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On Section 4 - Smart Inverters

Additional submitted attachment is included below.

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Project Title: Distributed Energy Resources (DER) Roadmap
Comments on Section 4: Smart Inverters

Dr. Aminul Huque, Principal Project Manager, Electric Power Research Institute (mhuque@epri.com)
Presented at the Staff Workshop Regarding DER Roadmap Draft Technical Assessment; Sacramento, CA; March 25, 2019

Opening Remark

This draft DER Integration Technical Assessment ("Technical Assessment") documents the relevance of smart inverters based on recent publications on the state of the science and related practices. This Technical Assessment provides an overview of the state-of-the-art technology, current status of standards, and examples of several projects related to smart inverters.

However, the current draft lacks a description of the technical gaps between the present state of development and the ability to utilize smart inverter capabilities. Identification and analysis of these gaps is needed if there is a need or desire to maximize benefits to DER owners and the overall power system. EPRI suggests these gaps can be addressed as the project progresses through the research roadmap development task.

Characterization of Technology and Strategy

The draft implies that a battery is a must-have requirement for smart inverters. However, research has demonstrated that smart inverters with solar PV or Wind, without energy storage, can also offer several grid support functionalities. Energy storage alone or with PV, connected to the smart inverter can offer additional functionalities.

Smart Inverter Cost

In this draft Technical Assessment, increased cost has been identified as one barrier to larger scale deployment of smart inverters. Clear identification of the sources of the additional costs would clarify the means by which those costs might be addressed.

For example, most of the additional cost needed might be for communication and management systems (which might be justified as part of overall grid modernization investments anyway). Additional costs, if any for the smart inverter itself, might be minimal. In case of autonomous functions (like Rule 21 Phase 1) there appears not to be any additional cost for DER owner at this time.

Smart Inverter Metrics

The Technical Assessment may wish to additionally consider a few other metrics:

- Accuracy of active function and setting implementation - *Reliability*
- Impact of firmware changes on the active function settings – *Reliability, Security*
- Availability to provide grid services when called for – Reliability, Flexibility,
- Response time to external signals – *Reliability, Security*
- Impact on generation/customer energy bill – *Sustainability, Affordability*

Research Needs

The Technical Assessment has identified several research needs including quantifying the benefits of smart inverters, need for communication networks, cybersecurity, standard communication protocols, role of smart inverters (SI) to improve overall system reliability, and extended real-world demonstration of SI use cases.

EPRI proposes few additional research needs for consideration including:

1) Maximizing the benefits of smart inverters to owners and to the grid, especially by utilizing custom settings of the advanced grid support functions based on DER location, feeder characteristics, and desired application. ***(near-term)***
2) Incorporating smart inverter capabilities in the DER interconnection screening process. ***(near-term)***
3) Coordinating transmission and distribution requirements for smart inverter functions and settings. ***(near- term)***
4) Incorporating smart inverter models in distribution and transmission planning and protection tools to accurately analyze their impacts. ***(mid- term)***
5) Harmonizing smart inverter requirements in Rule 21 to match IEEE 1547-2018. ***(mid- term)***
6) Identifying economic and market mechanisms to enable grid-services from smart inverter-coupled DER. ***(long-term)***

Concluding Remark:

In most cases smart inverters can help mitigate many grid issues caused by the distributed variable generation resources, like solar PV. However, EPRI believes additional research and demonstration regarding grid level solutions could also be needed, depending on the circuit conditions, DER penetration, and circuit load. Smart Inverters appear to hold great potential as a key components of the overall grid modernization effort to enable higher penetration of DER in a safe and more reliable manner.