

Grid Technology and Architecture

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NARUC-FERC Smart Grid Collaborative
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Outline

- **Moderating Expectations for Plug-and-Play**
 - Example: Building HVAC
- **Grid Landscape and Status of NIST Framework**
- **Policy Levers for Interoperability**

Plug-and-Play vs. Set-and-Forget

- **Grid devices unlikely to emulate USB in near term**
 - Unit volume does not justify PnP investment
 - People don't routinely unplug their appliances
 - Majority of electric consumption in stationary devices
- **Technicians likely required for home devices**
 - Similar business model to cable, appliances
 - Advanced users can still self-install



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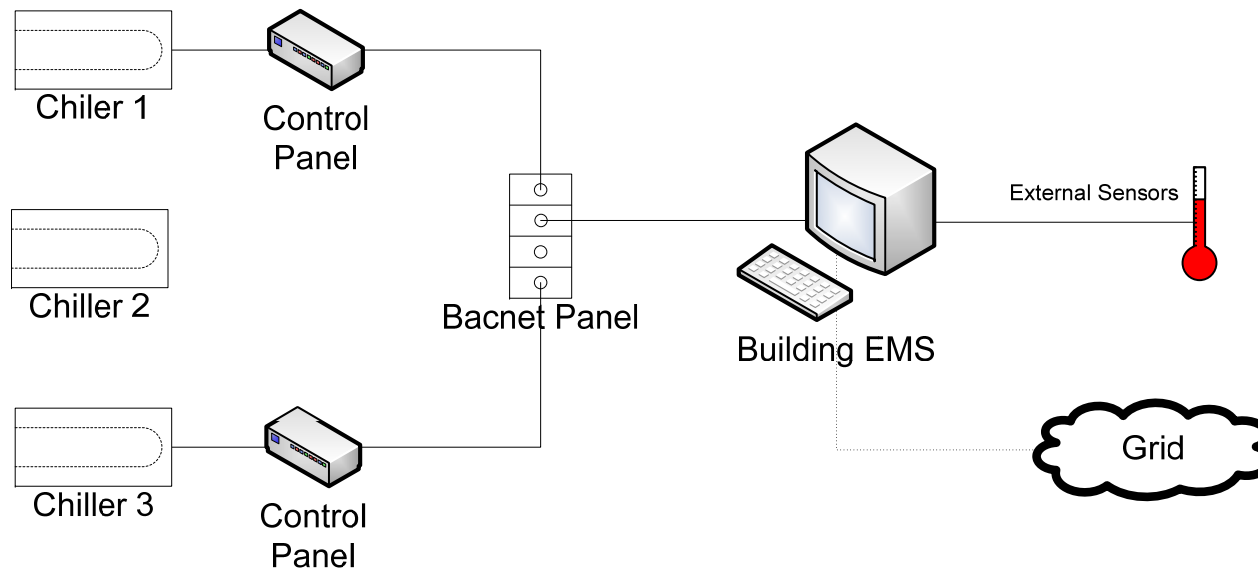
81 years of excellence

Chris the Engineer



L'Enfant Plaza: HVAC/EMS Integration

- Goal: automate control of the building's heating, ventilation, and air conditioning (HVAC) system with a new Energy Management System (EMS)
- Grid connection not in scope of current project





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L'Enfant Plaza: Chillers



Legacy Integration: Made in 1971





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Chiller Control Panel: BACnet Hookup

