MERLIN

Modelling the Economic Reactions Linking Individual Networks

Milestone 2

1.08 Defining Scenarios for Economic Modelling

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1 Introduction

1.1 Background

The MERLIN project is working towards improving our understanding on how Distribution Network Operators (DNOs) or Distribution System Operators (DSOs) can effectively manage flexible services, such as energy storage and demand side response, among others. The goal is to improve our understanding on the economic impact these flexible services could have in a number of possible future world scenarios. MERLIN is also exploring the impacts of managing constraints through traditional reinforcement and alternative DNO controlled methods, which can be used to evaluate the cost-effectiveness of flexible services. Modelling allows us to understand possible positive and negative financial impacts of flexible services in a safe and risk free environment, with relevant learning passed to sister innovation projects TRANSITION and Project LEO. This can help us make better and more informed decisions in order to reduce investment costs.

1.2 Aim

The aim of this document is to provide an overview of the various scenarios we plan on modelling within the Fort William and Oxfordshire areas. The purpose of these scenarios is to provide clarity on the learning we are attempting to achieve by replicating specific situations/events that could occur in the future.

1.3 Scenario Modelling

Three trials are being run on the Fort William and Oxfordshire Network Models:

1. Valuing Constraint Options – This aims to understand the cost of different investment / decision options for alleviating network constraints.
2. Economic Modelling Over Time – This aims to understand the economic impact of change over time e.g. altering the weighting assigned to utilisation / availability payments, altering the likelihood of non-delivery of flexible services, etc.
3. Spot Market Mechanics – This aims to understand how to run a spot market for flexible services within the UK and in what situations it would be best suited.

1.3.1 Trial 1: Valuing Constraint Options

One of the main issues DNOs are experiencing at the moment is that there are only a small number of flexible services willing to participate in DNO tenders for managing network constraints. The outcome of this is that few flexible services are contracted, so traditional reinforcement becomes the only viable option.

The purpose of this trial is to understand how much monetary value we can assign to flexible services. It is possible that we are under-valuing these services, which is why we are exploring different options to assign value to these services. We are also evaluating how flexible services compete with traditional reinforcement options and alternative DNO controlled options such as smart charging of electric vehicles (EVs) and operating assets beyond capacity.

More information on how we value flexible services and alternative options in this project can be found in the Milestone 2 report 1.07 Flexibility Valuation Mechanisms. Table 1.3.1 details the scenarios in more detail i.e. what questions we are attempting to answer and how the scenario would be set-up in a modelled environment.

1.3.2 Trial 2: Economic Modelling Over Time

The purpose of this trial is to understand what the impact on investment in flexible services and traditional/alternative reinforcement options will be over a duration of time (Still to be decided but likely between 0 and 10 years).

Within the Fort William and Oxfordshire Networks we are specifically investigating:

- The impact of changing the weighting of utilisation and availability payments. Understanding situations where higher utilisation or availability payments may be more beneficial for cost savings can assist DNOs with flexible service procurement strategy.
- The impact of non-delivery of service aka 'risk'. Understanding the impact of non-delivery will help DNOs strategize on where we may need to over-procure in order to establish network resilience and guarantee power to customers.
- The impact of changes to the network and new connections may have on investment decisions. E.g. what happens if a new apartment building connects to the network in an area where flexible services have already been contracted for several years? How do we know what the correct investment decision is, if one is necessary?

Table 1.3.2 describes this in more detail.

1.3.3 Trial 3: Spot Market Mechanics

At present, DNOs do not have experience operating spot markets. The purpose of this trial therefore is to give DNOs an understanding on how a spot market could potentially be run. Specifically, we are trying to understand the following:

- In what situations would a spot market be a viable option? E.g. do we require a large number of flexible service providers or can this be done with limited numbers?
- How exactly does a spot market operate? E.g. do we use blind bidding, how are bids selected, how do flexible service providers bid-in, etc?
- What considerations do we need to consider for spot markets within Great Britain (GB)? We know that the tool developed works in the USA, but we are not sure how this transfers over to GB.

