Long-Term Electricity Network Scenarios (LENS) Project,
Summary of Third Workshop

5 June 2008, Victoria Park Plaza,
Vauxhall Bridge Road, London

This note summarises the key points from the third LENS workshop on 5 June 2008. It is structured according to the agenda that was followed on the day.

The slides presented at the third workshop can be found on the LENS page of Ofgem's website.[1]

1. Introduction

Stuart Cook, director of transmission at Ofgem, introduced the session. He outlined the plans for the workshop and highlighted the objective of the LENS project. He invited questions, but none were raised at this point.

2. Key highlights of the interim report

Graham Ault, from the University of Strathclyde, gave an overview of the interim report. This included a description of how the scenarios were developed and an overview of the key characteristics of each scenario.

3. Update on current activities

Graham Ault described how the energy specific and network specific scenarios were merged. Nick Hughes, from King's College London, described the MARKAL model and gave an overview of the initial model results for each scenario.

4. Introduction to breakout sessions

Erik Sleutjes, from Ofgem, introduced the two breakout sessions by outlining the objectives of each, defining issues (or implications) for networks and their regulation, and explaining the conceptual framework and scope of the LENS project. The participants were then split into five sub-groups.

5. Breakout session 1: 2050 scenarios & issues for networks

The first breakout session consisted of three steps. Step one concerned all five scenarios, so a summary across the groups is presented below. For steps two and three each sub-group is treated separately, as they each discussed a separate scenario.

<u>Step one: do the scenarios meet our brief?</u>

All groups felt that the scenarios, on balance, met the brief of the LENS project. Various detailed comments were made by individual participants, including:

- Environmental awareness will likely be more acute than is suggested in the scenarios;
- Environmental concern should cover more issues than just climate change (e.g. visual pollution, nuclear etc);
- None of the scenarios met the 60% carbon reductions target, whereas there are talks that this target may increase;
- There is not much focus on Government led scenarios;

[1] http://www.ofgem.gov.uk/NETWORKS/TRANS/ELECTRANSPOLICY/LENS/Pages/lens.aspx

- Microgrids might not be realistic and may not be the most cost efficient and economic way forward;
- Population movements may need to be covered. For example, if the Severn Barrage is built, this could lead to migration;
- As the cost difference between thick and lean transmission is quite small, there was a question on the plausibility of the scenario with lean transmission;
- There are large sunk costs in the networks, and it is unlikely that they will go unused as they have many years left in them; and
- Active consumers may not be plausible, as they generally just want energy on demand.

Steps two and three – group by group

Group one: Big T&D

Step two: Discuss issues for networks

A key obstacle was noted as planning issues (consents etc). Another obstacle is the potential materials shortage, and also the potential skills and labour shortages associated with planning and constructing large assets.

One comment was on the operational issues with big generation, as you need a faster frequency response. Further interconnection with Europe was suggested as a solution. Another discussion focussed on the need for smart networks to manage demand if it increases rapidly.

One suggestion was that direct current (DC) would be needed onshore. Another comment was that environmental concern would need to decrease for consumers to remain passive, with the suggestion that this is unlikely.

Step three: Most important issues

The group discussed the various issues and noted these on a flip chart. The group then discussed which were most important, and marked these. The two most important issues were thought to be planning issues (consents etc) and the need for technological advances.

Other important issues were noted as the need for active/smart networks; shortages in skills and materials; the need for interconnectors; and big transmission leading to big generation.

Group two: Energy Services Market Facilitation

Step two: Discuss issues for networks

The discussion consisted of making points for notes to put on the flipchart. Necessary conditions were noted as: smart meters / smart appliances; resolving boundary issues on asset ownership and service provision; and co-operation between Transmission Owner (TO)/Transmission System Operator (TSO), Distribution Network Operator (DNO)/Distribution System Operator (DSO), Energy Service Company (ESCO) and customers and suppliers.

Another necessary condition was communication networks with agreed protocols. Also, there is a need for feed-in prices for energy at all times to enable household and distributed generation.

