Challenges and scope

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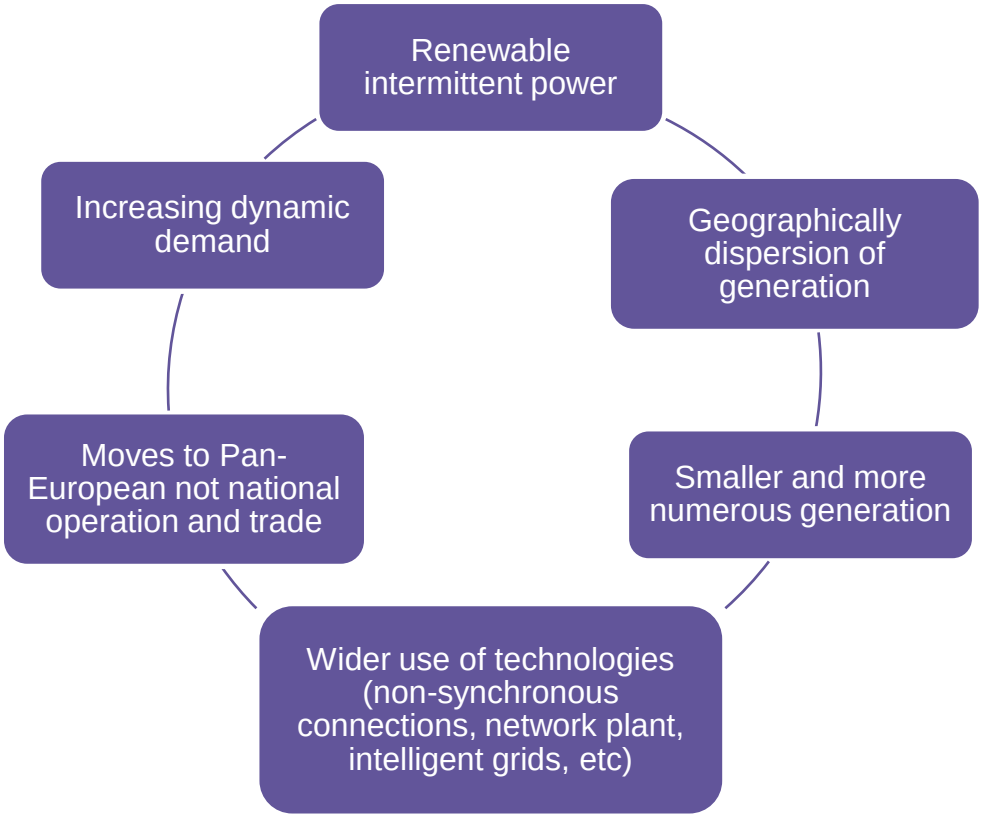
Reliable Sustainable Connected

Topics

1. Challenges ahead driving DCC philosophy
2. Principles used and impact on scope and content
3. Options for high RES and drivers for new requirements
4. New European requirements

Challenges Ahead - Drivers

Change is at the core of Transmission network planning and operation



However scale and speed of change in recent years is unprecedented

Challenges Ahead – Results of change

Within last 10 years:

- New generation has used most ‘spare’ capacity on the network
- Renewable grown to excess of minimum load in some countries
- Renewables built in remote (sparse) sections of network
- Centralised to dispersed generation (with reduced control and services)
- Greater energy efficiency in demand
- Networks highly leveraged
- Bi-directional power flow with distributions networks
- More automated users and networks
- Offshore generation
- Step change in interconnection
- Major network development programmes

10 years is within lead-time taken to build a major transmission line

Challenges Ahead – Necessary Response

Fundamental change to network planning and operation by TSOs to integrate RES and move from national to synchronous or European network view.

Network codes through EC 3rd legislative package will be instrumental in this

Key challenges identified within the context of this code:

- Replacing services previously held on large scale generation
- Dealing with the volatility of renewable energy sources
- Performance of distribution networks
- Ensuring Smartgrids deployment provides benefit to these needs

Challenges Ahead - Options to deal with High RES

Demand response appears to be most effective option

Option	Pros	Cons
synchronous conventional generators are required to provide the most significant system services	▪ No significant change from today	▪ Cost constraining off RES ▪ CO_2 emissions - RES constrained off ▪ 100 % CO_2 free production only with nuclear and CCS ▪ Risk of lack of system services
RES generators to provide their share of the system services	▪ No additional CO_2 emissions for voltage support services	▪ RES has to be constrained (and therefore wasted) ▪ Embedded generation needs full control
extensive building of storage systems	▪ Only limited CO_2 emissions (from less than 100% cycle efficiency) ▪ Supports RES integration	▪ New storage systems have to be built Europe wide ▪ Feasibility not in all areas ▪ High environmental impact
demand facilities provide their share of system services	▪ No additional CO_2 emissions ▪ Supports RES integration ▪ Services have the potential to be provided at low/no cost or minimum consumer impact ▪ Highly reliable - risk spread ▪ Consumers are able to participate in market to reduce CO_2 and will pay less	▪ Public perception of possible inconvenience ▪ Public acceptance ▪ DSOs need to contribute more towards managing a system with high RES (e.g. voltage)

