Frequently Asked Questions

The Enhanced Frequency Control Capability (EFCC) Project

Introduction

This document has been written for all parties interested in the EFCC project. The EFCC project has developed an innovative wide-area monitoring and control system (MCS) which was designed to help address the challenge of maintaining system frequency stability as more non-synchronous generation comes online.

We have collated questions received to date and included them in this document. For more information on this innovation project, please visit the website. The document is split into technical and commercial questions related to the project.

Some of these questions included in this document were generated during our commercial webinar on 25 September 2018. The slides can be accessed here for reference.

Technical questions

What assumptions of delay are there in the detection of events?

An approximation of what the monitoring and control system (MCS) is doing from the detection of a frequency event is outlined below:

- Event occurs (t=0)
- Phasor Monitoring Units (PMUs) capture data (≈40ms)
- PMUs to Regional Aggregator (≈100ms – dependent upon communications network)
- Regional Aggregators to Local Controller (≈100ms – dependent upon communications network)
- Event detection (≈150ms)
- Local Controller to Response Provider (<20ms – assuming GOOSE protocol communications)
- Response actuation (≈100ms – based upon a battery storage unit)

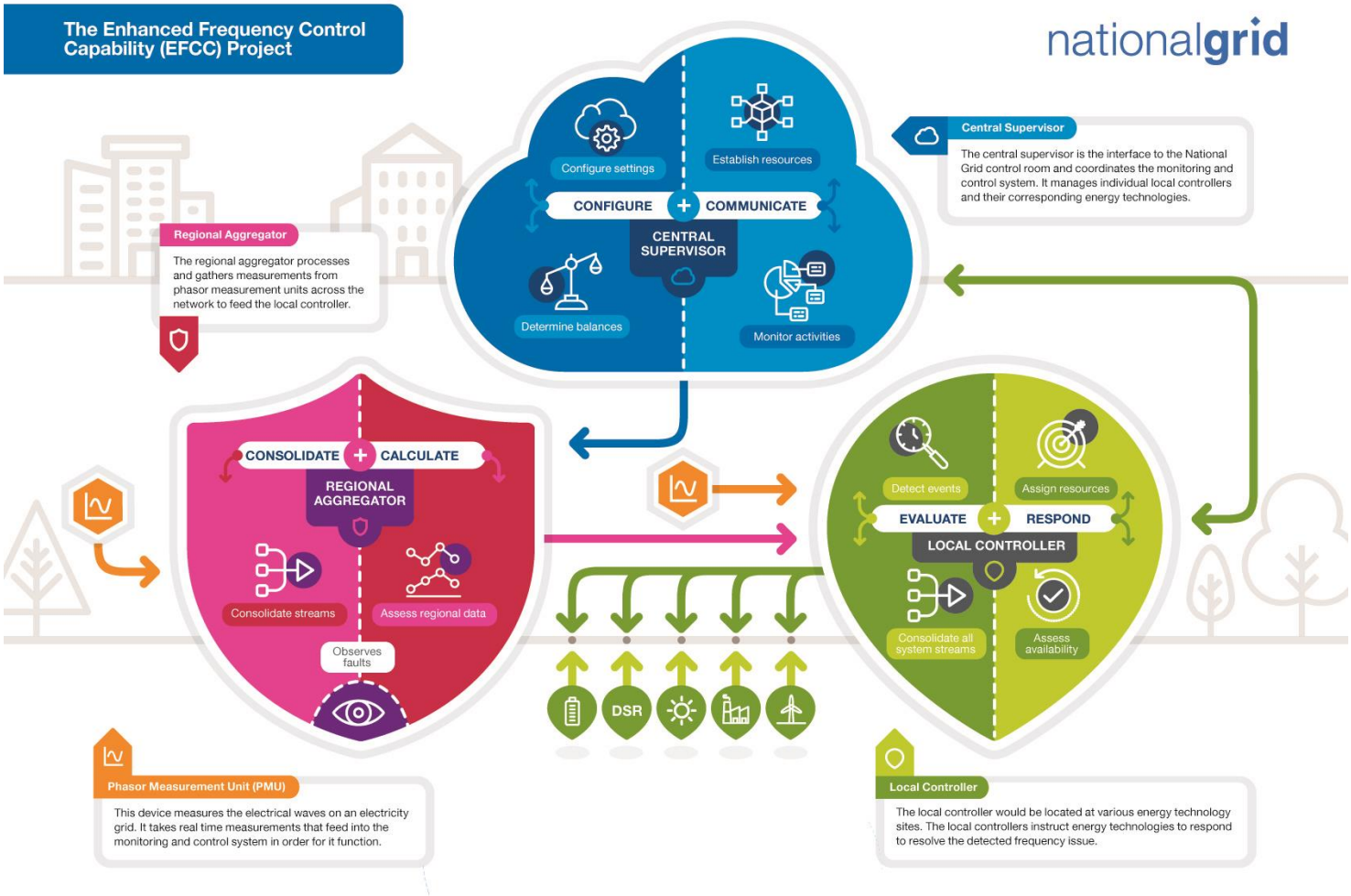
What is the negotiation process, and time to ramp up and down of fast and low inertia based service providers?

