American Council for an Energy-Efficient Economy

Intelligent Efficiency Conference

Track A: Integrating Distributed Resources

1A Enabling the Virtual Power Plant

Andrew Machado, Cadmus

Supporting the Virtual Power Plant

Agenda

Background

Technology & Infrastructure Review

Regulation Overview & Impacts

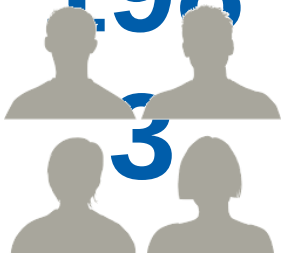
Key Take-Aways

CADMUS

Since 1983

Energy and environmental consulting firm with over 520 employees

33 years serving Utilities, Commercial & Industrial Customers, Government



Leaders in EM&V approach and methods: DOE's UMP, IPMVP

$ % Experts on DSM policy and planning, cost-effectiveness, and market effects analysis

Specialize in Energy Systems Engineering, Emerging Technology, EM&V

Understand regulatory environment underlying power planning methods

IoT, Smart Grid, HEMS

- **Internet of Things (IOT)** – network connectivity for objects (and not just people)
- **Advanced Metering Infrastructure (AMI)** – utility meter with two way communications
- **Open Systems Interconnection (OSI) model** – framework for communication over a network
- **Home Energy Management System (HEMS)**
- **Home Area Network (HAN)**

Source: http://gargasz.info/how_internet_works_i_think.pdf

Networking & Data

Protocol - set of rules for communication between two devices (e.g., Bluetooth)

Standard - adopted guidelines for communication (which often reference specific protocols, e.g., 802.11n)

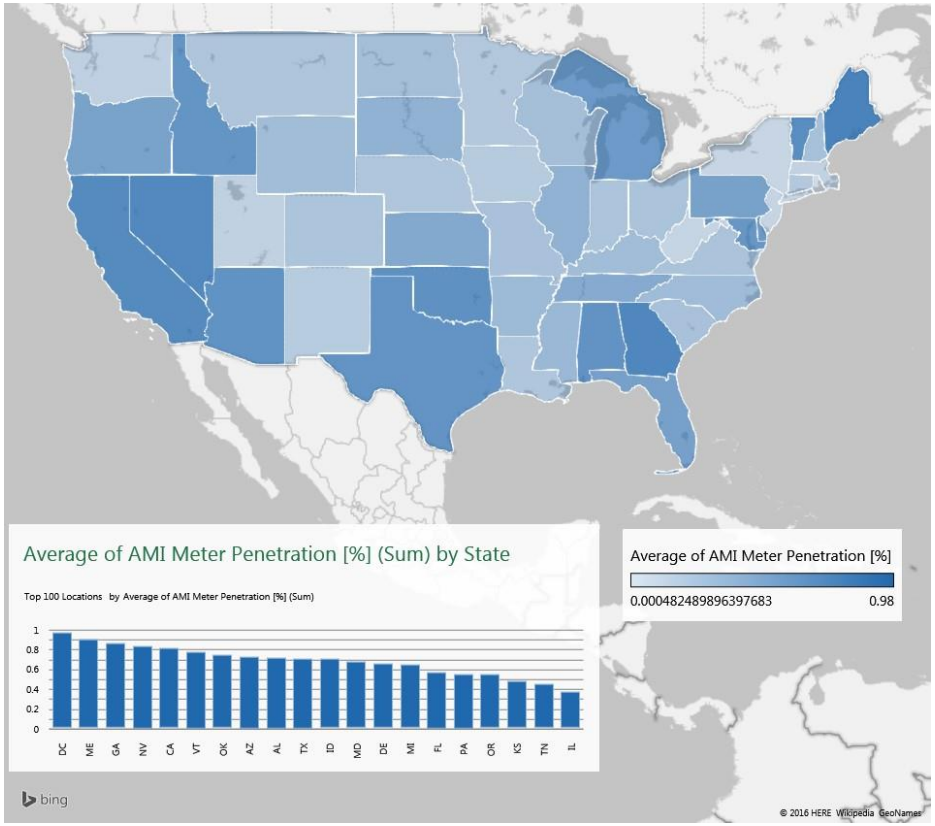
Green Button – DOE initiative for customer energy data access