Two main obstacles were noted. System balancing may be a problem in light of the lack of electrical engineers at university. Also, the form of contractual agreements between the diverse suppliers and both customers and system operators could lead to both fraud and mis-selling unless these could be agreed across the industry and codified. Other points made related to the difficulties with market signalling mechanisms in preventing oversupply of generation, entrenched attitudes at the existing monopoly suppliers, and regulation/arbitration to prevent mis-selling of services.

Other topics discussed included tariffs (i.e. capacity and peak kiloVolt-Amperes (kVAr) rather than kWh usage) and how to value energy use (i.e. the price put on security of supply).

Step three: Most important issues

Essential elements for the development of an ESCO environment were smart meters to communicate with the system operator(s) and smart appliances to communicate within the house with the smart meter.

There was doubt over the likelihood of the availability of sufficient skilled staff to successfully enable multiple parties to devise, construct, control and monitor system balancing.

As mentioned above, the form of contractual agreements could lead to fraud and mis-selling.

There would need to be either a formal requirement or incentives for DNOs/suppliers to change from the current system of tariffs and revenue setting to tariffs that reward reductions in consumption arising from energy savings by customers.

Group three: Distribution System Operators (Lean Transmission)

Step two: Discuss issues for networks

It was argued that the technology is present for this scenario to occur (although some level of scaling up would be required), but the economics and regulation needs to change. There was also a question on how you retire the existing network, in relation to funding or decommissioning.

It was questioned whether customers in the middle of London would accept the lifestyle changes implied by this scenario. It was argued that they may if the technology needed to manage demand was unnoticeable by consumers.

One comment was that you would need large scale demand side management for this scenario to be plausible. Another participant noted that you would then have 20 to 30 smaller groups trying to keep in balance without a strong back-up from the central grid.

Other issues raised included whether storage is needed and whether generation can really be local, as it has previously been distributed unevenly across the country.

Step three: Most important issues

The redesign of appliances to become 'intelligent' was considered a necessary condition. There is thus a need for a strong standards lead, for buildings for example.

There was further discussion on consumers' willingness to accept new technologies. Another issue was the consumer proposition, as consumers will want a return if they need to put more effort in.

One obstacle is that different geographical areas may not have the same drivers or technologies. Also, scaling/industrialisation of information and communication

technologies may be an obstacle. It was argued that you need huge data processes and that this scenario may only work in some areas, so you could get a patchy roll-out. Furthermore, there will be complex local/regional energy and services markets.

Group four: Microgrids (Small Transmission & Distribution)

Step two: Issues for networks

One participant noted the need for demand reduction alongside micro-generation. Another participant agreed, adding that this scenario requires reconfiguration of infrastructure on a large scale, with the need for an increase in gas networks and European interconnection.

It was noted that for consumers to drive this scenario they would need to be catalysed into action. This could arise through high energy prices. Another comment was that there was a need for increased trading facilities to optimise asset allocation and investment, allowing customers to become more actively involved in the market and providing a market structure conducive to the scenario.

Step three: Most important issues

Many necessary conditions were noted, with the most important ones being the need for increased trading facilities to create a conducive market structure, storage (for security of supply), and consumers taking the lead.

The most important obstacle was thought to be security of supply, particularly as gas becomes more important. Other obstacles noted include constraints on investment, constrained gas infrastructure, the possibility of stranded assets, and near-term plant constraints.

Group five: Multi-Purpose Networks

Step two: Issues for networks

This scenario was described as an 'accidental' scenario, but it was noted that it could represent business as usual. One participant observed that with large amounts of renewables in Scotland, more subsea cables would be needed to transport the energy. However, investment in the necessary interconnections is possibly hampered by the fear of owning stranded assets.

It was noted that one advantage of a multi-purpose network is that it can cover most outcomes, and the group agreed on this point. The flexibility of the multi-purpose network was thus considered an advantage. It was also noted that much of the infrastructure already exists for this scenario.

Step three: Most important issues

There will need to be regular changes in government and policy for this scenario to come about, but shifting policy following periods of stability could make assets uneconomic. There will be a need for protection against stranded assets, such that network owners would not be penalised for stranded assets.

The availability of technology was considered important. As the investment signals change regularly in this scenario, it was suggested that the risk-reward profile could favour higher risk takers. There would thus be a need for improved access to markets for small dynamic companies.

