

**GC0096 Storage
Grid Code Workgroup**

Monday 30th January 2017

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- Review/Approve Terms of Reference
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Background - Storage and the Grid Code

- 'Storage' (other than Pumped Storage) is not defined in the Grid Code.
- Storage connection applications continue to increase in volume - it is becoming more important therefore that the Grid Code provides technical clarity on connection requirements for new Storage schemes
- We are aware of many different types of Storage technologies and topologies
- However our aim is for transparency and consistency for all users of the Transmission System, including Storage. This means comparable technical performance requirements for users - be they Generation, Demand or Storage

Review/Approve Terms of Reference



GC0096 Overview

- A clear and precise defect has been identified
- Our focus is to deliver appropriate changes in a timely and efficient manner:
 - Fortnightly workgroups with a fixed end point
 - Catch-all meeting at the end of the cycle for interested parties to review outcomes *before* industry consultation
- Post-workgroup, we will direct interested parties to existing forums/workgroups reviewing commercial or charging arrangements for Storage.
 - **We cannot resolve these topics in a Grid Code workgroup**

Defining a Grid Code 'Storage' user



Definitions

Firstly, are we talking “**Energy Storage**”, “**Electricity Storage**” or both?

Some ‘associated’ Grid Code terms which may help us...

- **Onshore Generating Unit** - Unless otherwise provided in the Grid Code, any **Apparatus** located **Onshore** which produces electricity, including, an **Onshore Synchronous Generating Unit** and **Onshore Non-Synchronous Generating Unit**.
- **Onshore Power Park Module** - A collection of **Non-Synchronous Generating Units** (registered as a **Power Park Module** under the **PC**) that are powered by an **Intermittent Power Source**, joined together by a **System** with a single electrical point of connection directly to the **Onshore Transmission System** (or **User System** if **Embedded**) with no intermediate **Offshore Transmission System** connections. The connection to the **Onshore Transmission System** (or **User System** if **Embedded**) may include a **DC Converter**.

Definitions (cont'd)

- **Onshore DC Converter** - Any **User Apparatus** located **Onshore** with a **Completion Date** after 1st April 2005 used to convert alternating current electricity to direct current electricity, or vice versa. An **Onshore DC Converter** is a standalone operative configuration at a single site comprising one or more converter bridges, together with one or more converter transformers, converter control equipment, essential protective and switching devices and auxiliaries, if any, used for conversion. In a bipolar arrangement, an **Onshore DC Converter** represents the bipolar configuration.
- **Pumped Storage Generator** - A **Generator** which owns and/or operates any **Pumped Storage Plant**
- **Pumped Storage Plant** - The Dinorwig, Ffestiniog, Cruachan and Foyers **Power Stations**
- **Pumped Storage Unit** - A **Generating Unit** within a **Pumped Storage Plant**

