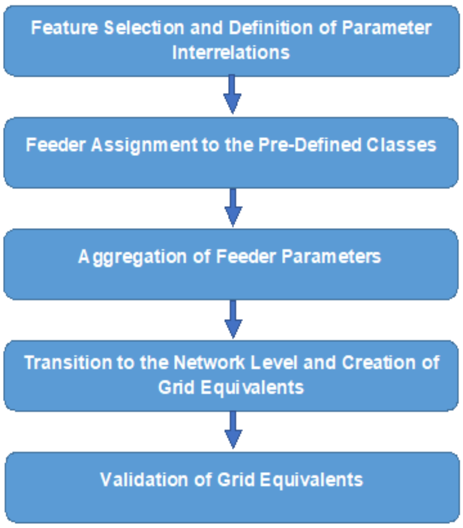
INTERPLAN

INTEgrated opeRation PLANning tool towards the pan-European network

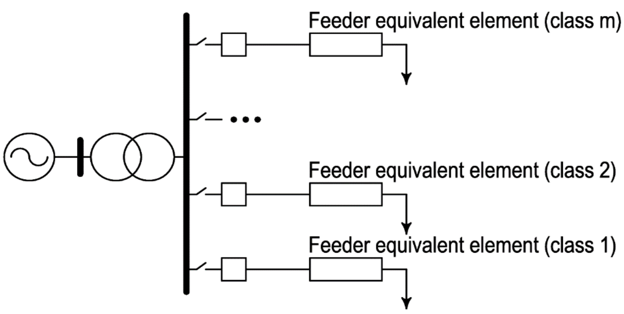
Transforming Grid Operation Planning

Approach for generating grid equivalents

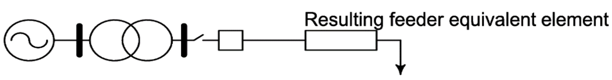
To support the EU power system planning and operation, a more fruitful interaction between DSOs and TSOs is expected, for which grid equivalents representing different parts of electrical networks are required. A fundamental step for this is feeder/ grid clustering, which allows identifying unique grid/ feeder clusters depending on specific network properties. Clustered electrical networks will provide the basis for the creation of a standardized reference grid model, permitting a wide range of simulations while requiring limited data input.



Basic algorithm for generating grid equivalents



Equivalenting of the population of feeder classes



Single equivalent representation

The basic grid equivalent should represent in a simple model the complex grids by only considering basic characteristics like connection node voltages and reactive and active power values. This can be achieved by scaling up of most representative feeders based on grid clustering. Thus, the resulting grid equivalent should look like a small network model with one or more feeders depending on the different identified feeder/network classes.

Type of grid equivalents:

- *Basic Grid Equivalents –* Simple representation of the grid focusing on preserving Voltage, Active and Reactive power characteristics.
- *Advanced Grid Equivalents –* Complex representation considering also different voltage levels and equivalenting different grid areas.
- *Dynamic Grid Equivalents –* Simple or Advanced Grid Equivalents suitable for transient stability studies.

Project duration

1 November 2017 - 31 January 2021

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This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 773708

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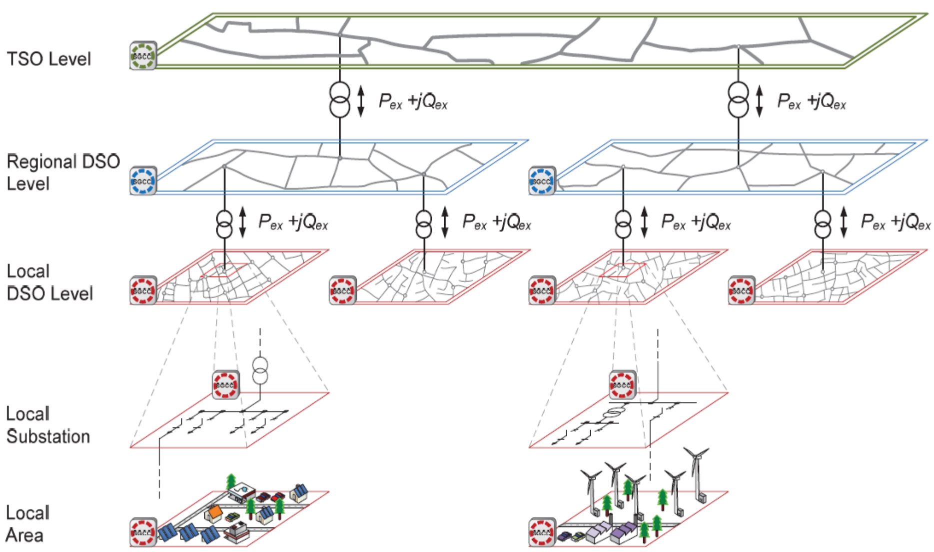
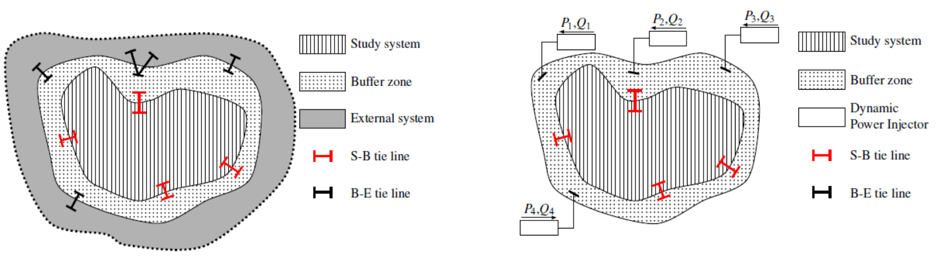
The advanced grid equivalents should be a combination of basic grid equivalents considering the topology and different voltage levels. The main idea is to keep as intact as possible the grid transformers parameters of the voltage levels under focus. The next figure shows for what parts of the network grid equivalenting should/could be performed.



Voltage levels used for the advanced grid equivalents

The dynamic grid equivalent consists of dynamic power injectors (DPIs) distributed along the boundary of the study system and emulating the response of the external system to active power imbalance and frequency excursions. The equivalent focuses on the global of rotor oscillation, which is the well-damped oscillatory mode with the lowest frequency present in all machine speed responses. The figure below represents and abstract illustration of the reduction of a large power system.



(a) Unreduced system divided into a study system, buffer zone and external system.

(b) Reduced system with external system replaced by DPIs.

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INTERPLAN Tool Grid Equivalents:

Provision of grid-equivalents covering all voltage levels to be incorporated in the operation planning and semi-dynamic simulations environment.

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