Location in network requires that adequate network performance ensured both from both transmission and distribution networks to realise the full potential of RES

Challenges Ahead – Key points

1. Change is not new, but present rate and scale of change is

2. Moving to a decarbonise, high RES, provides major challenges

3. Problem in planning terms is already upon us; developing new tools/services to meet challenges needed immediately

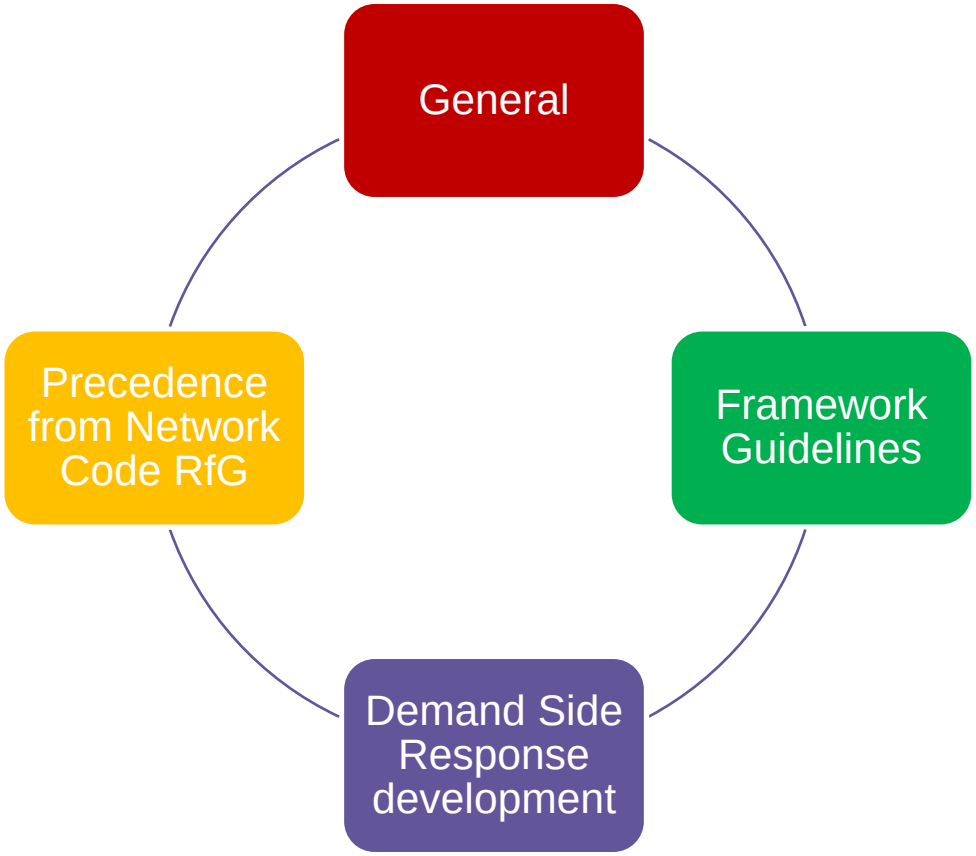
4. Distribution networks increasingly important in balancing demand and generation

5. All users can and may play a role going forward

6. Increased volatility in future network development predictions increases need for a more flexible and wider source of network services

DCC Scope

High level principles categorised in four areas:



General

- European harmonisation in three EC objectives to avoid EC derived code
- System Operation (TSOs/DSOs) responsibility of each system operator
- Demand elements of a Power Generating Facility, is not classed as a demand user
- Costs allocation/tariffs/etc (with exception of FWGL CBA process requirements) are not part of this code
- Equitable treatment of all demand customers
- Technology neutral approach
- Rational for requirements will be in a separate high level document and FAQs