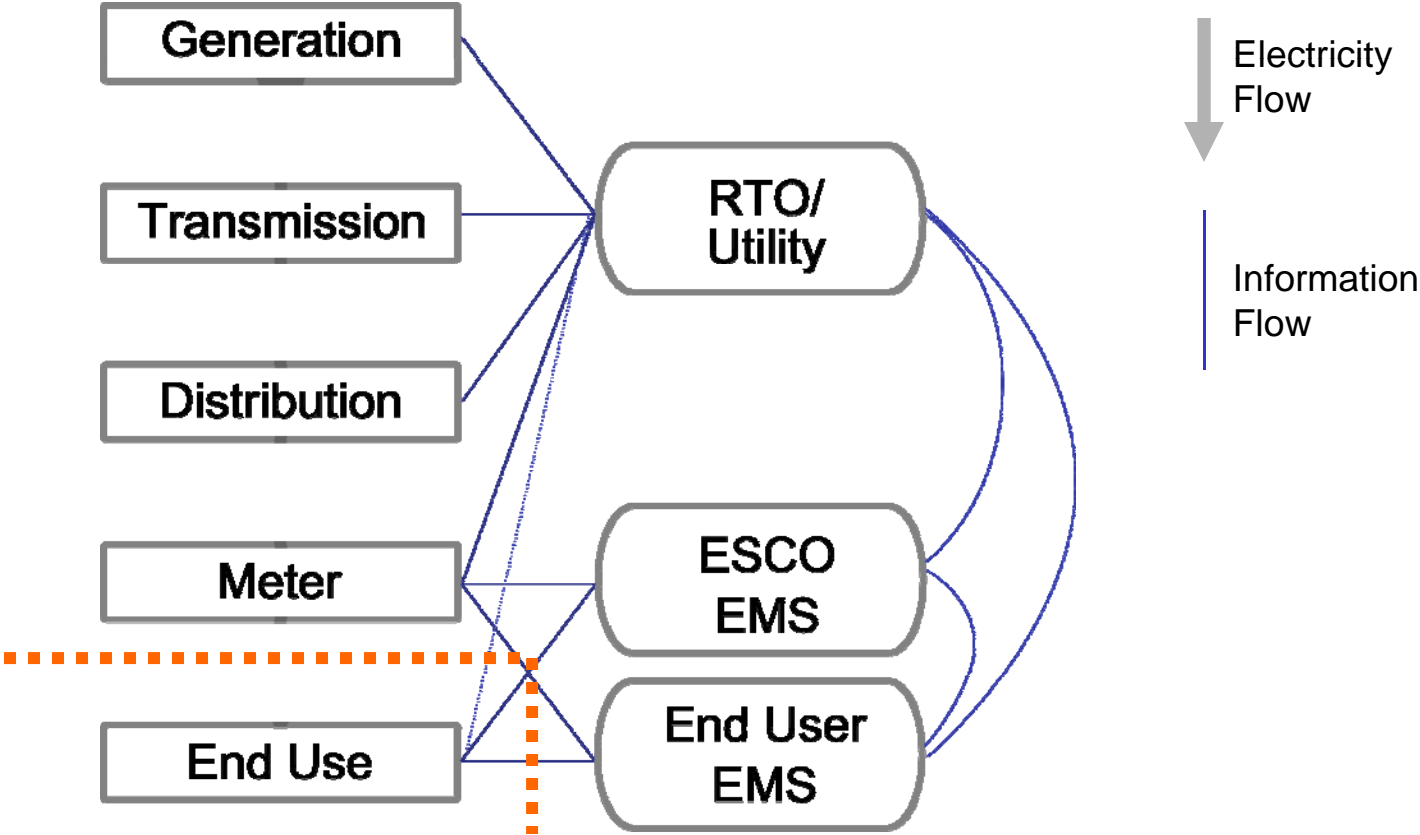


Integration Obstacles

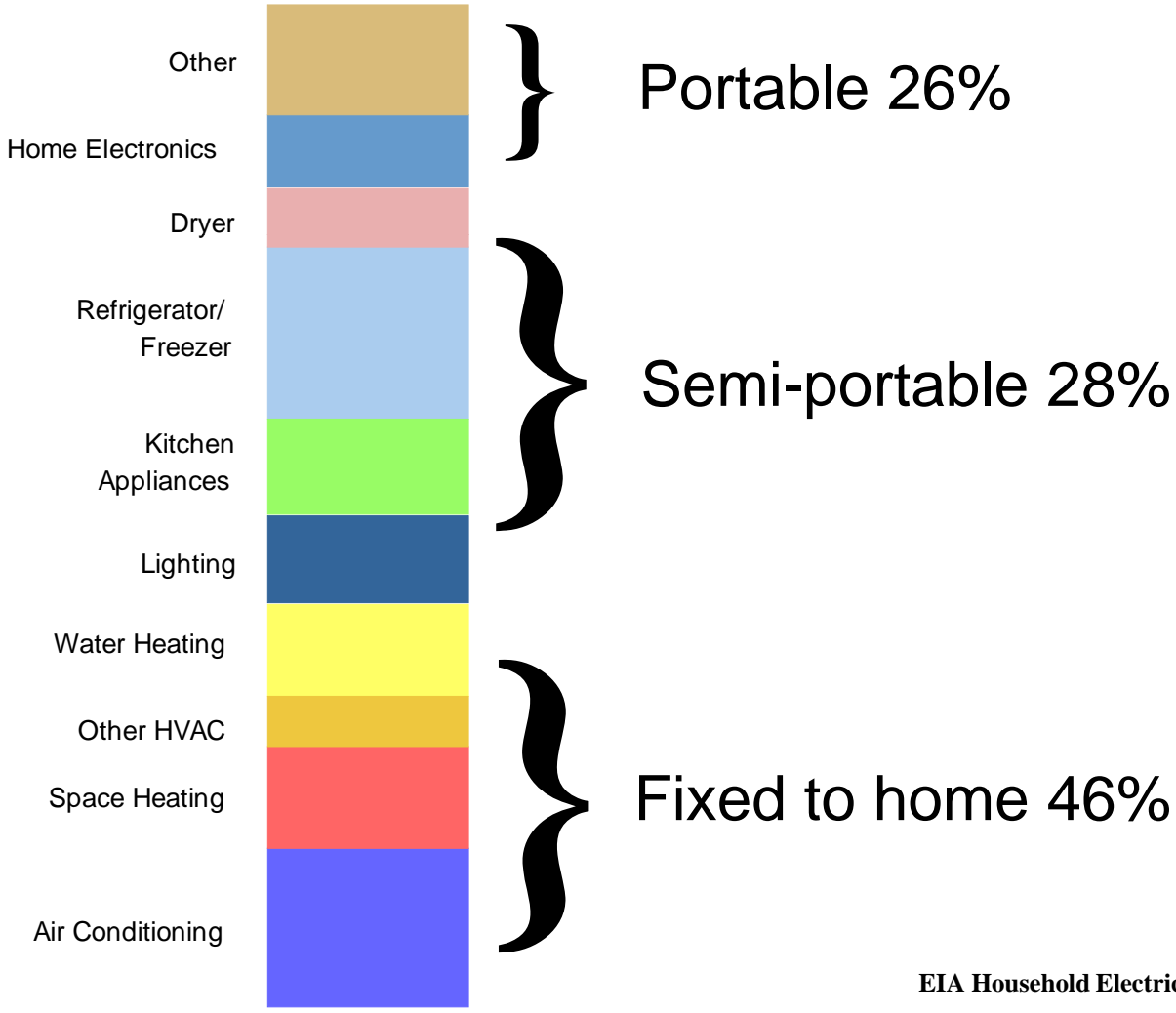
- **Variation in controllers from the same vendor**
 - Controllers speak different “dialects” of BACnet
 - What does “STATUS 5” mean?
 - Off, Standby, Startup, Running, Shutdown, Error
 - Manuals misplaced, determine through trial and error
 - Startup/shutdown cycles take hours
- **Device-to-EMS integration is labor intensive**
 - Restricts implementation to those who can justify the upfront cost
 - Reduction of implementation cost expands potential market
- **EMS-to-Grid will be difficult but not impossible**

