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| Network Innovation Competition 2020 Supplementary Answer form | | |

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| Project Name | Constellation | | |
| Question number | #16 | Pro forma section | Section 9 |
| Question date | 10/09/2020 | Answer date | 14/09/2020 |
| Question summary | Please clarify the original learning that will arise from deliverables 1 and 3, and what will form foreground IP. | | |

## 

## Answer (please retain document formatting and do not exceed 2 pages unless otherwise agreed with Ofgem)

Deliverable 1 is dedicated to the detailed design which is essential for setting up the core development stage for each Constellation element that is described in section 2.2.1. We will gain significant original learning as part of the design work in Deliverable 1, specifically in the following areas:

* Method 1: The departure from a fully deterministic approach to network management and the introduction of analytic measures to enable local (distributed) control is novel and a significant advance in the industry. The specific learnings are:
  + The functional approach (and requirements) to enabling DER operation to continue through extended periods of communication downtime; and
  + A hierarchy of active network management control that gracefully degrades from fully centralised control, through decentralised area control, to independent local control.
* Method 2: Constellation brings a change in protection philosophy from one that relies on conservative settings, to one that dynamically adapts them and keeps generation on if possible. The specific learnings are:
  + The functional requirements for wide area G59/G99 compliant protection using routable GOOSE across scalable 5G site-to-site communication; and
  + The system design of a platform for dynamic assessment of protection settings.
* Constellation system design: Development of a novel architecture suitable for distributed control and enhanced protection within a dynamic distribution network;
* Central management: The application of proven system management technologies to achieve techno-operational maturity and practical usability of advanced functionality management are novel in the GB electricity distribution. The specific learning is:
  + The system integration requirements for a central platform for management of on-site plant via a software application running across a substation computer;
* Site-to-site communication: Design of a novel communication service via 5G slicing to enable secure and low latency communication for distributed protection and control; and
* Virtualisation approach: Requirement specification for an environment suitable for virtualising Methods 1 and 2 to operate reliably (as software) within the required timescales, despite any other function operating or possible cyber-attack.

Deliverable 3 is dedicated to two key project aspects: Development of the Constellation elements delivering significant original learning building on the design work described above and the initial learning from the first trial, which will be in PNDC’s facilities. These include:

* Key new learning from the development and initial testing of Methods 1 and 2:
  + Initial understanding of the application of machine learning and detailed local measurements to preserve DER operation during periods of communication outage with minimal disruption;
  + Assessment of signal processing and machine learning techniques to extract network features and use predictions during communication outages;
  + Initial evaluation of the performance of the advanced algorithms for islanding detection and the G59/G99 block function triggers in complex network configurations; and
  + Performance evaluation for the functionality for protection settings verification and adaptation in real time.
* Key new learning from the development and initial testing of the Constellation system (central management, 5G site-to-site communication, virtualisation environment):
  + Assessment of the operational performance of key project elements after simulation with the Real Time Digital Simulator (RTDS);
  + Understanding of the installation and commissioning requirements from deployment of the Constellation system within PNDC’s 11kV test network;
  + Performance testing to ensure critical functions (e.g. protection) which need to be maintained by the system architecture and cannot be adversely impacted by non-critical functions; and
  + Initial evaluation of the end-to-end 5G communication latency, availability, security, and quality of service.

All Deliverables are designed with the aim to produce key reports that benefit the industry by enabling a clear understanding of the learnings generated throughout project. However, at this stage we do not know which learnings will be deployed as new products or services. As such, some learnings are likely to be in the form of foreground IP and some – relevant foreground IP. All Partners have committed to complying with the default IP requirements set out in the NIC governance and we will follow those as the project progresses. Furthermore, all relevant foreground IP will be identified in Project Progress Reports in order to enable other DNOs to identify whether they wish to use that specific learning to replicate the Methods as the project progresses.