



WORKSHOP 3: The ‘state of the art’ regarding UK energy pathways through to 2030/2050

Summary report on the third in a series of four project workshops. Held at Careys Manor, Lyndhurst Road, Brockenhurst, Hampshire, SO42 7RH
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Workshop Aims

Scenarios exercises are increasingly utilised by governments, business and third sector organisations for planning purposes. Such exercises are intended to provide plausible, comprehensive, integrated and consistent descriptions of how the future might unfold affording a tool to engage with stakeholders, build consensus and develop responses to challenges identified. Scenarios have been widely used in the energy domain to explore alternate futures of energy system, and have increasingly focused on pathways to decarbonisation. Similarly, scenario exercises have been used to explore drivers of environmental change and implications for the environment, biodiversity and ecosystem services.

At the end of the workshop it is hoped that we have either identified a candidate set of scenarios that we wish to explore in ADVENT, or have a clear route for developing these. This question will be answered both for the “fast track” analysis, and for the longer term deliverables of the ADVENT consortium.

To support the workshop discussion, the following essential reading list was circulated to participants in advance of the meeting.

Gove, Benedict, Leah J. Williams, Alison E. Beresford, Philippa Roddis, Colin Campbell, Emma Teuten, Rowena H. W. Langston, and Richard B. Bradbury. 2016. “Reconciling Biodiversity Conservation and Widespread Deployment of Renewable Energy Technologies in the UK.” *PLOS ONE* 11 (5): e0150956. doi:10.1371/journal.pone.0150956.

Holland, R. A., N. J. Beaumont, Melanie Austen, Robert Gross, Philip Heptonstall, Ioanna Ketsopoulou, and G. Taylor. 2016. “How Consistent and Comparable Are Ecosystem Services and Energy System Scenarios?” UKERC Technology and Policy Assessment Working Paper. London, UK: UKERC.

van Vuuren, Detlef P., Elmar Kriegler, Brian C. O’Neill, Kristie L. Ebi, Keywan Riahi, Timothy R. Carter, Jae Edmonds, et al. 2014. “A New Scenario Framework for Climate Change Research: Scenario Matrix Architecture.” *Climatic Change* 122 (3): 373–86. doi:10.1007/s10584-013-0906-1.

van Vuuren, Detlef P., Marcel T. J. Kok, Bastien Girod, Paul L. Lucas, and Bert de Vries. 2012. “Scenarios in Global Environmental Assessments: Key Characteristics and Lessons for Future Use.” *Global Environmental Change* 22 (4): 884–95. doi:10.1016/j.gloenvcha.2012.06.001.

Ekins, P., I. Keppo, J. Skea, N. Strachan, W. Usher, and G. Anandarajah. 2013. “The UK Energy System in 2050: Comparing Low-Carbon, Resilient Scenarios.” UKERC Research Report ESY/2013/001, UK Energy Research Centre, London, UK.

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The ADVENT team – September 2016

Summary of key discussions

Introduction

This report is framed around the answers to a series of questions that were posed in the workshop, the resolution of which are central to deciding the approach that ADVENT will take to the use of scenarios. Below we consider each question in turn, highlighting salient points from the discussion. We conclude with a summary of next steps that the consortium needs to take to decide on a final set of scenarios that will be used for future analysis.

Presentations

The ADVENT group listened to four presentations. Robert Holland and Tara Hooper presented their work on the UKERC Pathways project which focused on the comparability between Global and UK. Results from this analysis are presented in the working paper (Holland et al. 2016 – see Essential References / Reading).

Pip Roddis presented work carried out by the RSPB examining a vision for UK energy that reconciles biodiversity conservation with deployment of renewable technologies. This work is presented in Gove et al. 2016 – see Essential References / Reading).

Paul Ekins presented work carried out at the end of UKERC Phase 2 that provided a retrospective look at scenarios exercises from 1978 – 2002 to investigate whether the scenario exercise reflected the actual UK energy system transition (Trutnevyte et al. 2016. “Energy scenario choices: Insights from a retrospective review of UK energy futures”. *Renewable and Sustainable Energy Reviews*, 55, Issue C, 326-337).

Framing questions

What energy and environmental scenarios currently exist and how integrated are they?

