

INTEROPERABILITY AND EV-GRID INTEGRATION ACTIVITIES AT ARGONNE

Sponsored by the US Department of Energy



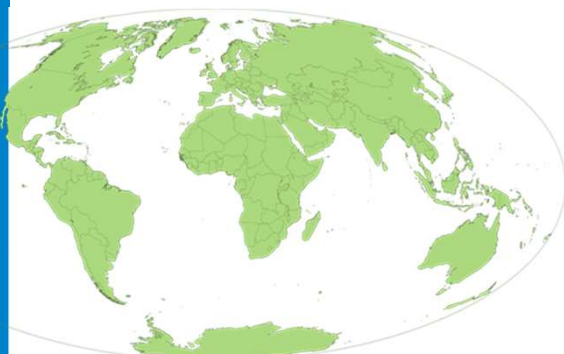
Climate, Energy, and Environment Policy Committee (CEEPC)
Metropolitan Washington Council of Governments

Keith Hardy
23 January 2020, Washington, DC



1

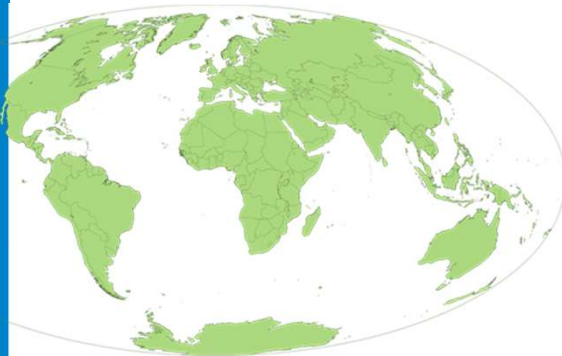
National challenges



- **Harmonization to support multinational trade**
 - EV-charger-network compatibility
 - Verification/certification methods
- **Integration of devices across multiple industries**
 - Power/communication interfaces
 - Smart energy management
- **Impacts of high power charging**
 - Mitigate power quality fluctuations
 - Minimize economic penalties

2

Argonne's role



- **Smart energy management**
Smart Vehicle-Grid Integration project
- **Enabling technologies**
Open source communication/control, diagnostics and metering
- **High power charging**
Transatlantic harmonization of test tools and procedures; integration with batteries
- **International coordination**
Europe and Asia

3

Smart Vehicle-Grid Integration (VGI)

Integrate vehicles in a 'Grid of Things' ... the always on, always there platform that enables the products and services customers need to engage with and use energy



- Lab demonstration and plan for pilot with industry partners in 2 years
- Pilot in community/workplace environment to follow

Global Grid Integration Program:

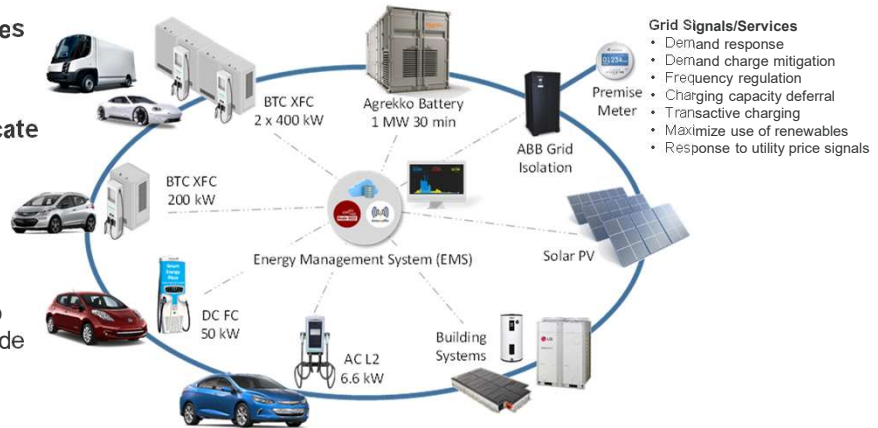


4

Smart VGI

Energy grid management to provide value to the customer and the grid operator

- **Site managers set priorities** for EV charging, building systems, etc. via the EMS
- **Grid operators communicate grid conditions** via the premise meter or EMS
- **Power for EV charging and other devices is optimally controlled** to satisfy priorities, respond to grid conditions and/or provide grid services



Global Grid Integration Program:



U.S. DEPARTMENT OF ENERGY Argonne National Laboratory is a U.S. Department of Energy laboratory managed by UChicago Argonne, LLC.

