand⁹, thus quantifying the risk itself rather than the factors which

9 The derivation of *expected energy unserved* is explained in full at <http://www.berr.gov.uk/files/file41822.pdf>.

contribute to the risk. We summarise scenarios for future levels of expected energy unserved in electricity in paragraph 4.7.7.

- 3.4.2 This measure can also be used to examine the relative importance of the factors which influence security of supply. These may be categorised as follows:
- **capacity margin:** the safety margin between likely demand and the physical ability to supply enough energy to meet that demand;
 - **reliability:** the probability that the capacity on the system is available to deliver supplies when required. This may be affected, for example, by technical or engineering problems or fuel availability. For example, in the case of imported commodities, availability may depend on wider geopolitical factors, such as the rise of resource nationalism and/or infrastructure investment shortfalls affecting one or another overseas supply source; or global market issues, notably whether the price in the UK is attractive enough to ensure that non-contracted supplies find their way here rather than to other markets;
 - **diversity** of energy sources, which has an impact on the probability of large amounts of supply being unavailable at the same time. This is particularly important where supply reliability is subject to a high level of uncertainty. Diversity may, for example, be geographic (not importing all fuels from the same country) or technological (not relying on a single type of generating capacity or fuel);
 - effective **price signals**, to ensure that market participants have appropriate incentives to react in a timely way to any mismatch between supply and demand.
- 3.4.3 The relative importance of these will vary between different kinds of energy sources and over different time periods, and they inter-relate. For example, we might have a very limited *diversity* of sources of supply, but whether this is a major concern would depend on the *reliability* of those sources.
- 3.4.4 In general, our analysis suggests that the single most important influence on expected energy unserved is the overall balance, the margin, between demand and physical supply capacity. In this report we therefore take that indicator as our main proxy for security of supply, adding qualitative commentary where appropriate on other factors

such as production and/or distribution reliability, diversity and the functionality or otherwise of the relevant markets.

3.5 The optimal level of security of supply

3.5.1 Any level of security depends on the balance between the costs and the benefits of increasing security, but carrying out a comparison of this type is far from straightforward in practice:

- the costs of interruptions to supply vary widely, depending on various factors including their frequency, duration and timing; whether and how much advance warning can be given; which customer groups are affected; and the extent of contingency preparedness on the part of energy users. For example, the Value of Lost Load (VOLL) for gas has been assessed at £5 – £30/therm¹⁰;
- the risks driving the level of security are often qualitative and uncertain; weather conditions and technical availability can be subjected to probabilistic analysis on the basis of historic experience, but the development of EU and global market liquidity require more subjective assessment;
- quantifying the extent to which a particular policy measure, or the addition of extra capacity, would reduce the risk and size of interruptions is technically challenging.

3.6 The international context

3.6.1 In addition to the specific risks to the security of supply of individual energy sources dealt with in the following chapters, there are some which are international in nature.

3.6.2 Globally, energy security is threatened by the fact that rapidly increasing energy demand from the emerging markets has not been matched by corresponding levels of investment in increased oil and gas production. Most forecasts suggest these supply constraints are likely to persist and (particularly in the case of gas) worsen in the coming decade. The result will be increasing competition for limited oil and gas supplies which pushes up prices,

¹⁰ <http://www.berr.gov.uk/files/file38980.pdf>

increases consumers' vulnerability to supply shocks, and gives producers increased leverage.

- 3.6.3 Although the UK remains one of the least import-dependent countries in the EU, we cannot expect to be immune from security of supply challenges facing the EU as a whole, especially given the increasing interconnection between the UK and other EU markets. In both oil and gas, risks are increased by the fact that remaining global reserves are concentrated in a small number of countries and increasingly held by national oil companies.
- 3.6.4 Individual EU Member States have adopted various approaches to national energy security. For example, France seeks to reduce its energy dependence by relying heavily on nuclear power for its electricity and diversifying its gas imports. Italy and Germany are both heavily dependent on Russia for gas supply and have entered into bilateral commercial deals. As a major hard coal producer, Poland's energy import dependency is among the lowest in the EU but because of environmental concern over the carbon implications of coal burn and political concern over greater dependence on Russian gas, the Polish Government is considering building nuclear power plants and an expansion of electricity interconnections.
- 3.6.5 The EU as a whole has agreed to increase the proportion of its energy demand met from renewable sources, and to improve its energy efficiency, partly for the carbon benefits but also with a view to reducing its dependence on fossil fuel imports. The EU has also agreed to the establishment of a fully functioning competitive energy market, and the removal of commercial and infrastructural barriers to market responsiveness, within the EU. This will:
- enable and encourage suppliers to respond to price signals and increase the flow of energy around the EU in the event of a localised shortage, hence improving market resilience;
 - ensure, through the unbundling of network utilities, that there are stronger incentives to build infrastructure to meet market demand, e.g. cross-border interconnectors and network reinforcement needed for the connection of renewables;
 - improve diversification of supply to each market, as it will be easier to contract for supply through other networks; and

- improve the incentive on individual Member States to engage in a common external policy – the more it is the case that once energy supplies are in the EU they will move freely to wherever they are needed, the more it is in the interests of member states to support each other, rather than see each other as competitors, in negotiation with external suppliers.

3.6.6 The European Commission published its 'Second Strategic Energy Review: an EU Energy Security and Solidarity Action Plan' on 13 November, together with a number of supporting documents. It focuses on energy security, identifying five areas for action: infrastructure and diversification of energy supplies; external energy relations; oil and gas stocks and crisis response mechanisms; energy efficiency; and making the best use of the EU's indigenous energy resources. The European Council in Spring 2009 is expected to agree an Action Plan to implement the recommendations of the Strategic Energy Review.

3.7 Conclusion

3.7.1 The Government will continue to take very seriously the security of energy supply in terms of both physical supply and price volatility, while recognising that there are no simple or easy answers. The analysis set out in subsequent chapters is intended to help market participants reach their own view of the levels of demand, which is essential for planning to meet our future demands, alongside a strategic role for HMG in assessing the scale and nature of the risks and the extent to which action to address it is appropriate, and to facilitate and inform debate about the risks we face.