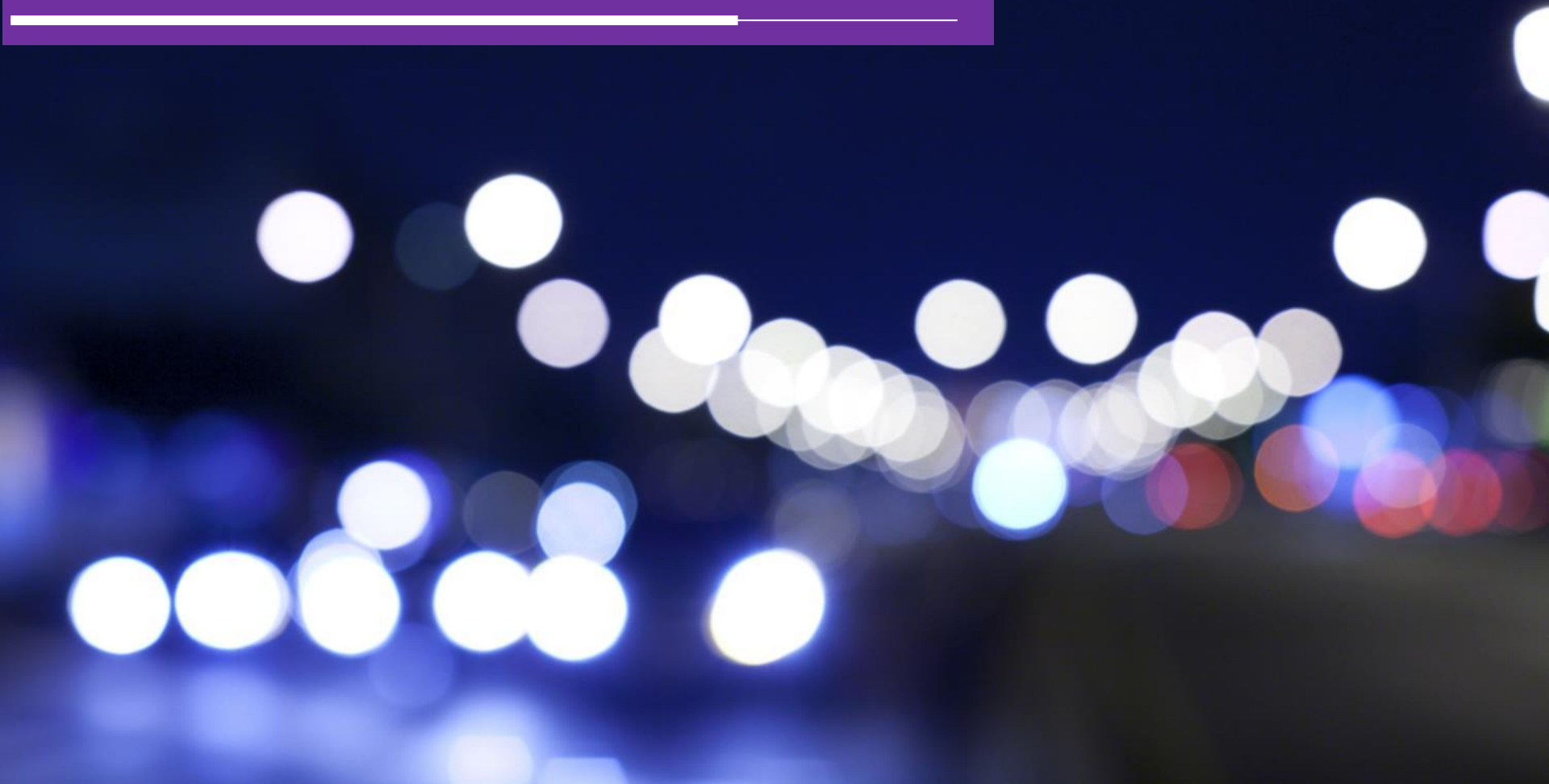
Definitions (cont'd)

- **Onshore Non-Synchronous Generating Unit** - A Generating Unit located Onshore that is not a Synchronous Generating Unit including for the avoidance of doubt a Power Park Unit located Onshore.
- **Onshore Synchronous Generating Unit** - An Onshore Generating Unit including, for the avoidance of doubt, a CCGT Unit in which, under all steady state conditions, the rotor rotates at a mechanical speed equal to the electrical frequency of the National Electricity Transmission System divided by the number of pole pairs of the Generating Unit.
- **Demand** - The demand of MW and MVA_r of electricity (i.e. both **Active** and **Reactive Power**), unless otherwise stated

What are our basic Storage definitions?

- How do these impact on Grid Code Technical Requirements...?
- Adopt similar approach to other technologies in the Grid Code