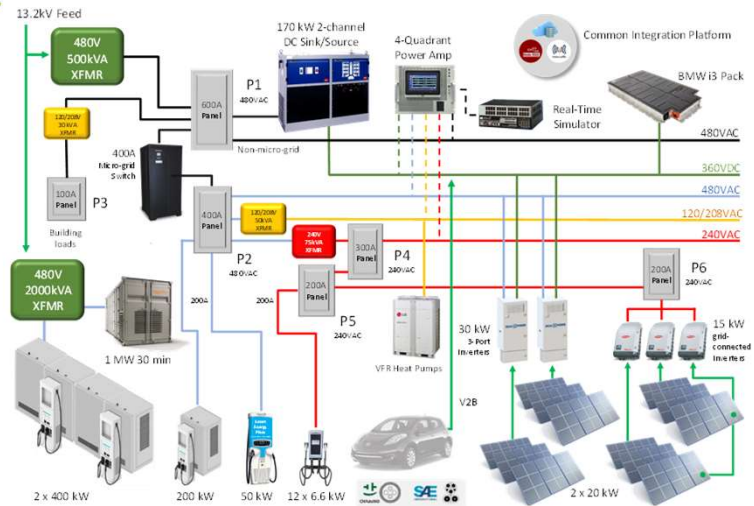
Argonne NATIONAL LABORATORY

5

Smart VGI

Technical integration challenges

- Multiple AC and DC voltages, sources and power levels
- Incompatible and proprietary interfaces
- Latencies in communication and information processing



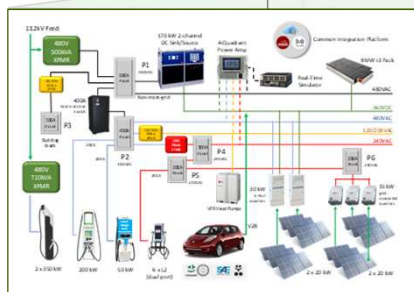
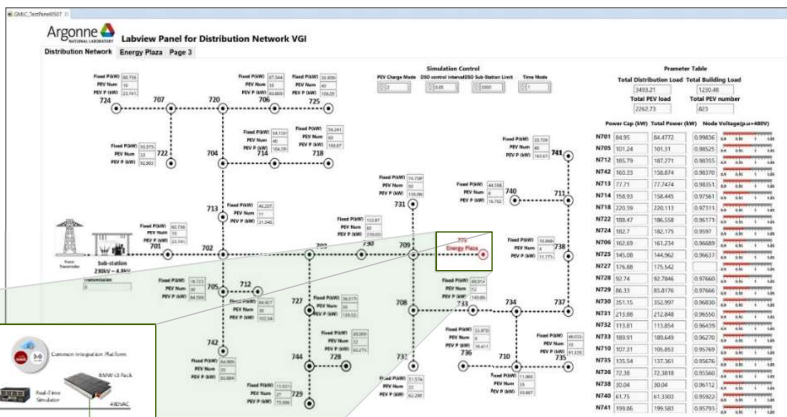
U.S. DEPARTMENT OF ENERGY Argonne National Laboratory is a U.S. Department of Energy laboratory managed by UChicago Argonne, LLC.

