



# GC0139 Consultation

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## Defect

The existing requirements of the Grid Code (in respect of data exchange between DNOs and National Grid ESO) are insufficient for the coordinated and efficient planning of their networks as the industry transitions to a smart energy system and distribution operation activities.

## Why

To facilitate the efficient and coordinated planning of the Transmission System, National Grid need a greater understanding of the quantity, type and impact of Distributed Energy Resources connected to Distribution Networks.

To facilitate the efficient and coordinated planning of their Distribution Networks DNOs need a greater understanding of Transmission System flows and fault contributions within a variety of demand/generation scenarios.

If these changes are not made, as the overall system becomes more interactive, with increasing volumes of Embedded Generation, demand side services and active network management, it will become more difficult to achieve coordinated and efficient overall network planning to facilitate the transition to a smart energy system.



## What

### DNO to National Grid ESO Data Exchange

It is proposed to enhance the Grid Code requirements for week 24 and week 50 data submissions. This will provide National Grid ESO with:

- Full details of the sub-transmission network and any connections directly connected to the sub-transmission network
- Details of all distributed energy resource connections (and those “accepted to be connected”) greater than 1MW to the distribution network and their impact on energy flows at peak demand, summer minimum demand and solar peak/daytime-minimum demand.
- Details of all distributed energy resource connections less than 1MW to the distribution network, aggregated by fuel type and disaggregated by substations connecting to the sub-transmission network.



## What

### National Grid to DNO Data Exchange

It is proposed to enhance the Grid Code requirements for the week 42 data submission.

The data describing a transmission system model will be a switch level, single boundary format model. This model will cover the whole of the DNO area in detail, together with equivalent networks at agreed boundary points.

It is proposed that the transmission model shall be provided for the following demand points:

- Maximum fault level
- Peak demand
- Summer minimum demand
- Minimum fault Level (Summer)
- Solar-peak/daytime-minimum demand
- National high-power transfer dispatch scenario
- National low power transfer dispatch scenario