The EFCC cost benefit analysis (CBA) results to date make no assumptions of the commercial negotiation and contracting processes which may be required to obtain a given ‘pool’ of EFCC resources in each year. In the CBA, Baringa (the consultants carrying out the cost benefit analysis) have considered project partners’ estimates of the expected participation in the provision of a fast-coordinated frequency response service. These technology based assessments have been applied to two of the 2017 Future Energy Scenarios (FES); Consumer Power and Steady State.

In terms of the process to ramp up and down resources, ahead of any event the MCS would determine, for a given system inertia and power imbalance, what the optimal shape of the resource deployment should be. The MCS will ensure that adequate resources are deployed to meet this overall response shape.

Is the whole process from negotiation to operation decentralised? If not, please explain it in more detail.

The MCS has been developed using a decentralised approach. This is a diagram showing the monitoring and control system (MCS) and how it works.



- **Central Supervisor**: The central supervisor is the interface to the National Grid control room and coordinates the MCS.
- **Regional Aggregator**: The regional aggregator processes and gathers measurements from phasor measurement units across the network to feed the local controllers.
- **Local Controller**: The local controller would be located at various energy technology sites. The local controllers instruct energy technologies to response to resolve the detected frequency issue.
- **Phasor Measurement Unit**: This device measures the electrical waves on the electricity grid. It takes real time measurements that feed into the MCS in order for it to function.

The EFCC data shown in the webinar on 25 September 2018 clearly shows that the Initial RoCoF, in the first 0.5 seconds of a RoCoF event, is faster than the following average RoCoF by a factor which is more than 2:1 for a worst-case example. Shouldn't the future average of RoCoF be limited to 0.5 Hz / s or lower?

The National Grid Electricity System Operator (ESO) is not looking to impose RoCoF limits. However, it is reasonable to expect that close to a frequency event, a Phasor Measurement Unit (PMU) may record a

higher RoCoF within the first 0.5 seconds compared to the following average RoCoF. ENTSO-e has developed recommended guidelines to measure and calculate RoCoF, though there is currently no agreed single standard specification applicable to relays and PMUs. Joint code modification GC/DC0079 will result in embedded generation RoCoF relay settings changing from 0.125Hz/s to 1Hz/s based on an average measurement in the first 500ms.

What can EFCC do the help limit the future Initial RoCoF?

The MCS was not designed to limit the initial RoCoF, as it will be used primarily to contain frequency within fast timescales. National Grid ESO has separately worked across the industry under the joint modification GC/DC0079 to increase the RoCoF relay settings up to a maximum of 1Hz/s across the first 500ms of any event for new generation and to develop a programme of RoCoF relay setting changes. This increased limit would still need to be respected following EFCC implementation, for the first 500ms of any event.

Do the EFCC conclusions need to be updated to allow for a future Average RoCoF of 0.5 Hz / s or lower?

The EFCC conclusions hold for average RoCoF at 0.5Hz/s and lower. System studies and CBA analysis have shown that even before RoCoF reaches 0.5Hz/s, a faster frequency response is required to maintain frequency stability. Using slower response requires market intervention to constrain generation that will lead to significant costs across all FES scenarios. The MCS provides targeted and proportionate response by detecting a specified RoCoF that can be adjusted within its settings. By utilising a wider range of resources than is currently possible and layering asymmetric provisions of frequency response into the overall requirement in an effective way, benefits can be achieved at 0.5Hz/s or lower.

How will it link to future developments of Virtual Synchronous Machine (VSM) and fast storage?