Argonne NATIONAL LABORATORY

6

Smart VGI

Must address impacts of charging on the grid and the ability to respond to grid conditions using smart energy management

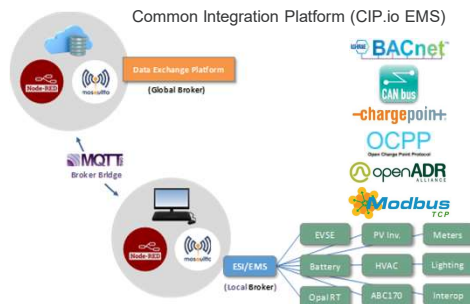


Energy Plaza is linked to a dynamic grid model ... one of 24 'nodes' populated with buildings, infrastructure, chargers and EVs

Smart VGI

Requires enabling technologies

- Open source smart energy management system
- Communication control modules
- Diagnostic EV Interoperability tools
- AC/DC sub-metering for charging stations and multi-unit dwellings



SpEC module 2.0 alpha board



SAE J1772 connector w/DEVA



Multi-unit sub-meter (w/o current sensors)

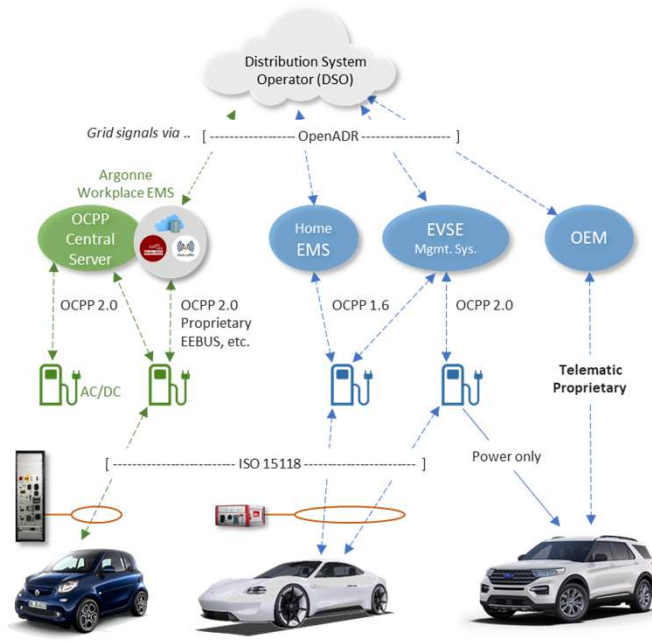


Smart VGI

Requires common VGI verification tools and procedures



U.S. DEPARTMENT OF ENERGY Argonne National Laboratory is a U.S. Department of Energy laboratory managed by UChicago Argonne, LLC.



OpenADR = Open Automated Demand Response; OCPP = Open Charge Point Protocol

Argonne NATIONAL LABORATORY

High Power Charging

Supports long-range cars and medium/heavy duty trucks

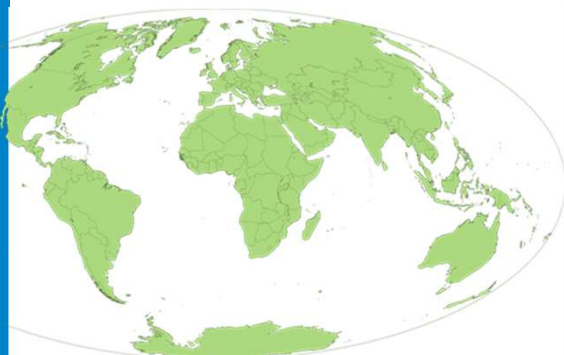
- Harmonize test equipment and procedures
- Assess 200-350 kW DC charging systems
- Integrate 1 MW battery to provide peak power
- 1+ MW charging requirements and industry engagement for electric trucks



U.S. DEPARTMENT OF ENERGY Argonne National Laboratory is a U.S. Department of Energy laboratory managed by UChicago Argonne, LLC.

Argonne NATIONAL LABORATORY

International cooperation



■ Europe

- European Commission's Joint Research Centre (JRC)
- Global Grid Integration Program (GGIP)

■ Asia

- Support initiatives of the Dept. of Commerce International Trade Administration in APEC and ASEAN

11

Electrification impacts all sectors



■ Residential

Integration with home EMS; possibly neighborhood-level control

■ Workplace

Integration with building and site EMS; EVs will contribute to local/grid needs

■ Fleet/Public

High power charging will facilitate EVs for multi-unit dwellers, long distance passenger cars and commercial trucks

Infrastructure/cost challenges TBA

12