Framework Guideline

- Meet requirements in Framework Guideline on Grid Connection July 2011
- Functional requirements/capabilities only in Network Code not their use
- Compliance is only for requirements in the NC and these requirements specifically
- Retrospective application in line with FWGL and RfG will only be implemented at a National level following TSO demonstration in a CBA and agreement with National Regulatory Authority of need and appropriateness
- Quality of connection (i.e. Number of circuits, etc) is not part of this code
- Demand connected that singularly or grouped that causes a cross border issue is covered by code regardless if they are connected to TSO and DSO networks
- DSOs are treated as significant demand users
- Closed Distribution Networks are covered in NC as per 3rd legislative package

Framework Guidelines

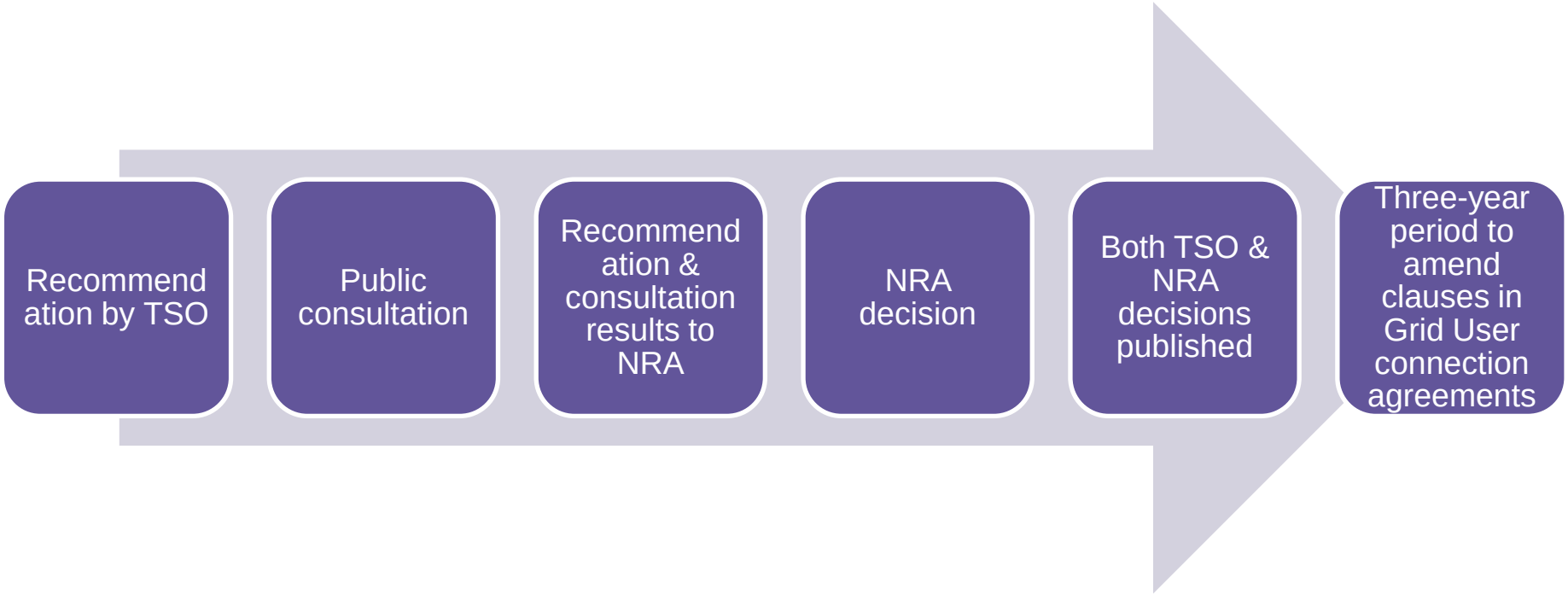
Frequency and voltage parameters	Section 2.1
Requirements for reactive power	Section 2.1
Load-frequency control related issues	Section 2.1
Short-circuit current	Section 2.1
Requirements for protection devices	Section 2.1
Balancing capabilities and provision of ancillary services	Section 2.1, 2.1.1,and 2.1.2
Equipment requirements at connection point	Section 2.1.1 and 2.1.2
Disconnection/Islanding/Reconnection	Section 2.1.3
Instructions provide by TSO/DSO to user	Section 2.1.2 and 3.2
Information/Data exchange	Section 3
Compliance	Section 2.4
Derogation	Section 2.2
Enforcement period	Section 2.3

Precedence from Network Code Requirements for Generators

- Format and approach to be aligned with Draft Requirements for Generators Network Code
- Requirements will be of a number of different format
  - European single threshold
  - European range Synchronous Value
  - European range TSO/Relevant network operator value
  - European capability TSO/Relevant network operator specified application
  - No mention in code, National Code applies
- RfG Approach followed for consistency and non-discrimination
  - Retrospective application
  - Operational Notification
  - Derogation