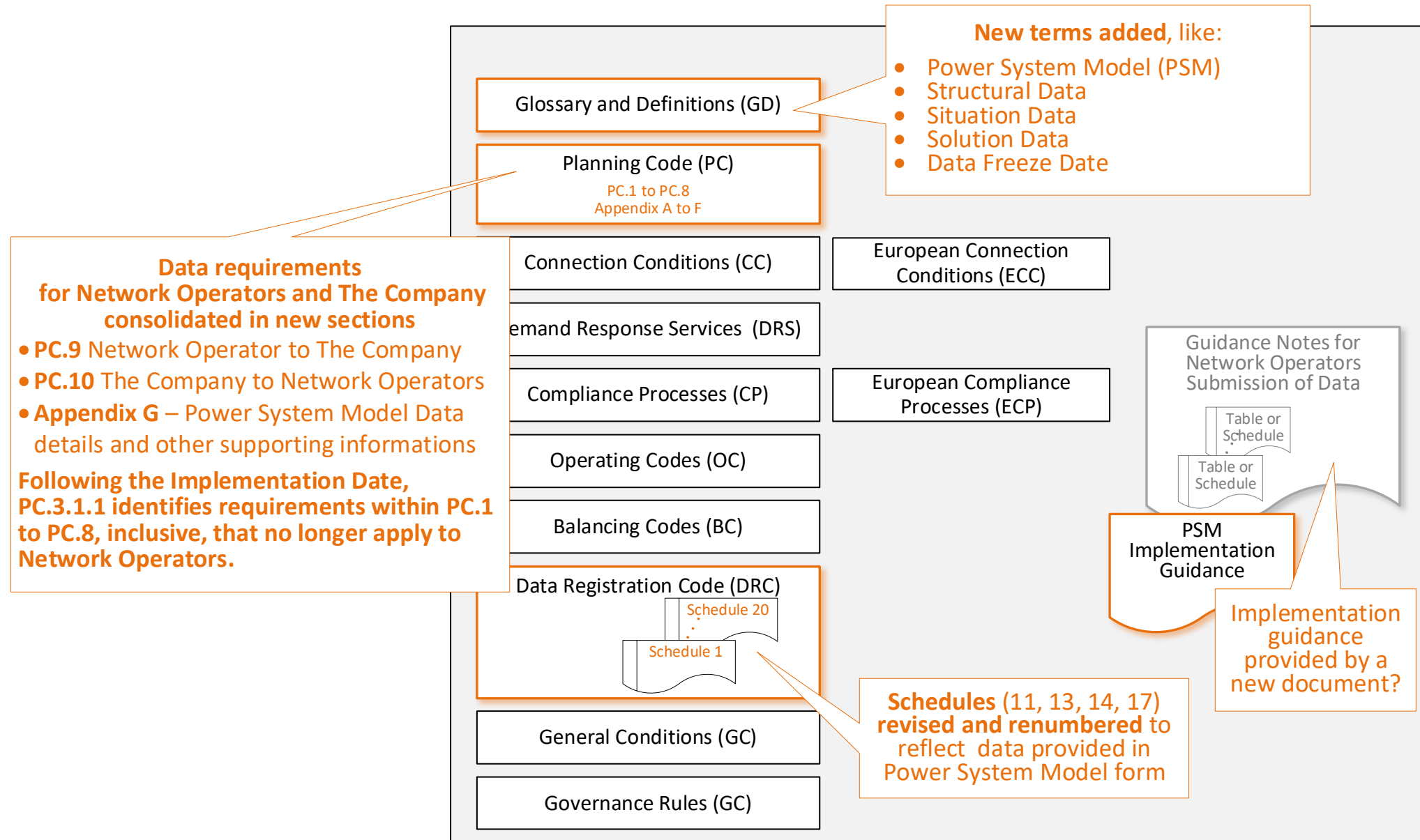


- The requirements of the PC will remain unchanged until the implementation date for this modification – currently January 2026.
- Post implementation date Network Operators will need to comply with the requirements of a new PC.9 and the Company will need to comply with the requirements of a new PC.10.
- PC.9 and PC.10 are augmented with a new appendix PC.G, new schedules within the DRC and a suite of new definitions within the Glossary & Definitions.
- PC.9 and PC.10 will require the exchange of Power System Models (PSM) in the Common Information Model (CIM) format. The PSMs will represent cardinal system loading points.
- PC.9 will also require the completion of several schedules communicating Connection Point demand and generation forecasts.
- PC.9 requires information that supports the Evaluation of Transmission Impact assessment process.



- Data exchanges support activities at The Company and Network Operators:
    - Routine grid data exchanges to facilitate efficient system planning
    - ‘As needed’ data exchanges to support grid connection or modification activities
  - Information is supplied in three forms
    - As a connected Power System Model (PSM) suitable for analysis calculations (steady state or short circuit). PSM information includes:
      - Structural Data: asset, generation and load characteristics, connectivity
      - Situation Data: grid condition
      - Solution Data: steady state power flow or short circuit calculation results
- PSM data is expressed as both grid snapshots and future projects
- As tabular data – DRC Schedules
  - As a narrative – Change Document & Scenario Document

# What parts of the GC are Impacted



# Changes to the PC



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PC.9 details submission requirements placed on Network Operators:

- PC.9.1 General information
- PC.9.2 Purpose & definitions
- PC.9.3 Submissions
  - Week 2
  - Week 28
  - Information for Evaluation of Transmission Impact Assessment
- PC.9.4 Subtransmission PSM
  - Scope
  - Components of Solved PSM (Structural, Situation, Solution), referring to Appendix PC.G.1 for detailed data requirements
- PC.9.5 Assessment of Site Compliance
- PC.9.6 Confidentiality and Sharing



PC.10 details submission requirements placed on the Company:

- PC.10.1 General Information
- PC.10.2 Purpose
- PC.10.3 Submissions
  - Week 12
  - Week 38
  - For Distribution Impact assessment or Transmission Licensee-initiated modification
- PC.10.4 NETS PSM
  - Scope
  - Components of Solved PSM (Structural, Situation, Solution), referring to Appendix PC.G.1 for detailed data requirements
- PC.10.5 Assessment of Site Compliance
- PC.10.6 Confidentiality and Sharing