Grid Standards Landscape

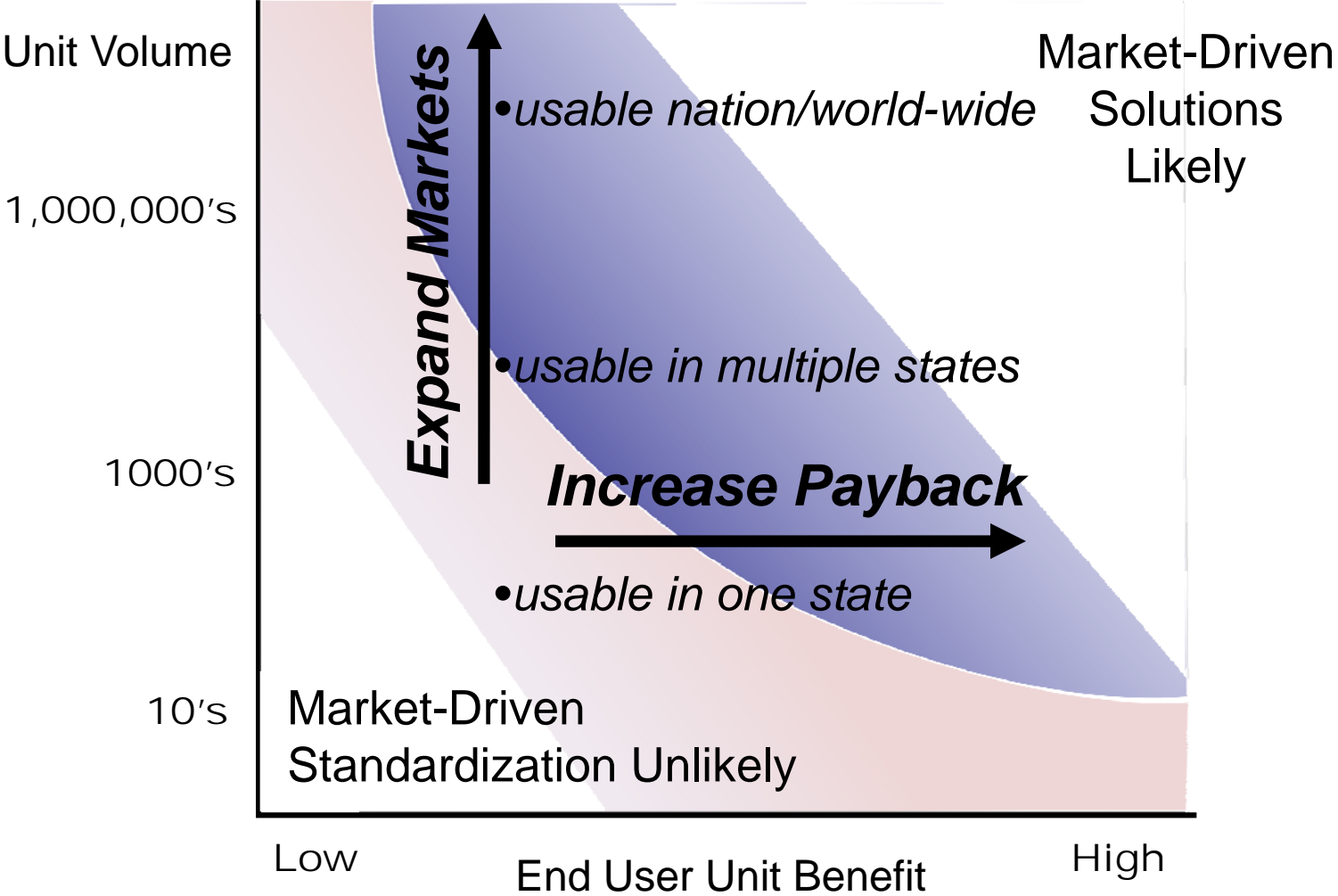
- Lather, rinse, repeat for all grid interfaces



Savings Areas with Set-and-Forget



Where Policies Help Drive Solutions



IEEE SCC21 1547 Series of Interconnection Standards

IEEE Std 1547™ (2003) Standard for Interconnecting Distributed Resources with Electric Power Systems

P1547.6 Draft Recommended Practice for Interconnecting Distributed Resources with Electric Power Systems Distribution Secondary Networks

Guide for Impacts

P1547.4 Draft Guide for Design, Operation, and Integration of Distributed Resource Island Systems with Electric Power Systems

P1547.3 Draft Guide for Monitoring, Information Exchange and Control of DR Interconnected with EPS

**Guide
For
Interconnection
System Certification**

IEEE Std 1547.1™ (2005) Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems

P1547.2 Draft Application Guide for IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems

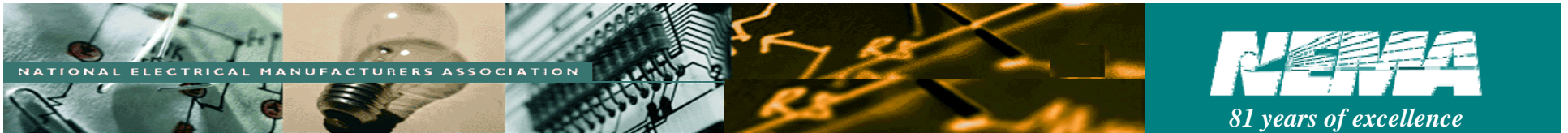
P1547.5 Draft Technical Guidelines for Interconnection of Electric Power Sources Greater Than 10 MVA to the Power Transmission Grid

DP Specifications & Performance (includes modeling)

(publication year in parentheses; P1547.X are under development; other topics are under consideration by SCC21 work group members) <http://grouper.ieee.org/groups/scc21/index.html>

Sept 2008 Slide 13





NIST as Technical Coordinating Body

- **NIST Smart Grid Standards Framework**
 - As enacted in EISA 2007
 - Currently in data acquisition phase
 - Experts gathered into working groups
 - Eventual work in identifying standards that enable functional requirements and applications
 - Standards recommendations for nationwide use?
- **Potential forum for coordination across states**
- **States could use NIST recommendations as a template**

Conclusion

- Legacy integration will be challenging
- Set-and-forget rather than plug-and-play
- Regulators can catalyze innovation by providing harmonized market opportunities
- Retail interface is a top priority