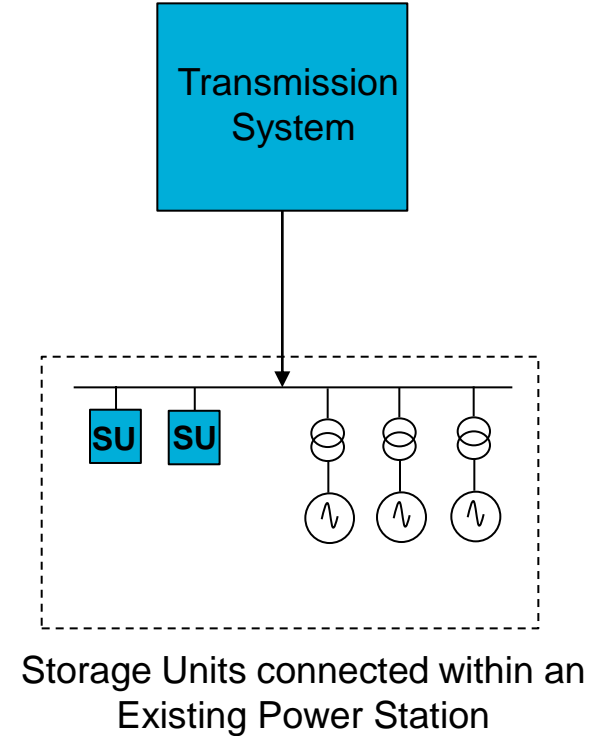
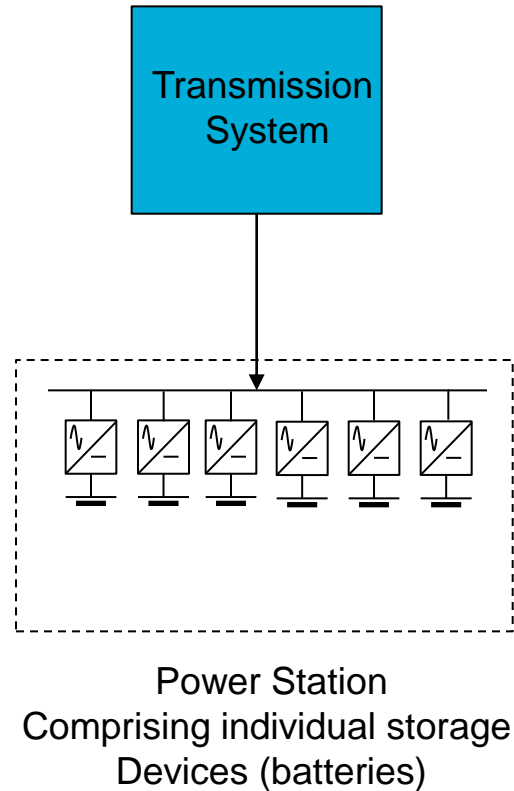
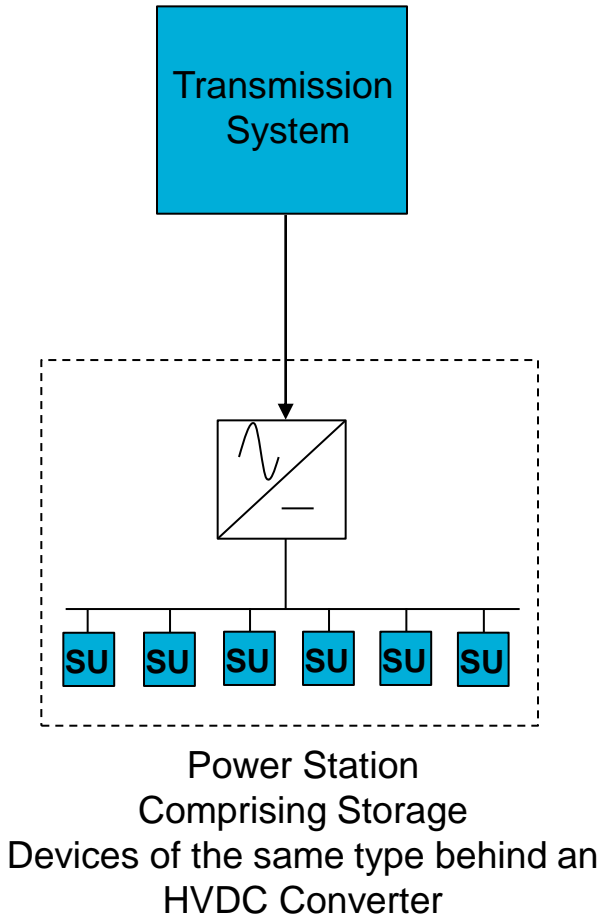
Storage Technologies & Topologies - Assigning technical requirements