Appendix PC.G provides detail in support of PC.9 and PC.10

- PC.G.1 Data to be included in a Solved PSM
- PC.G.2 Additional data not included in the Solved PSM
- PC.G.3 Organisation of PSM data
- PC.G.4 PSM Data Exchange Standards
- PC.G.5 PSM Scenario Document
- PC.G.6 PSM Change Document
- PC.G.7 Assessment of Site Compliance
- PC.G.8 Generation



|                          |                          | <b>Routine</b>   | <b>As Needed</b>  |
|--------------------------|--------------------------|--|---|
| <b>Network Operators</b> | Power system model (PSM) | Week 2: Solved Subtransmission PSM for historic NETS minimum demand<br>Week 28: Solved Subtransmission PSM for historic NETS peak demand | Evaluation of Transmission Impact assessment:<br>Planned connections and updated network development projects   |
|                          | Tabular                  | Week 2: Schedules 21C-E, 21G-J<br>Week 28: Schedules 21A-B, 21F-I, 17, 10A-C, 11C, 12A-C   |   |
|                          | Narrative                | Week 2: PSM Scenario Document/PSM Change Document<br>Week 28: PSM Scenario Document/PSM Change Document                                  |   |
| <b>The Company</b>       | Power system model (PSM) | Week 12: Summer Solved NETS PSMs for 4 forecast grid conditions<br>Week 38: Winter Solved NETS PSMs for 3 forecast grid conditions       | Distribution Impact assessment or Transmission Licensee-initiated modification:<br>Planned connections/works and updated network development projects |
|                          | Narrative                | Week 12: PSM Scenario Document/PSM Change Document<br>Week 38: PSM Scenario Document/PSM Change Document                                 |   |



- PSM
  - Solved Subtransmission Power System Model representing
    - Subtransmission System at historic NETS minimum demand condition
    - Subtransmission System minimum fault level condition
  - Description of Model changes related to each Subtransmission planned (firm) network development project and ‘accepted to connect’ connection
- Tabular
  - Revised Schedules 21C, D, E (GSP-level demand data – summer conditions)
  - Revised Schedules 21G, H (embedded power stations)
  - Revised Schedule 21I (embedded generation constraints)
  - New Schedule 21J (forecast aggregate registered capacity)
- Narrative
  - PSM Scenario Document
  - PSM Change Document



- PSM
  - Solved Subtransmission Power System Models representing
    - Subtransmission System at historic NETS peak demand
    - Subtransmission System maximum fault level condition
  - Description of Model changes related to each Subtransmission planned (firm) network development project and 'accepted to connect' connection
- Tabular
  - Revised Schedules 21A, B (GSP-level demand data - winter conditions)
  - Revised Schedule 21F (GSP-level demand data – access periods)
  - Revised Schedules 21G, H (embedded power stations)
  - Revised Schedule 21I (embedded generation constraints)
  - Schedule 17 (access period schedule)
  - Schedules 10A, B, C (system-level demand profiles – various conditions)
  - Schedules 12A, B, C (system demand reduction characteristics)
  - Schedule 11C (User's system active energy per customer type)
- Narrative
  - PSM Scenario Document
  - PSM Change Document



- PSM (Structural only)
  - Model changes describing each Power Station associated with ETI and any proposed related alteration to the Network Operator System
  - Representation of the Network Operator System at the time of connections proposed by the ETI



- PSM
  - Solved NETS Power System Models representing
    - Next summer's forecast NETS minimum demand condition
    - Next summer's forecast NETS minimum daylight demand condition
    - Next summer's forecast NETS low power transfer condition
    - Next summer's estimated NETS minimum fault level condition
  - Description of Model changes related to each NETS planned (firm) network development project and 'accepted to connect' connection
- Narrative
  - PSM Scenario Document
  - PSM Change Document





- PSM
  - Solved NETS Power System Models representing
    - Next winter's forecast NETS peak demand condition
    - Next winter's forecast NETS high power transfer condition
    - Next winter's estimated NETS maximum fault level condition
  - Description of Model changes related to each NETS planned (firm) network development project and 'accepted to connect' connection
- Narrative
  - PSM Scenario Document
  - PSM Change Document



- PSM
  - Model changes describing each new User connection or Transmission Licensee-initiated modification
  - Representation of the National Electric Transmission System at the time of proposed connection



- PSM Models & their profiles
  - Structural Model
    - Equipment (EQ) profile: grid asset, generation/load capability, connectivity
    - Short Circuit (SC) profile: short circuit characteristics of assets
    - Geospatial Location (GL) profile: geo-location of assets and facilities
  - Situation Model
    - Steady State Hypothesis (EQ) profile: switch states, load/generation injections, control settings
  - Solution Model
    - Topology (TP) profile: simplified connectivity (needed for calculations)
    - State Variable (SV) profile: output of power flow calculations
    - Short Circuit Results (SCR) profile: output of short circuit calculations