Retroactive application

If CBA justifies retroactive application for a user or a class of users



Operational Notification Procedure

EON

- Energisation Operational Notification …
  - Permission to energise internal network

ION

- Interim Operational Notification …
  - Permission to operate temporarily

FON

- Final Operational Notification …
  - Permission to operate unconditionally

LON

- Limited Operational Notification …
  - Permission to operate temporarily with constraints

… to be issued by the Relevant Netw

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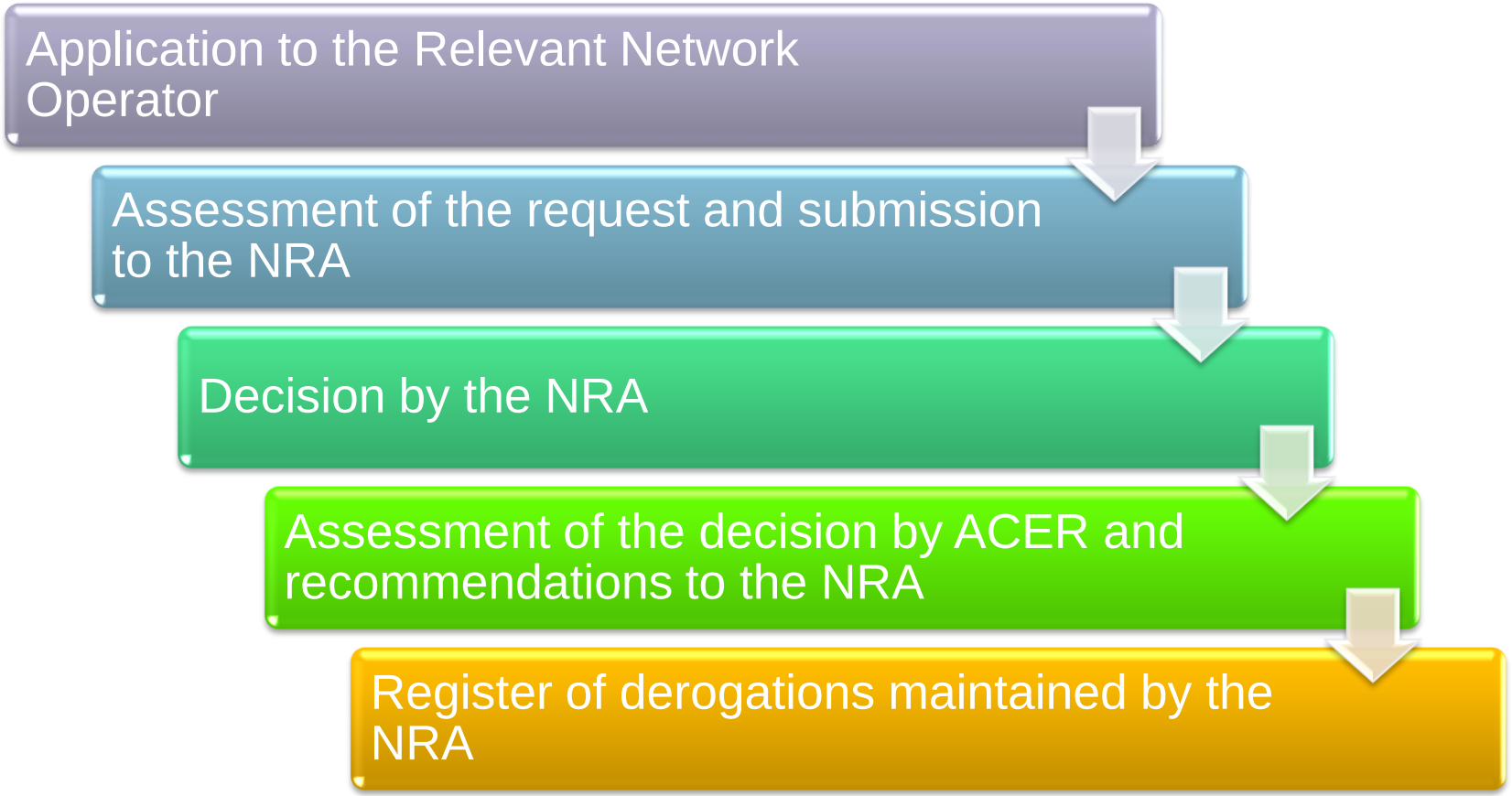
Procedure for derogations