An obstacle could be the ability to respond quickly enough considering the time lag associated with planning and obtaining skills/materials. Another obstacle could be customer apathy.

6. Breakout session 2: Transitional (2025) issues for networks & issues for regulation of networks

The second breakout session was split into two steps. Each group focused on their assigned scenario, which was the same scenario as in the first breakout session. The discussions are summarised on a group by group basis.

Group one: Big T&D

Step one: Transitional issues

Someone argued that sophisticated technology would try to squeeze more out of the existing networks. It was suggested that you need to decide whether to replace the networks with tried and tested technology or use something more radical. You may have to choose between onshore and offshore cables and between AC and DC technology.

It was suggested that much of the research and development (R&D) in progress will need to turn to product by 2025. One participant questioned where commercial incentives will come from? Another noted that we need a more focused strategy and clarity of direction than we currently have.

The issue of intermittency was raised, with a suggestion that interconnection with Europe could reduce this risk. It was argued that there may be issues with a lack of skills (human resources), for example with obtaining and laying the subsea cable needed for interconnection.

Step two: Issues for regulation of networks

Much discussion focused on strategy (both for investment and visionary strategy), such as the need for a long term plan for network investment that reduces investment risks. One participant suggested the formation of a single agency to manage this.

The scenario was described as technology rich, but a key question is how to make this technology available. It was suggested that a quicker R&D time is needed. However, another participant noted that only incremental steps in technology are needed, as much of the progress required is simply evolutionary.

Other points noted on the flip chart regarding advantages of this scenario were that it is easier to connect large generation as the network would be quite large, and that this scenario is less revolutionary than other scenarios (e.g. in terms of the technological changes needed).

A disadvantage noted was that you need a GB central planning process that avoids gold plating. Mitigation/remedies included the formation of a new agency (or an extension of Ofgem's remit) for an overall strategic role.

Group two: Energy Services Market Facilitation

Step one: Transitional issues

One necessary condition was having more flexible regulation. Another was the need for energy storage to assist balancing. Other necessary conditions included the need for new entrants to provide sufficient competition, and certainty on investments/profitability to ensure a market led approach.

Possible obstacles included a lack of investment in skills and education, uncertainty about who should supply the meters and decide on the specification, and the regulatory

attitude to asset stranding. Another issue was the need for education on and a shift in the perception of ESCOs by consumers.

Step two: Issues for regulation of networks

Many of the points made were similar to those in breakout session one. Other points raised included the need for incentives to innovate, and the need for an acceptance of stranded investment. One participant mentioned the greater emphasis on (bilateral) agreements with customers.

One disadvantage discussed was that regulating an SO is already complex and would be more difficult in this scenario. Another disadvantage is the need for more complex system balancing.

One possible remedy was to license ESCOs, with ongoing monitoring. Other remedies included education of planning control officials, standardised contract forms and industry code modifications.

Group three: Distribution System Operators (Lean Transmission)

Step one: Transitional issues

It was suggested that a big push for combined heat & power (CHP) would be needed over the next ten years to reach the 2050 scenario. But it was argued that if new nuclear build commences, it may remove the economic incentives for CHP.

It was noted that there may be a behavioural obstacle as you need people to contract collectively. There was a discussion as to how that change in consumer attitudes could come about, with a suggestion that it could arise from a deterioration in system performance.

One suggested necessary condition for this scenario was either a tax or subsidy to encourage the uptake of CHP. Another necessary condition could be building regulations. However, it was noted that changes to appliance regulations and standards need to come from the EU, which has an associated time lag.

Step two: Issues for regulation of networks

One suggested advantage to this scenario is that of greater energy efficiency, and subsequently lower carbon emissions. It was questioned whether there is more choice for consumers in this scenario. There would be more operators, but consumers may just go with the local operator, so choice may actually be reduced.

A suggested disadvantage was that the system is more complex in terms of markets, systems and operations. Other comments included that CHP is more dependent on fossil fuels (i.e. gas) than some other technologies, that there is less system diversity (hence making the system less secure), and that there are sunk costs in transmission assets.

Potential remedies to these problems include a change in regulation and use of storage. However it was noted that if DSOs become involved in storage, they become players in the energy market. It was unclear to the group whether this is an advantage or disadvantage.