- CGMES (or LTDS) defines the data present in each profile
- Structural Model and Situation Model are inputs of grid calculations; Solution Model is output
- Many Situation Model/Solution Model pairs can be defined for the same Structural Model
- A PSDM describes a proposed future change to a Structural Model



The DRC is proposed to be expanded with a suite of new schedules to support PC.9 and PC.10. These schedules, are based on the 'Guidance Notes for Network Operator's Submission of Data' issued by the Company annually, are as follows:

- Schedule 21A – Demand/Generation forecast at time of NETS peak demand
- Schedule 21B - Demand/Generation forecast at time of Connection Point peak real demand
- Schedule 21C - Demand/Generation forecast at time of NETS minimum demand
- Schedule 21D - Demand/Generation forecast at time of Connection Point minimum gross demand
- Schedule 21E - Demand/Generation forecast at time of Connection Point summer daylight minimum gross demand
- Schedule 21F - Demand/Generation forecast at time of Access Period peak real demand
- Schedule 21G - Detail of Embedded Power Stations greater than or equal to 1MW
- Schedule 21H - Detail of Embedded Power Stations less than 1MW
- Schedule 21I – Embedded Generation Constraints
- Schedule 21J – Aggregated Forecast Registered Capacity

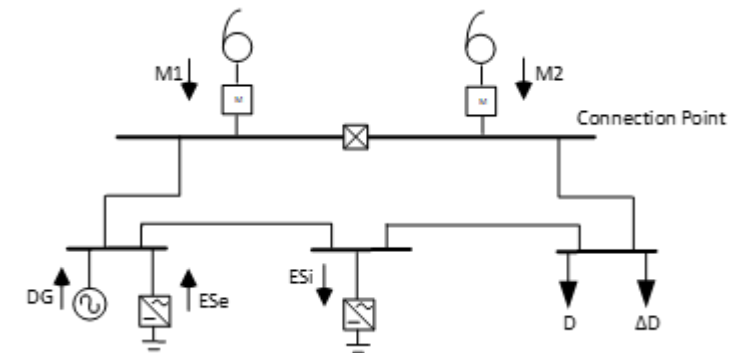
# Power Flow Definitions used in PC.9, PC.10 & DRC



- M1, M2 - Measurement at the Connection Point
- DG - export from embedded generation other than from Electricity Storage
- Esi - import to Electricity Storage
- ESe - export from Electricity Storage
- D - aggregate network / customer demand
- $\Delta D$  - Latent Demand

Where:

- **Group Demand** =  $D + \Delta D$  [underlying customer demand]
- **Group Demand** =  $(M1 + M2) + (DG + ESe) - ESi + \Delta D = (D + \Delta D)$
- **Latent Demand** =  $\Delta D$  [factors that modify the underlying customer demand]
- **Embedded Generation Export** =  $DG + ESe$
- **Embedded Generation Import** =  $ESi$
- **Measured Import** =  $M1 + M2$
- **Gross Demand** =  $(D + \Delta D) + ESi$
- **Net Demand** =  $M1 + M2$