TRIAL	Trial 1 – Valuing Constraint Options Designed to simulate the economic impacts of alleviating constraints in a variety of scenarios. We want to understand what monetary value we can assign to flexible services, how different flexible service valuations can compete with traditional reinforcement and how alternative value streams such as operating assets beyond capacity and installing smart EV chargers compete against traditional reinforcement and flexible services.																			
SCENARIOS	Scenario 1 – Traditional Reinforcement Valuation				Scenario 2 – Proposed Short Term Flexible Service Valuation				Scenario 3 – Possible Future Flexible Service Valuation				Scenario 4 – Possible Future Plus Flexible Service Valuation				Scenario 5 – Operating Assets Beyond Capacity (Oxfordshire Only)			
OPTIONS	Option 1: FES Consumer Evolution Scenario	Option 2 – FES Community Renewables Scenario	Option 3– N/A	Option 4 – N/A	Option 1: FES Consumer Evolution Scenario	Option 2 – FES Community Renewables Scenario	Option 3– N/A	Option 4 – N/A	Option 1: FES Consumer Evolution Scenario	Option 2 – FES Community Renewables Scenario	Option 3– N/A	Option 4 – N/A	Option 1: FES Consumer Evolution Scenario	Option 2 – FES Community Renewables Scenario	Option 3– N/A	Option 4 – N/A	Option 1: FES Consumer Evolution Scenario	Option 2 – FES Community Renewables Scenario	Option 3– N/A	Option 4 – N/A

Table 1.3.1. Trial 1: Valuing Constraint Options

TRIAL

SCENARIOS

OPTIONS

Trial 2 – Economic Modelling over Time

Designed to simulate the economic impact of various scenario options over a period of time. Core learning from these simulations include: A) What network conditions would benefit from high/low utilisation/availability payments? B) How do different load/gen (FES) forecasts impact flexible services? E.g. do high load forecasts reduce the benefit/need of flexible services? C) What is the impact of flexibility not delivering i.e. CI/CML and IIS costs incurred? D) What situations require flexibility to be delivered with more certainty e.g. higher number of customers? E) What strategy should be taken and when e.g. high customer numbers require over-procurement of services. F) What network changes have the highest impact on flexible service economics? G) How do new connections impact flexible service economics?

Scenario 1 – Varying Utilisation / Availability Payments				Scenario 2 – Risk Factor				Scenario 3 – Network Changes				Scenario 4 – New Connections				Scenario 5 – N/A			
Option 1 – Apply 100% utilisation payment weighting	Option 2 – Apply 50% utilisation weighting	Option 3– Apply 0% utilisation weighting	Option 4 – Repeat Option 1 – 3 for every load forecast & valuation type	Option 1 – Flexibility service delivers 100% of the time	Option 2 – Flexibility service delivers 50%% of the time	Option 3– Flexibility service delivers 0%% of the time	Option 4 – Repeat Option 1 – 3 for every load forecast & valuation type	Option 1 – Apply large number of network changes	Option 2 – Apply moderate number of network changes	Option 3– Apply no network changes	Option 4 – Repeat Option 1 – 3 for every load forecast & valuation type	Option 1 – Apply large number of new connections	Option 2 – Apply moderate number of new connections	Option 3– Apply no new connections	Option 4 – Repeat Option 1 – 3 for every load forecast & valuation type	Option 1 – N/A	Option 2 – N/A	Option 3– N/A	Option 4 – N/A

Table 1.3.2. Trial 2: Economic Modelling Over Time

TRIAL	SCENARIOS	OPTIONS
Trial 3 – Spot Market Mechanics **Designed to test how a spot market would work in practice for a DNO/DSO. Specific learning we want to gain includes: A) In which situations would a spot market be a viable option? B) What are the processes / mechanics? C) How would this work in GB? D) In more remote areas, is this viable given the load and generation mix?**	**Scenario 1 – 33kV Spot Market**	Option 1 – spot market scenario over 1 year with large number of flexibility service providers.
		Option 2 – spot market scenario over 1 year with moderate number of flexibility service providers.
		Option 3– spot market scenario over 1 year with small number of flexibility service providers.
		Option 4 – Repeat Option 1 – 3 for every load forecast
	Scenario 2 – 11kV Spot Market	Option 1 – spot market scenario over 1 year with large number of flexibility service providers.
		Option 2 – spot market scenario over 1 year with moderate number of flexibility service providers.
		Option 3– spot market scenario over 1 year with small number of flexibility service providers.
		Option 4 – Repeat Option 1 – 3 for every load forecast
	Scenario 3 – LV Spot Market	Option 1 – spot market scenario over 1 year with large number of flexibility service providers.
		Option 2 – spot market scenario over 1 year with moderate number of flexibility service providers.
		Option 3– spot market scenario over 1 year with small number of flexibility service providers.
		Option 4 – Repeat Option 1 – 3 for every load forecast
	Scenario 4 – N/A	Option 1 – N/A
		Option 2 – N/A
		Option 3– N/A
		Option 4 – N/A
	Scenario 5 – N/A	Option 1 – N/A
		Option 2 – N/A
		Option 3– N/A
		Option 4 – N/A

Table 1.3.3. Trial 3: Spot Market Mechanics

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