Demand Side Response Development

- Political agenda for the development of a Smart Grid network will be realised over the next few years
- DCC should provide requirements for DSR based on this concept assuming high take up from domestic level upwards
- The DCC should be cognisance of EC Mandate 490 on ‘Smartgrid’ standards development
- Demand Side Response (‘Smartgrid') is in the code in the context of cross border issues:
  - Included: Wide spread phenomena frequency management/voltage collapse/etc
  - Not Included: Localised phenomena Self healing networks/ Localised automatic local voltage/Post fault sectionalising management

Level of Detail

Cross border impacts can arise from:

1. Localised events cascading into wide spread events
2. Aggregated impacts of large numbers of smaller sized system users

Therefore ENTSO-E's view is:

- Detail is adjusted to the purpose of each requirement - Determined by the extent of the system-wide impact of each requirement.
- The NC DCC focuses on significant users which are either Demand Facility or Distribution Networks (DSO or Closed Distribution Network Operator) connected to the transmission system.
- Facilitate all players to participate in the market place, all users significant grid users in the context of DSR.

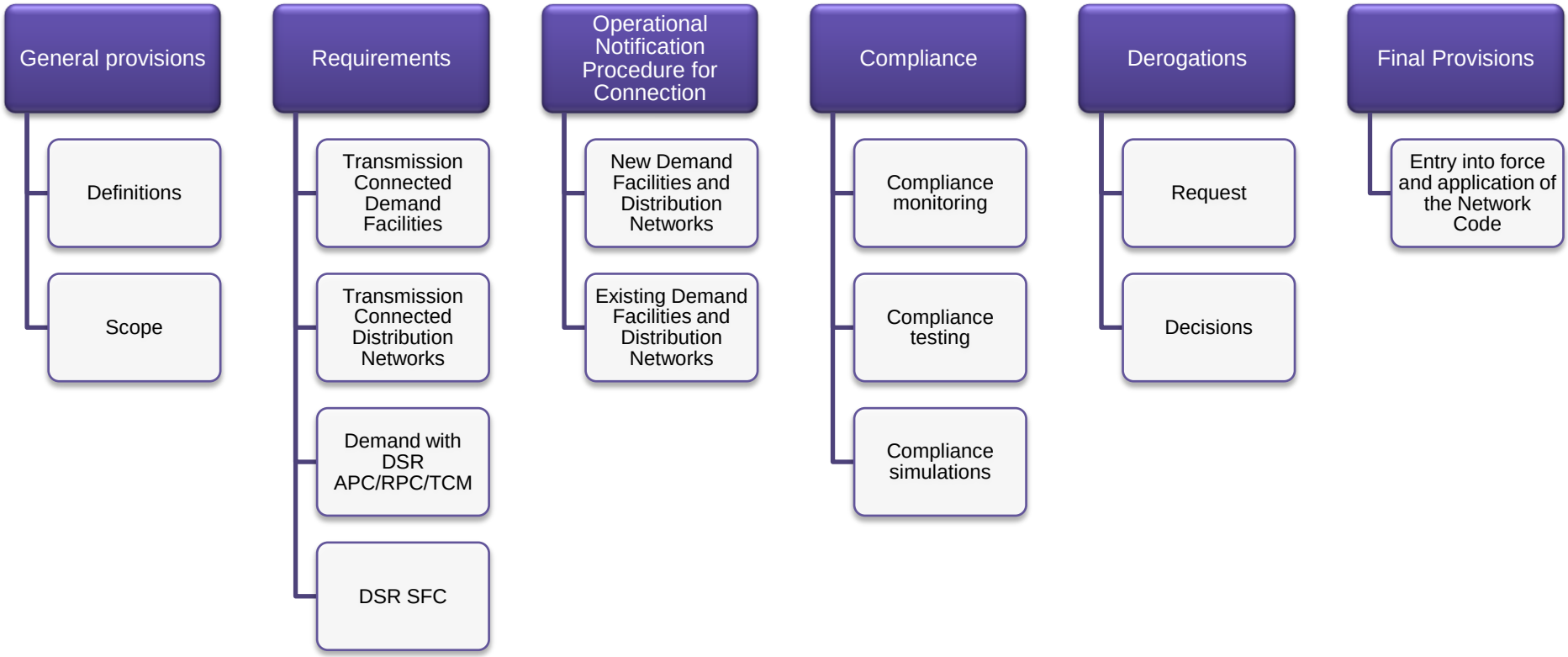
New European Requirements

The new requirements identified by ENTSO-E cover the following:

1. Demand Side Response delivering Reserve Services
2. Demand Side Response delivering System Frequency Control
3. Reactive power exchange capabilities
4. Voltage withstand capabilities
5. Frequency withstand capabilities

These will be covered individually this afternoon in a series of discussions

Network Code structure



Thanks for your attention!