Group four: Microgrids (Small Transmission & Distribution)

Step one: Transitional issues

One suggestion was that there may be a disruptive technology to revolutionise generation, thus making small scale production more economically viable. You may also need new technology to respond to consumer needs.

A suggestion was that an extreme event such as environmental disaster or a nuclear accident could spur the development of microgrids. Another comment was that more participation and liquidity in the market is needed to establish a suitable market by 2025 to reach the 2050 scenario.

Other necessary conditions mentioned include the political will and statement of intent to develop microgrids, research and development in small scale and economical technologies, and common technical standards.

Obstacles mentioned include who pays for stranded assets, and the growing pains associated with the process of transition.

Step two: Issues for regulation of networks

One participant noted that there is a need for legislation to curtail duplication of networks and wires. Two other participants argued that regulation would have to undergo a fundamental change, with greater harmonisation between EU and domestic regulation, which may be an advantage.

Other advantages noted include there being an environmental regulatory focus and flexible planning laws. A disadvantage could be a lack of consumer choice. No remedies/mitigation strategies were discussed.

Group five: Multi-Purpose Networks

Step one: Transitional issues

There may be a need to renegotiate the relationship between the system operator and the DNOs to allow the reallocation of responsibilities. For example, it was suggested that DNOs may need to take the responsibility for system balancing in place of the GBSO. There will thus need to be flexibility in the regulatory regime.

One comment was that there needs to be access to markets for new technologies, including smart meters. Other necessary conditions include DNOs being incentivised to offer improved flexibility to customers (e.g. through smart meters), a change in the structure of price controls, and incentives/rewards for providing responsive energy storage. Another was that smart metering may need to be mandated.

One obstacle mentioned was the lack of clarity over who is responsible for controlling the network.

Step two: Issues for regulation of networks

Advantages of this scenario were noted as the flexibility of the network, the fact that it allows for a range of renewables, and the free functioning of the market.

If smart meters are only implemented in certain regions then you will lose out on the potential benefits of economies of scale. Other disadvantages include the conflicts of interest between DNOs and generators, stranded assets, and whether the market will deliver all the goals.

Mitigation/remedies include implementing national standards, such as a minimum functionality on smart meters, and having more formal arrangements for relationships between DSOs and the system operator.

7. Feedback from breakout sessions

One participant from each group was nominated to present the key issues from the discussions to the wider audience. The following is a brief overview, picking up some of the key points made by each group.

Group one: Big T&D – presented by Jeremy Blackford, SP Energy Networks

- All scenarios were plausible with no major omissions.
- For the scenario to work a clear strategy is needed to get us to 2025, including investment strategy.
- An advantage of this scenario is that to get there is an evolution from today's situation (in terms of technology).

Group two: Energy Services Market Facilitation – presented by Dave Openshaw, EDF Energy Networks

- There could be a major technical breakthrough before 2050 which could completely change our views of network development.
- Will the 60% carbon reductions target be high enough, or will it be pushed higher?
- An obstacle is the need for system balancing, particularly if intermittent technology is used.
- New entrants are needed in the market, specifically ESCOs.

Group three: Distribution System Operators (Lean Transmission) – presented by Steve Argent, ARUP

- The scenarios do cover the brief.
- A big change in consumers' attitudes is needed and it may be that this change would have to be imposed on customers as economic incentives may not be sufficient. A change may be triggered by a deterioration in system performance.
- You could lose system diversity with weaker transmission, which would put a greater emphasis on storage and reliance on demand-side management.
- You need stages to get there. The Government could create conditions to make CHP more favourable. You may need a diktat to get all housing estates with CHP built in.

Group four: Microgrids (Small Transmission & Distribution) – presented by Nigel Wilkinson, National Grid

- The group agreed with the scenarios, but would like to understand the underlying economics and engineering perspective.
- To progress to 2050 you would need to pay for security of supply, with the appropriate communications in place to support it.
- You would need a shock such as climate change or a breakthrough in photovoltaic technology to get to a position in 2025 that will plausibly lead to the final scenario. Also, consumers will need to make a choice that they must pay for security.

Group five: Multi-Purpose Networks – presented by Tim Warham, Poÿry Energy Consulting

- The scenarios provided good coverage of plausible futures, but the options that included lean networks were a bit improbable due to the pre-existing asset infrastructure that already exists.

