INTERPLAN

INTEgrated opeRation PLANning tool towards the pan-European network

Transforming Grid Operation Planning

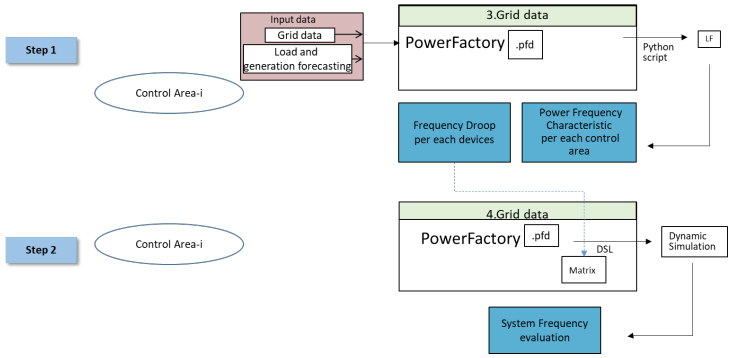
Use Case 4: **Fast Frequency Restoration Control**

Objective: Improving frequency stability by using local distributed resources integrated in the grid.

Network operation planning criteria: Assuring transient stability, maximizing DG/DRES contribution to ancillary services, Assuring frequency stability.

Use case solution: Identification of instability events in predefined control areas and activation of specific functions to, locally, solve local problems. These functions: (i) solve the total tie-lines active power variation by using the assets in the control area; (ii) evaluate the active power flexibility available at local resources level; (iii) define the power-frequency response per each resource.

Context diagram:



Operation challenge:

- Frequency stability

Actors:

- TSO
- DSO
- Aggregator

Controllable units:

- Synchronous generators
- DRES and DG

Description:

Step1: Calculate the total power-frequency characteristic per each control area of the power grid under analysis. Thus, based on the asset's flexibility information, the frequency droop per each device is calculated. Calculation of frequency droop per each device is used as input setting for the asset's dynamic models.

Step2: Frequency Droop per each device is systematized under a matrix. A dynamic simulation of an instability event is performed. This is done in order to locate the instability event in the grid and verify the effectiveness of the devices frequency droop calculated at step one. System Frequency is evaluated whereas post-processing is performed offline. The post-processing result is a set of plots and KPIs metrics.

Project duration

1 November 2017 - 31 January 2021

Contact

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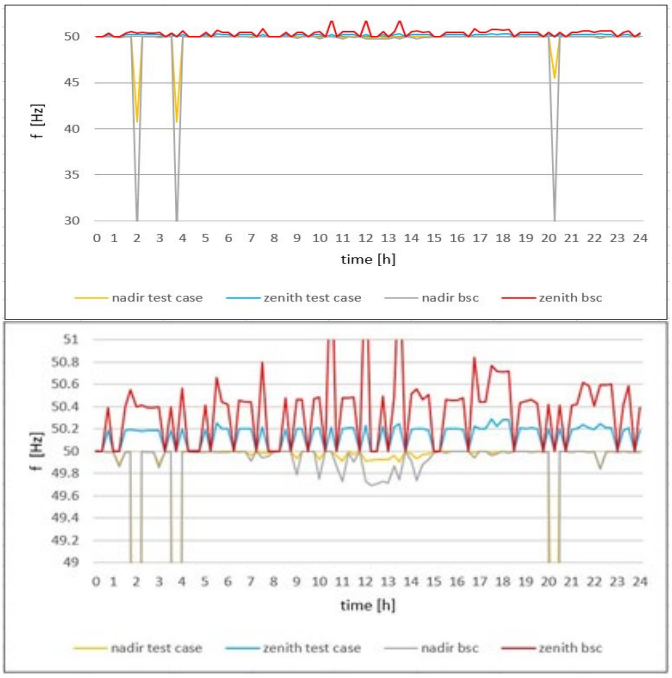
The key results of implementing use case 4 control functions:

Frequency restoration control effectiveness

The upper diagram shows frequency minimum and maximum values after a generator/load trip with (yellow and blue curves) and without (grey and red curves) use case 4 control function.

In the lower diagram, a zoom in the interval 49-51 Hz is presented.



- The three most severe cases (f<48 Hz) are the synchronous generator trips. In those cases, the system was unsuccessful in bringing the frequency back to safe operational values due to a lack of frequency support from UC4 (as synchronous generators are not within defined control areas). In the rest of the cases, (where the trip occurred in one of the control areas) UC4 has helped with reducing frequency nadir/zenith.

- The simulation is performed for the time range of 00:00 to 23:45 with the resolution of fifteen minutes.

INTERPLAN Tool Use Case 4:

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