ANCILLARY SERVICES

PASREN – Provision of Ancillary Services from Regional Energy Networks

Funding:
Swissgrid, Innosuisse

Duration:
02.2017-12.2020

PI:
Dr. R. Cherkaoui (EPFL-PWRS) &
Prof. Dr. P. Favre-Perrod (HES-SO-Fribourg)

Partners:
EPFL-PWRS, HES-SO-Fribourg, Groupe-E, Swissgrid

Contact:
Dr. R. Cherkaoui
Prof. Dr. P. Favre-Perrod

Distributed energy resources (DERs) installed in regional energy networks (RENs) can be exploited to provide both active and reactive power reserves to the transmission system at their connection point. The outcomes of PASREN cover all parts of electric power system and propose a solution for integrating more renewable energy resources throughout the grid. Therefore, a bottom-up and top-down approach is followed by the definition of DSO's capacities and TSO's needs in providing ancillary services.

Method for the definition of DSOs capability to provide ancillary services to the transmission grid based on the later needs

PROJECT GOALS

PASREN project aims at developing three fully independent tools to address the three below-mentioned goals.
Therefore, PASREN develops:

- 1 - a framework for sizing the required active and reactive power reserves of transmission system operator (TSO, e.g., Swissgrid) from RENs;
- 2 - a linear methodology to redispatch the DERs installed in a REN (e.g., Group-E Network) in such a way that the requested active and reactive power reserves of TSO are provided at the REN connection point;
- 3 - a linear methodology to characterize the capability area of RENs (e.g., Group-E network) for provision of active and reactive power reserves to TSO at their connection points.

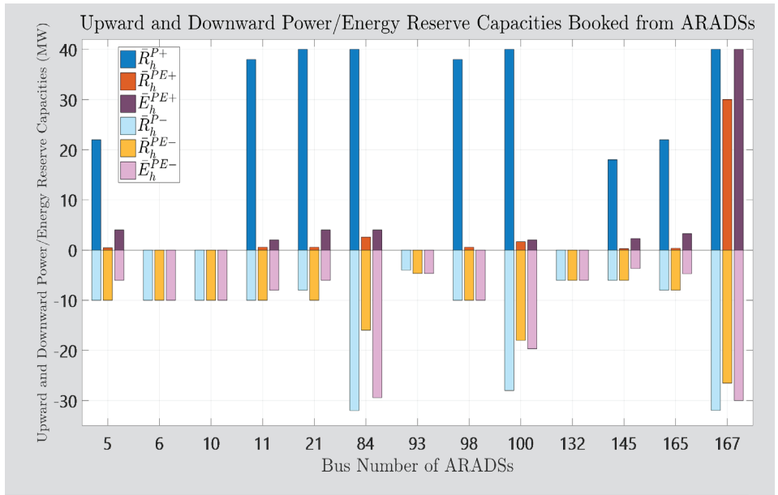

Fig. 1 Swissgrid's required active power reserve capacities from RENs.

RESULTS

1. A linear multi-period multi-scenario method was developed to size the required active power reserve of Swissgrid from RENs.
2. A linear methodology was developed to characterize the capability of primary distribution systems (voltage level 5 of Switzerland network) for provision of both active and reactive power reserves to the upper-layer grids at their connection points.
3. The statistical analysis of wind and PV production considering up to 10 years, depending on the available weather data [1], is performed. The mean, minimum with 84% probability and maximum with 16% probability of available power are determined at each time step (10 minutes) for all studied period. The simulation model of the real DSO network NL3 (Groupe E) containing 55 loads (53 load profiles and 2 constant industrial loads) and 5 wind turbine parks (204.2 MW) is prepared for AS analysis.

Credits for the results 1 and 2:
EPFL-PWRS.
Credits for the result 3:
HES-SO Firbourg.

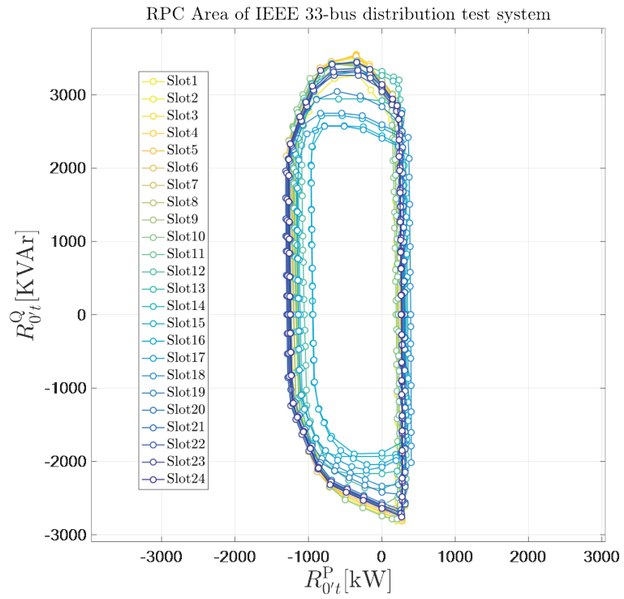

Fig. 2 A day-ahead estimated capability of IEEE 33-bus test system for provision of both active and reactive power reserves to the upper-layer grid at its connection point for all 24 hour of the next day.

INNOVATION

To our best knowledge, PASREN is the first activity dealing with the solution for the three above-mentioned goals.
The PASREN project is performing the analysis that allows to define DSOs network capability to provide AS to higher network layers.
The potential supplementary AS providers can cover the increased need in AS or/and substitute the conventional AS providers.

IMPACT

The outcomes of PASREN help:
A) TSO to economically size its required active and reactive power reserves from RENs;
B) DSOs operating RENs, to find a concrete perception from their potential capabilities for provision of active and reactive power reserves to the TSO.
PASREN can be regarded as a solution for tighter and more reliable cooperation between different grid-levels operators and a transition from the current top-down ancillary services provision manner to a bi-directional manner. This transition improves the electric power systems security of supply against contingencies and reduces the cost of ancillary services by diversifying the ancillary services providers and increasing competition between them.

NEXT STEPS

The next step concentrates on the resources redispatch in REN (third objective) while considering REN represented by different voltage levels.
Implementation of various AS provision scenarios on the defined network simulation models.

FURTHER READING:

M. Kalantar-Neyestanaki, M. Bozorg, F. Sossan & R. Cherkaoui, Allocation of Frequency Control Reserve from Aggregated Resources of Active Distribution Systems., [in] Power Syst. Computation Conf., Dublin, Ireland, Jun., 2018.

O. Galland & P. Favre-Perrod, Provision of ancillary services from regional energy systems (PASREN): Distribution network, Poster presented at 2018 Annual Conference, Oct. 2018.

LINKS:

SwissGrid Web Page.
Groupe-E Web Page.
SCCER-FURIES on Innosuisse Web Page.