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Economic Uncertainty, Energy Infrastructure and SLR

SLR, Flooding and Energy Infrastructure

- The UK is highly susceptible to coastal flooding (Prime et al., 2015).
- The UK has three times as many coastal energy facilities than any other European country (Brown et al., 2014).
- The prospect of alternative sources of energy, as seen in recent years with renewable energy, fracking and carbon capture will potentially see the development of new coastal facilities.
- Climate change and sea level rise represent significant challenges to the power infrastructure and to the preservation of the current level of electricity supply security in the future (Reichl et al., 2013).

Consumer/Provider Interface: Energy Reliability

- Reliability of supply (as a component of the quality of service), is an important aspect of the overall security of supply
- Reliability cost is considered to be the investment needed in the system to achieve a certain reliability level,
- Reliability worth is considered to be the monetary benefit derived by the supplier and customer of such an investment (Kariuki and Allan, 1996a).
- The assessment of the benefit or worth of reliability is perceived as being a major contribution in providing the justification for infrastructure and systems investment.
- The costs incurred by consumers, customer interruption costs (CIC), as a result of interruptions in their electricity supply are considered key indicators of customer expectations and therefore of reliability worth (Kariuki and Allan, 1996b).
- In the UK, the concept of reliability worth has been considered a factor in justifying reliability investment since the late 1970s.

Investment in Energy Infrastructure

- The viability of investment is valued by cost benefit analysis
- Most common method is discounted cash flow (DCF)
- This allows the summarising of the economic performance of an investment decision as a single metric known as an net present value (NPV)
- However, it does not address uncertainty or any flexibility in management decisions
- NPV often leads to suboptimal decisions for irreversible investments

Energy consumers & the value of electricity

- However, electricity consumers (domestic and business) do not send a signal as to how much they value a continuous electricity supply to energy providers
- Consumers pay their bills; however price is not the same as value
- **Uncertainty about the value of continuous electricity supply to consumers**

- This uncertainty is compounded by
  - High reliability of supply in – Few outages
  - No information on **market-based losses** due to outages (business)
  - No research on **financial losses** (e.g. food defrosting) for domestic consumers
  - Cannot conduct a lose based assessment

ARCoES: Overcoming Uncertainty for Electricity Distributors

- Investing in infrastructure is expensive and irreversible
- However, no information on the consumer value of constant electricity supply to guide investment decisions/investment models

- This WP uses method from the social sciences to overcome this uncertainty

  - Willingness to pay methods to calculate the value of constant electricity supply: Karyn/Mary
  - Real Options analysis to integrate consumer value within an investment model: Tom/Karyn

Non-market Valuation & WTP

- Non-market valuation - how much people would be willing-to-pay for goods not traded in markets, such as environment - clean air, biodiversity
- Apply recognised methodologies for n-m valuation, using latest techniques, to address uncertainty

Challenges

- People have little (or no) experience of recent outages
- Focus groups to explore value of electricity
- Conceptualising 'value' not 'price' difficult
- Use of characteristics (attributes) of an outage to help
- e.g. would you prefer an outage in summer to winter?
- Eventually get responses from focus group to inform values for WTP research (Choice Experiments)

Real Options Analysis

- In an uncertain investment environment, flexibility in management provides value
  - Real Options Analysis (ROA) is a approach that values this flexibility
- Investment plans are modified or deferred in response to new information that reduces uncertainty (eg new SLR projections)
  - Able to take advantage of new opportunities while mitigating losses
- Flood defences will be required for some assets but future increases of mean sea level are uncertain
- Investing in defences for all assets is suboptimal, as is building defences that are too big or too weak
- Real Options allows the valuation of the management flexibility for investment in flood defences
- Options include invest now, defer or abandon investment.

Economics WP

- Finished product:
  - Integrated model to allow energy providers to decide future investment decisions in the face of SLR based on consumer signals
  - Reduction in Uncertainty for Energy Suppliers
  - Consumer preferences fully taken into consideration