Members of the UKERC Pathways team provided an overview of work that has been carried out examining how consistent and comparable energy and environmental scenarios are. The supplementary material for this report provides details of the scenarios covered representing the major global and UK focused exercises.

Across all scenarios key messages that emerged from work of the Pathways theme are that existing energy and environmental scenarios are exploring a similar space in terms of the energy mix, worldview (i.e. globalisation, isolationism), focus on decarbonisation and technological development. Complexity in the narratives of the scenarios arises for a number of reasons including: (i) inherent trade-offs between ecosystem services, for example a “green” agenda may prioritise local food and timber production at the expense of other ecosystem services; (ii) the same endpoint in scenarios can be reached through multiple routes, for example decarbonisation can be driven by local, national or global action; (iii) the level of detail in the energy system, with environmental scenarios often considering highly aggregated energy systems; (iv) environmental scenarios often consider the environmental impact of energy pathways based on implication for land use or climate.

Focussing solely on UK scenarios, themes explored across the exercises include energy supply, agriculture and land use, transport, household demand, and societal characteristics. There is broad agreement across exercises on which technologies are likely to be employed although there are some “outliers” such as nuclear fusion or floating wind. The most marked contrast is that energy scenarios consider fewer social variables (e.g. GDP, population change) and where they do they are across lower ranges than are considered in environmental scenarios.

How plausible do we want the scenarios to be? Should we explore a range of likely futures, or are we seeking to “push the boundary”?

The group felt that for analysis emerging from the ADVENT project to be legitimate there is a need to ground the scenarios within the range of futures that are currently envisaged across different scenario exercises. However, within this parameter space there are options to “push the boundaries” for some of the parameters. An example of this might be how demand for gas supply is met – so what technology or which countries it is imported from.

Do an entirely new set of scenarios need to be developed within the ADVENT project? If so how would this be achieved?

There was consensus in the group that ADVENT has neither the capacity or time to generate an entirely new set of scenarios. It is an extremely time consuming process and to have legitimacy would require significant stakeholder engagement and buy-in.

Could a typology of scenarios be developed and then modelling work explore this parameter space?

The UKERC Pathways presentation indicated that it is possible to create a typology of scenarios which describe a coherent set of futures. The problem with using a typology approach is that for the analysis that will be required across many of the work packages it is essential that we have access to the underlying data behind the energy models. The use of the typology would therefore require us to effectively generate a new set of scenarios in the sense that we would need to model each of the typologies. Again this causes problems in terms of resources and legitimacy.

Should ADVENT use a set of existing scenarios (e.g. from the UK NEA; from UKERC) and parametrise modelling work to assess the energy and environmental implications of the futures that are explored within them? If so which set of scenarios?

This was the preference of the group. It is important to choose a set of scenarios that ADVENT can access, and that are established so that there will be buy-in from stakeholders about the results emerging from analysis undertaken in the ADVENT project.

Some key points about existing scenarios that should inform our decision;

- We need to have access to the underlying data for the models. So the choice of which ones we go for is determined by this access.
- To engage with stakeholders we should choose a set of scenarios that are in the mainstream. This could be Energy UK, National Grid or UKERC.

- It will not be possible to mix and match scenarios as the outputs and underlying assumptions may be quite different. Depending on the flexibility of the approach it may be strategically important for us to perhaps examine a couple of set of scenarios. For example, UKERC and National Grid.
- Social and behavioural changes are treated as endogenous in energy system models – this is detailed in the UKERC scenarios book. Effectively what you say is that demand for energy changes in response to a specific social change, for example a greater uptake of public transport.

The meeting then focused on identifying a set of criteria that will be used to select the scenarios that will be used in the ADVENT analysis. The group compiled a wish list of criteria, and points that need to be considered;