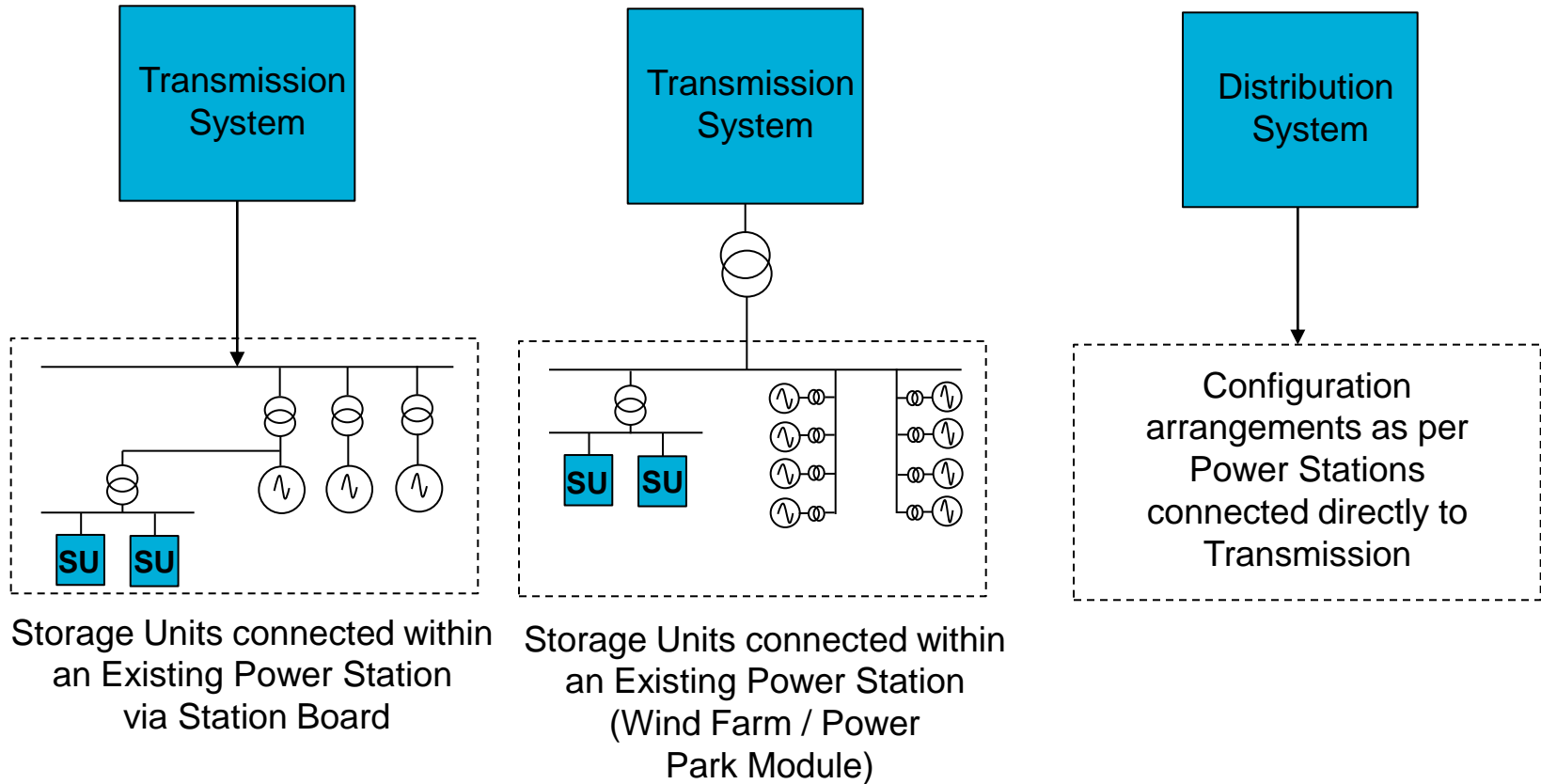
Storage Technologies

- Pumped Storage (Hydro Electric)
- Compressed Air Energy Storage
- Flywheels
- Batteries
- Superconductive Magnetic Energy Storage
- Hydrogen Storage Systems
- Supercapacitors
- **Others...?**

Topologies



Topologies (cont'd)



Key questions for setting technical requirements nationalgrid

- **Where do technical requirements derive for new Storage schemes?**
 - Connection Point? Other?
- **Is there a correlation between some Storage technologies and existing Grid Code Users allowing us to deem appropriate technical requirements?**
 - For Battery/Converter-based technology = Power Park Module or HVDC converter?
- **How do we consider Storage co-located with new or existing Generation schemes?**
 - Do requirements apply to the entire scheme, or Generation and Storage elements separately?

Other factors for Grid Code requirements

- Both static and dynamic models should be submitted by a Storage developer under the Planning Code and Data Registration Code
- These models must represent an accurate behaviour of the plant as built; NGET will work with developers and manufacturers on the development of these models
- How will availability be understood (e.g. running regime)? Will additional signals be required for operational metering purposes
- How do we consider EU Connection Code technical requirements? (see next slide)

European Codes

- There are x3 EU Codes which dictate Connection requirements for *new* users:
 - Requirements for Generators
 - Demand Connection Code
 - HVDC
- Whilst ‘Storage’ users are not bound by these codes, to what extent do our proposals need to reflect EU standards? Do we just reflect existing (as-is) Grid Code standards?

Next meetings



Future meeting dates/topics

- ~~■ 30th January 2017: Meeting 1~~
- 13th February 2017: Meeting 2
 - Assigning Technical Requirements
- 27th February 2017: Meeting 3
 - Assigning Technical Requirements
- 13th March 2017: Meeting 4
 - Proposed Drafting Grid Code changes
- 27th March 2017: Meeting 5
 - (If needed)