# Open Networks Project

## DNO Connections options and summary tables

31 January 2018

Energy Networks Association

Document Ref: ON-WS2-Guidance on DNO Connection Options-180131

Restriction: N/A

# Document Control

## Version Control

| Version | Issue Date | Author | Comments |
|---|---|---|---|
| 8 | 31/01/2018 | Open Networks Project | Issued for Publishing |

# DNO Connections options and summary tables

## Purpose

This discussion document aims to describe the different types of connection that DNOs may offer in response to requests from customers. Customers seek more clarity on the different types of connection available and the level of supply security they provide. In addition, as some networks become constrained, customers will need to more carefully consider what they need and what they wish to pay for in terms of connection availability. Useful links are included at the end of this document for customers seeking guidance on getting connected.

## Context

This document is to help customers understand different options for connections and that different types of connection have different features, including on costs and levels of security i.e. to help customers be clearer about what the connections are that they are paying for and their characteristics. This is also aimed at helping customers with their discussions on 'firm/unfirm' connections. This initial document does not represent an end point in the work of the Open Networks programme on this topic and, for example, the category identifiers in the tables below are to aid discussion only and are likely to change. Definitions, connection types and descriptors will be subject to further work as outputs are produced from the different work streams.

## Background

Traditionally, DNO's have referred to firm and un-firm connections for both demand and distributed generation (DG) to separately categorise connections that remain available in a first fault scenario and those that do not. Single circuit connections are a clear example of an un-firm connection whereby the connection becomes unavailable after a fault and remains unavailable for the duration of the fault repair. As some networks become constrained customers seek more clarity on the different types of connection available and the level of supply security they provide; simply using the terms firm and un-firm are no longer adequate to provide the level of clarity required. This options summary aims to describe different types of connection and their key characteristics. Generally, connections with intrinsically higher levels of security consist of more assets and cost more money, both to install and operate.

Customers of all types will benefit from clarity on the characteristics of different types of connection in terms of connection security and it is also important to highlight the distinction between the connection type and the nature of the network it is connected to, with the combination of the two providing different levels of overall security and network availability. This options summary seeks to increase clarity in two areas:

- Connection types and network availability for all types of customers (demand, generation and storage).
- Connections for storage and other forms of network response services to accommodate power swings and step changes e.g. from import to export.

## Illustrative Examples

This section simply highlights that there are different types of connection availability to customers from more traditional connections to newer flexible arrangements to reflect network constraints while helping customers to avoid funding reinforcement.

**Single circuit connections**

A customer may seek a single circuit connection to reduce initial costs and accept the outage effects of faults and maintenance e.g. if the circuit is subject to a fault the connection will be unavailable for repair time. However, if that connection is also connected to a constrained network the customer may not have 24/7 availability for its full export or import capacity even when its connection to the network is physically intact.

**More secure connections**

A customer seeking a new connection with more security may request a dual circuit connection in order to maintain availability in the event of a fault on one circuit. However, if the local distribution network is constrained, the customer may also opt to contribute to network reinforcement to remove the constraint under the rules in the Common Connection Charging Methodology.

**Flexible connections**

Examples of flexible connections include those in Actively Managed Network (ANM) areas and connections with timed unavailability e.g. unavailable for export at times of minimum demand. These connections are made available to customers to provide connections in constrained areas in a manner that avoids extensive network reinforcement to provide a connection.

## Connection types and network availability

This section and table 1 below seeks to highlight the key features of different types of typical physical connections and that access may be to an unconstrained network or via a flexible connection with an agreed curtailment arrangement. For a customer to take a view on the level of security it is willing to pay for there needs to a be consideration of both the connection type and the prevailing level of network access that is readily available. The connection type identifiers represent a combination of connection type and network access with category A1 being the most secure, these identifiers may provide greater clarity for non-technical stakeholders. As network constraints have increased with increased levels of DG; flexible, non-traditional, connections have been made available to provide connections at minimum cost, however, these flexible connections come with some level of curtailment driven by the level of constraints on the network, irrespective of the number of circuits in the connection or any switching arrangements. It should be noted that new un-curtailed connections may not be available in constrained areas unless the customer makes a contribution to reinforcement.