- We may need to focus on the most significant energy technologies in terms of the environmental impacts. This may come down to the spatial footprints – this poses a danger that our analysis becomes dominated by bioenergy.
- Energy systems models may not specifically state the route through which demand for an energy vector is met. For example, many scenarios will specify a high demand for gas at least in the short/medium term. It is then an open question as to how this demand is met, for example is it through fracking or imports etc. This means that there could be an opportunity to explore different specific options within any given scenarios.
- Given the way that energy scenarios are represented there may be an option for pushing the parameter space to explore the ecosystem service implications. For example demand for gas could be met in multiple ways (e.g. fracking, imports etc.) that will have different implications both nationally and internationally.
- What are the implications of achieving net zero emissions?
- Our analysis needs to have a certain amount of flexibility to incorporate new scenarios. Given the timelines for the project it is likely that we may want to alter some of the scenarios to reflect the situation in 2018 (e.g. IPCC report on achieving 1.5°C target).
- The RSPB have produced a set of constraints maps that are available. This could be an important resource for factors in the analysis that we are not able to incorporate into the modelling using a metric that is compatible with the optimisation tool. We could remove areas that are simply unavailable.
- Cost optimal solutions may diverge considerably from environmentally preferable options. Here, the accompanying narrative of scenarios may be important for understanding the tension between the energy and environmental aspects of the scenario.
- An interesting focus of analysis may be on unexpected knowns – that is elements of the energy system that we are aware of but which have not been examined in detail in other scenario exercises. Examples of these include fracking, the nexus, non-UK impacts, geoengineering, storage technologies, CCS, nuclear, will renewables actually deliver?, role of biotechnology, changes in mass transit, materials implications of low carbon technologies, geopolitical change, heat use efficiency.
- This list of unexpected knowns should be refined down to those that are likely to have the biggest consequences.

Criteria for selection of scenarios

Following discussion at the meeting, it was suggested that the ADVENT team should focus on the potential of two scenarios exercises – those conducted as part of UKERC Phase 3 pathways project, and those carried out annually by the National Grid. The ADVENT team identified a set of criteria that describe desirable features of the scenarios. These are detailed in Table 1 along with a description of whether and how the scenarios exercises meet them.

Key points include (i) neither scenario set considers a pathway that achieves net zero emissions; (ii) the majority of UKERC 3 scenarios consider a role for CCS, whereas this is only a feature in one of the National Grid scenarios; (iii) UKERC 3 considers a timeline out to 2050 whereas National Grid primarily focuses on 2040 with some elements extended out to 2050; (iv) data is available for UKERC 3 scenarios as these are produced through UCL. Data is potentially available for National Grid although this would require negotiation.

Table 1: Features of two scenario exercises identified for use in ADVENT.

Criteria	UKERC 3 SCENARIOS	NATIONAL GRID 2016
Meeting a 1.5C target	They are UK scenarios, and some are designed to meet UK carbon budgets and targets. Those are more compatible with 2 degrees than 1.5.	Framed around progress towards the 2 nd , 3 rd , 4 th carbon budgets and meeting an 80% reduction in CO ₂ out to 2050.
Gas must play a role	Definitely, to varying degrees depending on the scenarios.	A range of different scenarios including shale gas.
CCS to feature	Yes. One scenario includes a future where CCS is not available.	Yes. It is a feature of the Gone Green scenario.
Bioenergy should feature with varying targets	Yes. There are no targets as such, but some constraints on the use of UK / imported biomass - and different outcomes with respect to the amount of biomass.	Bioenergy does feature, although in the scenarios it tapers off over the coming decades due to constraints on the availability of imports.
Details of role of onshore wind	Yes.	Yes. A number of options explored from decommissioning to repowering at end of life.
Achieve and 80% reduction in emissions	Yes, for some scenarios - though it also analyses scenarios that do not meet the 2050 target (similar to those in the 'Future of UK gas' report).	Yes, in one scenarios.
Miss the 80% target	Yes - see above	Yes. In the other scenarios reductions of between 50 and 70 per cent are achieved.
Achieve net zero emissions	Not explicitly, though some scenarios rely in part on negative emissions technologies (BECCS).	No.

Criteria	UKERC 3 SCENARIOS	NATIONAL GRID 2016
Should be mainstream scenarios	Yes, in that they have been presented, tested and revised following discussions with stakeholders such as the UK government, Ofgem, National Grid.	Yes. These are produced every year and are well respected.
Data should be accessible	Yes.	Potentially.
NOTES		Only out to 2040 for much of the data, although some key findings are presented out to 2050.

Next steps

This document will be circulated to the group and the UKERC 3 and National Grid Scenarios discussed in further detail at a project meeting in January.