

Interconnection and Interoperability Requirements of Hydrogen Assets to Enable Grid Integration

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BACKGROUND/INDUSTRY IMPACT

- Support interoperability and interconnection standardization of hydrogen assets.
- Reduce the cost of integrating hydrogen assets into power systems.

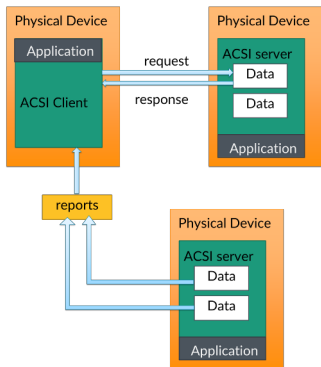
PROJECT OVERVIEW/OBJECTIVES

- Develop controller-hardware-in-the-loop and power-hardware-in-the-loop test bed to support interoperability and interconnection-related experiments.
- Perform code development and testing at NREL's Energy Systems Integration Facility.

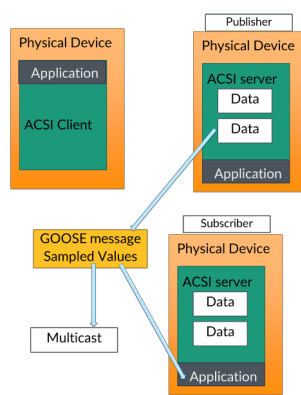
Interoperability

- Support interoperability standards for electrolyzers, fuel cells, fuel cell inverters.
- Interoperability standards guide the communication between different assets in the system.

Client-server architecture



Publisher-subscriber architecture



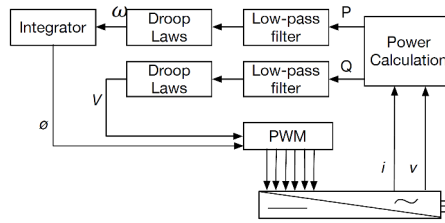
METHODS

- Using Triangle MicroWorks to develop .icd files for IEC 61850
- Will work with IEC 61850 to update the interoperability codes developed under this work
- Will use Banshee microgrid model as a test microgrid model for the microgrid use cases and support the grid-forming and grid-following use cases for the fuel cell inverter
- Will use 100-kW fuel cell and 100-kW commercially available fuel cell inverter for this work

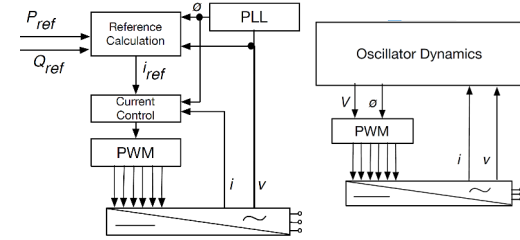
References

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GRID-FOLLOWING CONTROLS

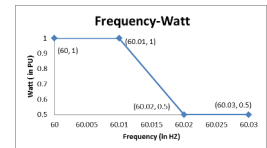
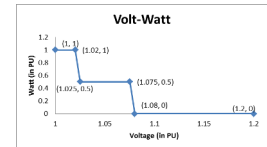
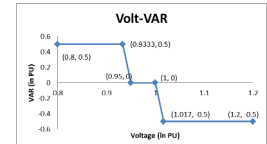
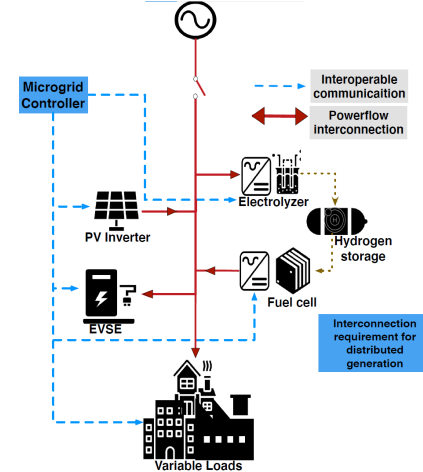


GRID-FORMING CONTROLS



Interconnection

- Support interconnection standards for electrolyzers, fuel cells, fuel cell inverters.
- Interconnection standards guide the power interactions between the assets in the system.



KEY OUTCOMES/MILESTONES

- Developed novel interface for running power-hardware-in-the-loop experiments with the fuel cell inverter
- Tested the codes in BeagleBone boards at the Energy Systems Integration Facility
- Completed digital real-time simulation model and purchase of microgrid controller for the experiments planned in budget Period 2
- Finalizing the controller-hardware-in-the-loop and power-hardware-in-the-loop setup.

SUMMARY

- The outcomes of this work will support the interoperability and interconnection standardization of hydrogen assets.
- This project will use the Banshee microgrid model as the test model, 100-kW fuel cell and fuel cell inverter for power-hardware-in-the-loop setup.
- The interoperability codes using IEC 61850 standards will be developed using simple BeagleBone boards and will be made available in the public domain.
- Technical reports on required updates for the interoperability and interconnection will be completed at the end of the project.