The developments of VSM and fast storage are complementary methods to assist in maintaining system stability alongside theMCS. The MCS enables faster frequency response in more volatile frequency scenarios and due to its ability to utilise a wider range of technology resource characteristics, fast storage can be integrated into the scheme. VSM is primarily focused on the requirements for stability on the transmission network due to electrical faults. The VSM control development looks to replicate the effect of synchronous machines to ensure the system remains stable for both voltage and frequency disturbances. VSM works within transient system disturbance timescales so after its been deployed, other sources of frequency support are still required. The development of VSM is covered in more detail within a Grid code VSM expert working group.

Commercial questions

Is the EFCC scheme going to be rolled out more widely and developed as another service? If so, will the service be restricted by cannibalisation of prices in the same way that other ancillary services have been treated?

At the time of the bidding for the EFCC NIC funding, the objective of the project was to develop a RoCoF based frequency response balancing service product. However, in 2017 National Grid ESO embarked on a process to review and simplify its existing suite of balancing services to ensure that they were simple, and in line with our operational requirements as well as having a transparent means of procurement. This process is called the System Needs and Product Strategy (SNAPS).

With that process being undertaken it was determined that it would not be appropriate to progress with the development of a standalone EFCC balancing service product. Therefore, as this has not been developed as

another balancing service there are no service requirements, implementation dates or compensation terms associated with EFCC. We will communicate any future changes in the commercial direction and next steps for the project at our final dissemination event on the 5 February 2019.

How will services be procured and when can we register an interest?

See above

What level of compensation will be provided for services?

There is currently no compensation available through EFCC as this is not being developed as a balancing service.

What is the look of the service for suppliers to understand the revenue opportunity in the future?

An EFCC balancing service is not being developed therefore there are no service terms. Please refer to our existing suite of balancing services and our product roadmap for more information.

When will the scheme be implemented?

There is currently no scheme implementation date, the project closes on 31 December 2018 and the next steps will be communicated at our closing event on the 5 February 2019. To register, please click here.

What is the roadmap of actions beyond the commercial trial to make this part of the cluster of services?

Following the introduction of our System Needs and Product Strategy, it was determined that it was not appropriate to develop an EFCC balancing service, therefore there are currently no road map actions planned following the commercial trials.

Why is the EFCC approach is being that shy now? Other services are being designed on the back of SNAPS with a similar purpose? This makes me think this is one part of NG ESO trying to convince other part of NG ESO about the advantages of having the EFCC features included in the fast frequency response service. Who makes the call at the end? Why have we had to wait for results of the potential of onshore + offshore wind within the fast frequency response service?

There is a focus to align the EFCC project with the ongoing System Needs And Product Strategy (SNAPS) work within National Grid Electricity System Operator (ESO). The project team are working to ensure that learning from the EFCC project is being used to support, where appropriate, the development of our new fast acting response services that are currently in development. The next steps for the EFCC project will be communicated further at our final dissemination event on the 5 February 2019. The learning from the project, as well as the potential benefits, challenges and any associated risks are all being assessed within National Grid ESO to determine the most appropriate way forward.

If EFCC is expected to bring benefits in early 2020s, what is NG ESO doing to unlock the benefits as soon as possible

The cost benefit analysis is currently being undertaken to determine the financial benefit or potential savings associated with the implementation of EFCC. This work is due to complete in early 2019 and will support in determining the next steps for the project. However, this will also need to be considered alongside the development of and /or implementation of new IS infrastructure or systems to enable interaction with existing business as usual (BAU) systems and processes to support EFCC. There are a significant number of areas

that must be considered before any potential benefit can be unlocked. These will be discussed further at the EFCC project's final dissemination event on 5 February 2019. To register, click here.

Implementation / Technical Requirements

What are the on-site equipment requirements?

Results from the commercial trials will indicate what work / upgrades will have been made to the various technology types and locational sites to deliver faster acting response; these technical results reports will be available on the National Grid website. The EFCC project will not develop a standalone balancing service therefore the project has not explored the technical compliance requirements at sites for the provision of faster acting response now.

What level of infrastructure will need to be installed and will this become a mandatory requirement on future developments?

See above

Other questions

How were the limits on ROCOF i.e. inertia calculated in the cost benefit analysis? Has this been done directly in PLEXOS?

Using year-round dispatch of generation and demand, provided by PLEXOS on an hourly basis, it is possible to identify the synchronous generation that contribute to total system inertia for every hour. This can be combined with an estimation of demand at the time. The system inertia and RoCoF calculation follows a methodology described in our System Operability Framework.

END

If you have any questions that haven't been included in this document, please email us: box.EFCC@nationalgrid.com or visit our project website.