Synthesis of Qualitative Narratives and Quantitative Models into Consistent Descriptions of Low Carbon Energy Transitions

Authors:

John Barton, CREST, Loughborough University, LE11 3TU

Evelina Trutnevyte, University College London, UCL Energy Institute

Abstract

Energy transition pathways (as combinations of qualitative narratives and series of possible energy scenarios for different future years) can bring new insights, not as predictions of the future but as tool for strategic planning and decision making (Hughes and Strachan, 2010). The 'Realising Transition Pathways' (RTP) Project brings together nine UK universities in an interdisciplinary exploration of three different pathways of the UK energy sector out to 2050. Three pathways, called Market Rules, Central Co-ordination and Thousand Flowers are represented as qualitative narratives and then analysed from the quantitative perspective, using six energy models, two appraisal techniques and the DECC 2050 Calculator (DECC, 2014). All the models and techniques address the UK power system transition until 2050, but differ in their disciplinary perspective, objectives, methodological approaches and parts of the power system addressed.

In phase 1 of the project, 'Transition Pathways', a large amount of time and effort was expended to quantify the three pathways and to make the numerical inputs and outputs of each model consistent. The data flows were unclear: which model uses each quantity as an input and which creates it as an output? Sometimes the interpretation of quantities was unclear. The links between the models and the narratives were hard to achieve in practice. As a result, it proved to be challenging to synthesize all these quantitative models, appraisal techniques and narratives into relatively consistent analyses. Even the meanings of some technical terms were unclear. For example: Does 'electricity supplied' include transmission and distribution losses?

In this presentation, we present a systematic three-step approach to synthesising insights from qualitative narratives and two soft-linked energy system models. We organise this process in three steps, where each step adds more detail to the analysis:

1. Qualitative narratives define the broader picture of the low-carbon energy transition and in detail describe the softer energy system governance aspects;
2. Every qualitative narrative is 'translated' into five maximally-different energy scenarios that show different ways in which the actual energy system transition could develop under the narratives. For this purpose, the D-

EXPANSE model is used (Trutnevyte et al., 2012; Trutnevyte and Strachan, 2013). D-EXPANSE enables the systematic translation of qualitative narratives into a number of quantitative energy scenarios.

3. Each of the five energy pathways, generated with the D-EXPANSE model, are then fleshed out in detail with the technical feasibility FESA model (Barnacle et al., 2013; Barton et al., 2013). D-EXPANSE is a coarse model but FESA can validate the D-EXPANSE model results as well as add the necessary detail on hourly supply-demand balancing.

In this way, the combination of narratives and two different models gives a more complete picture of the low carbon energy transition; both qualitative and quantitative elements are included and merged. D-EXPANSE provides the link between qualitative and quantitative data. As the FESA model fleshes out in detail the technical energy system configurations, it checks the feasibility of the qualitative narratives and adds enough detail to show how this qualitative narrative may look in reality. As FESA itself does not include any economic considerations, the soft-linking of it with D-EXPANSE also enables some economic parameters to be brought into the analysis.

References

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