# Glossary & Definitions – New Definitions



| Term                              | Definition   |  | Term                                 | Definition   |
|-----------------------------------|--|--|--------------------------------------|--|
| Aggregated Energy Source          | The aggregation of <b>Energy Source</b> types as defined in PC.G.8.2   |  | Network Data                         | The data to be provided by <b>The Company</b> to <b>Users</b> in accordance with the <b>PC</b> , as listed in Part 3 of the Appendix A to the <b>PC</b> or PC10 as appropriate.  |
| CIM Standard                      | A standard published by a standards body (e.g., IEC, BSI) which utilises <b>CIM</b> concepts. <b>CIM</b> Standards describe various facets of <b>CIM</b> and its use: the underlying information model, data exchange and serialisation  |  | Power System Difference Model (PSDM) | A digital model that describes changes to the <b>Structural Data</b> of a <b>PSM</b> .   |
| CIM                               | Common Information Model is an abstract information model that describes and organises electricity power system data. Such a model provides a standard way of representing assets owned and / or operated by a <b>User</b> and assets of customers connected to <b>Users' Systems</b> and facilitates the integration of independently developed power system modelling applications.  |  | Power System Model (PSM)             | A digital model of an electricity transmission and/or distribution system created for the purpose of performing studies. It organises the relevant data into: <b>Structural Data</b> , <b>Situation Data</b> , and <b>Solution Data</b> , and facilitates data exchange between relevant parties.  |
| Data Freeze Date                  | The date at which the <b>Structural Data</b> of a <b>Network Operator's Solved PSM</b> reflects the <b>Network Operator's System</b> .   |  | PSM Change Document                  | A document associated with a submission describing changes to the <b>NETS</b> or <b>Network Operator's</b> system or its operation and changes to the assumptions used in the creation of a <b>Solved PSM</b> and/or the associated schedules forming part of the periodic information exchanges. Additional detail is provided in PC.G.2. |
| Evaluation of Transmission Impact | as defined in the <b>CUSC</b> .  |  | PSM Implementation Date              | 1 <sup>st</sup> January 2026 unless otherwise agreed in accordance with PC3.1.2.   |
| Embedded Generation Import        | Import to an <b>Embedded Customer's</b> site where the primary purpose is wholly or mainly that of an <b>Embedded Generator</b> . When establishing the primary purpose, the <b>Network Operator</b> will consider factors including: <ul style="list-style-type: none"><li>the maximum export capacity relative to the maximum import capacity;</li><li>whether the <b>Embedded Customer</b> has a generation licence or licence exemption; and</li></ul> whether the <b>Embedded Customer's</b> site is categorised as having a demand connection or generation connection as defined in DCUSA Schedule 22.  |  | PSM Interface Node                   | A point in an interconnected electrical system model that defines the boundary either side of which different parties are responsible for data.  |
| Embedded Generation Export        | Export from an <b>Embedded Customer's</b> site.  |  | PSM Scenario Document                | A document associated with a submission which provides information relating to the assumptions used in preparation of the solved <b>PSM</b> and the associated schedules. Additional detail is provided in PC.G.1.   |
| Energy Source                     | Any of the sources of energy listed in PC.G.8 used in the production of electricity.   |  | Situation Data                       | Data representing an operational state of an electricity system, including demand and generation output and switch positions.  |
| GB CIM Governance Group           | A GB standing group of technical experts who are responsible for the maintenance and coordination of the GB extensions to the <b>CIM</b> and to CGMES profiles, such that they effectively support the Grid Code and other relevant data exchanges.  |  | Solved PSM                           | A <b>PSM</b> which includes <b>Structural Data</b> , <b>Situation Data</b> , and <b>Solution Data</b> .  |
| Gross Demand                      | The sum of the <b>Group Demand</b> and <b>Embedded Generation Import</b>   |  | Solution Data                        | Data comprising the results of a steady-state power flow calculation and/or short circuit calculation, together with topology, voltage, and power flow data representing a steady-state solution using a coordinated <b>Structural Data</b> and <b>Situation Data</b> .  |
| Group Demand                      | Aggregate import to <b>Embedded Customers'</b> sites other than to those where the primary purpose is wholly or mainly that of an <b>Embedded Generator</b> . When establishing the primary purpose the <b>Network Operator</b> will consider factors including: <ul style="list-style-type: none"><li>the maximum export capacity relative to the maximum import capacity;</li><li>whether the <b>Customer</b> has a generation licence or licence exemption; and</li><li>whether the <b>Customer's</b> site is categorised as having a demand connection or generation connection as defined in DCUSA Schedule 22.</li></ul> When estimating the <b>Group Demand</b> the <b>Network Operator</b> should, where necessary, take into consideration <b>Latent Demand</b> . |  | Structural Data                      | Data representing the characteristics of electricity system assets, including their capabilities and connectivity.   |
| Latent Demand                     | An increase in <b>Group Demand</b> that would appear: <ul style="list-style-type: none"><li>If any demand side response was not operating;</li><li>If any <b>Suppliers'</b> time of use tariffs were not implemented;</li><li>If any <b>Network Operator</b> or <b>The Company's</b> price signals were not implemented;</li></ul> If any other means of suppressing the <b>Embedded Customer's</b> demand were not operating; orIn the event of <b>Cold Load Pickup</b> .   |  | Subtransmission PSM                  | A <b>PSM</b> with the scope as set out in PC.9.5.1   |
| Measured Demand                   | Demand measured at the relevant <b>Connection Point</b> . Sometimes referred to as the net demand.   |  | Switch-based Model                   | A <b>PSM</b> that includes all relevant switching devices. Such a model can be used to represent different system topologies, compared to a node and branch model which generally only represents a single system topology.  |
| NETS PSM                          | A <b>PSM</b> with the scope as set out in PC.10.4  |  |                                      |  |