### Connection security

This describes the availability of a connection in the context of its physical assets and configuration and its ability to import or export under fault conditions or for routine maintenance. Multi circuit connections are inherently more secure than single circuit connections.

### Constraints and curtailment

This describes that constraints are present in the local network and highlights that the customer may face curtailment even when its connection to the network is intact and operating normally. In some cases customers may be able to reduce level of curtailment, for example by reducing the fault level contribution from a generator site through the design of its plant.

Table 1.

| Connection from site to local network | | | | General distribution network availability | |
|---|---|---|---|---|---|
| **Description** | **Type (indication)** | **Security** | **Relative cost** | **Un-curtailed** | **Curtailed** |
| 3 feeder connection from different source substations. | A | Secure for first and second circuit outage and also secure in the event that a fault affects one of the source substations. | £££££ | A1 | A2 |

| | | | | | |
|---|---|---|---|---|---|
| 2 or more feeders connected to different source substations. | B | Secure for first circuit outage and also secure in the event that a fault affects one of the source substations. | £££££ | B1 | B2 |
| 2 or more feeders with connection to the same source substation | C | Secure for first circuit outage, but not secure in the event that a fault affects the whole of the source substation. | ???? | C1 | C2 |
| Automatic switched alternative connection | D | Post fault restoration times will depend the time it takes to carry out the switching. | ??? | D1 | D2 |
| Manually switched alternative connection | E | Post fault restoration times will depend the time it takes an engineer to travel to site and do physical switching. | ?? | E1 | E2 |
| Single circuit/feeder connection | F | Post fault restoration times will be driven by fault detection and repair time. | ? | F1 | F2 |

**Connections for larger storage or flexibility service**

In addition to the connection types in table 1 there is an additional consideration for connections for larger storage and for other DER uses where import or export is adjusted significantly and quickly. This is because the connection needs to be robust enough to handle different levels of power flow steps (up or down) or power flow swings (from import to export) without creating network voltage swings that go outside specified limits i.e. to limit voltage disturbance on the network and disturbance to customers connected to it. Table 2 was used at the DER Forum on 21 September 2017 to try and help storage stakeholders gain some understanding of the difference in connections capability required for different storage use cases e.g. for different power swing capabilities for different types of network support. It sets out the different levels of required connection capability and robustness for different storage service use cases described here as gold, silver and bronze. In general, more robust connections (in this context) are available at higher network voltages, but network asset equipment costs more at higher voltages and results in generally higher connection costs. It is important to note that where a customer requests a connection for storage and does not specify a use case the DNO is likely to assume 'worst case' scenario and assume a 'gold' level requirement. Specifying the intended type of use at the time of application may result in a lower cost connection.

We would welcome stakeholder views on whether this helps to improve general understanding in respect of connections for storage and other.

Table 2.

| Type of storage use | Connection capability | Examples of services | Relative network cost/Impact |
|---|---|---|---|
| **Response** | Full import and export. Full power swings. | Enhanced / firm frequency response to NGET.* | £ |
| **Reserve** | Full export, limited import capacity. Managed power swings. | STOR, capacity markets, DSO support (future) | £ |
| **Price and Time shift** | Limited import and export capacity. Managed power swings. | Behind the meter, time of day trading, load shifting | £ |

## Guidance on getting connected

Existing guidance on getting connected is available on the Energy Network's Association's website and the websites of individual DNOs. Please find below some useful links to guidance on connecting storage, connection generation and flexible connections.

http://www.energynetworks.org/assets/files/news/publications/ENA%20Electricity%20Storage%20Guide.PDF

http://www.energynetworks.org/electricity/engineering/distributed-generation/dg-connection-guides.html

http://www.energynetworks.org/electricity/futures/flexible-connections.html