- This scenario could be described as business as usual.
- The scenario is very flexible and allows the connection of renewables and a free functioning market, but the complexity of the market is a potential barrier to entry.
- A remedy for this scenario could be to develop a set of regional/national/pan-national standards.

8. Plenary discussion / Q&A session

The workshop attendees had the chance to ask questions to the LENS panel. The following is a summary of the questions and answers.

Q1. Does the model give an idea of the cost that the customer will pay?

The model doesn't give an idea in terms of the cost of electricity to the consumer. It looks at the cost of the overall energy system.

Q2. All the graphs produced by the Markal Model demonstrated a carbon saving. If politicians saw the same data they may decide to ignore big T&D as it had a low carbon saving.

This is a good point. Scenarios need to be coherent and cover a range of possibilities. The lower carbon saving in this particular scenario is due to the price of carbon that was entered as an input, because the big T&D scenario happens to assume moderate environmental concern. Prior model runs (with big T&D networks) tended to produce higher carbon savings.

Q3. Networks shouldn't be considered just a bundle of wires. There are many other factors that are crucial to the smooth running of the networks, such as people and maintenance issues as well as operational, regulatory and commercial aspects. The report perhaps didn't cover these enough.

We tried to keep these aspects in mind. We will have a look again as we never intended that it was just about assets. This is also something that will develop more as we look at the transition to 2050. It is common to begin broadly and to narrow in on the details as the scenario develops. As the network and energy scenarios are merged, this will come together. The merging exercise will increase the level of context for the scenarios.

Q4. Should the focus be on what we think will happen in the future? Where are we going?

Developing scenarios is not a task of designing desirable blue prints, and creating blue prints is not why scenarios are considered useful. Predicting where we are going goes against the grain of developing scenarios. It is inherently difficult to forecast the future, and trying to predict 50 years ahead is even more difficult.

The scenarios are produced to inform decisions. By saying that one scenario is the most likely, you diminish opportunities for taking actions now. Some elements can get 'locked in' by putting infrastructure in place now. One purpose of the LENS work is to consider applications for the scenarios.

Q5. Concerning the microgrids scenario, how does the energy come in? Would lorries bring biomass fuel to each region? If you downsize one system (e.g. electricity), would you have to upgrade another (e.g. road transport or gas)?

There are clearly various options for supplying different areas. Energy could be brought in as biomass on lorries or via heat pipes. The microgrids scenario is plausible because

lots of energy vectors exist. There are various options for bringing in the energy, and this aspect of the scenario has deliberately been loosely defined.

Q6. All scenarios imply significant changes in the future, and the modelling shows that the changes probably start now. As there are impacts in the shorter term, is this something we should be planning around now?

Decisions are already being made and these will tie us into certain routes. If Ofgem/Government or another body wants to strategically steer us to a particular solution, then the scenarios can guide us.

Q7. We could design a network to be self-sufficient, but it would be out of their control to keep the lights on. For example, if a business with a CHP plant closes then you could lose supply security. How would that situation be handled?

If someone leaves an asset behind, another party may see that as an opportunity. We probably need to think more about security of supply in the final analysis, and consider how the scenario performs in terms of system balancing and stability.

Q8. Security of supply is only one parameter in the new market. The key thing is the market value of security of supply. With smart metering and demand side management, the costs of offering security of supply may radically change.

The impact on customers is one of the key themes. This is a key issue and there is a strong relationship between the scenarios and what customers are willing to do. Customers may be willing to accept a lower level of security of supply at lower prices.

Q9. What is the impact of the different scenarios on customer behaviour?

The development of the scenarios is dependent on customer behaviour, which could influence the way in which scenarios pan out in future.

Q10. What is the role of the regulator in these scenarios, as the regulator can influence customer behaviour? Do you have a view already as to what shape the future could take?

Regulation evolves based on different factors. It could evolve to support changes in customer behaviour. Regulation shouldn't be an impediment to change that is beneficial, however it is not always appropriate for regulation to lead.

9. Next steps and closing remarks

Stuart Cook rounded up the day with some closing remarks and by outlining the next steps the LENS team plans to take.