Latency – network transit time

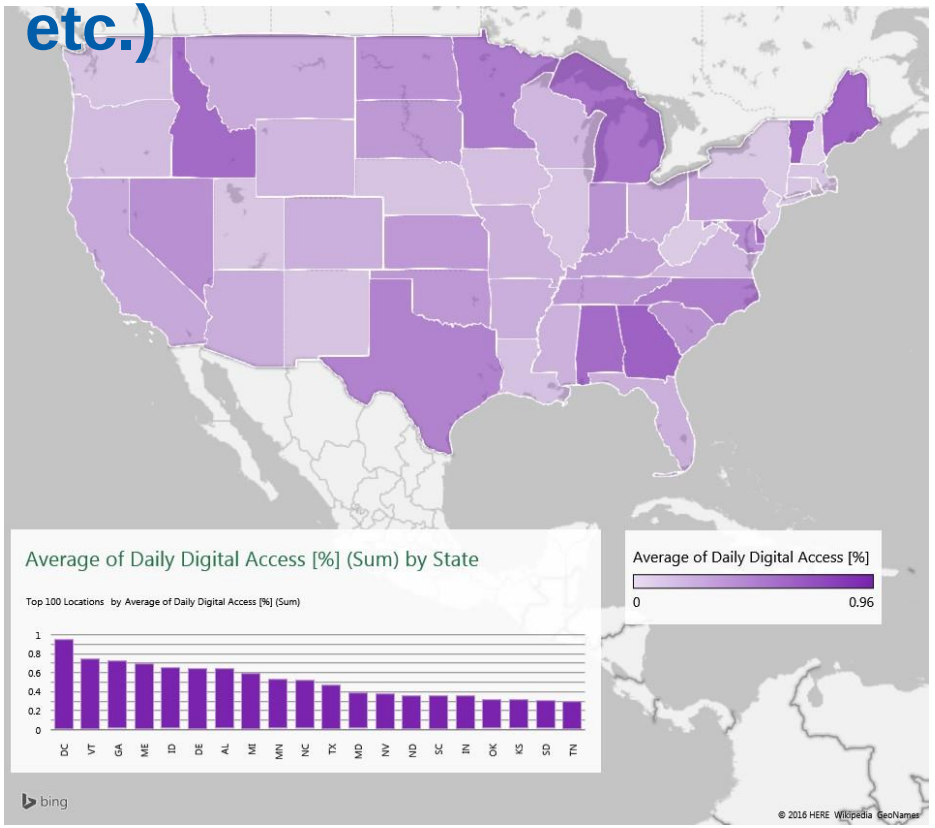
Cellular (GSM, CDMA)

2015 Smart Meters & Energy Data

AMI Meter



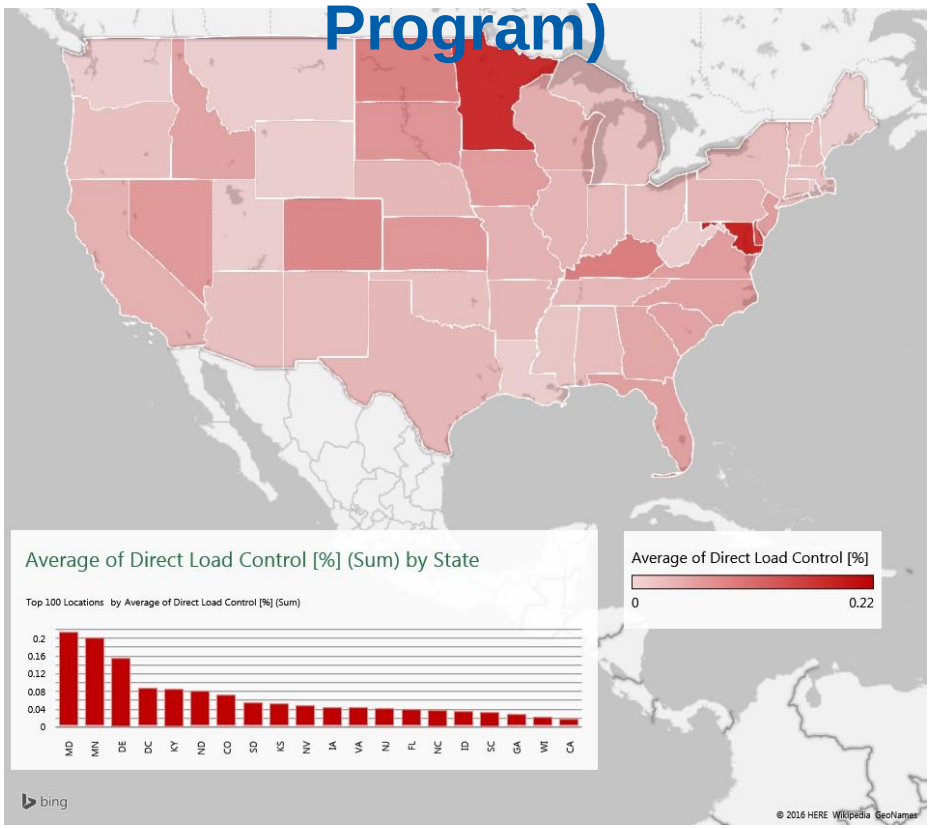
Daily Digital Access (portal, etc.)



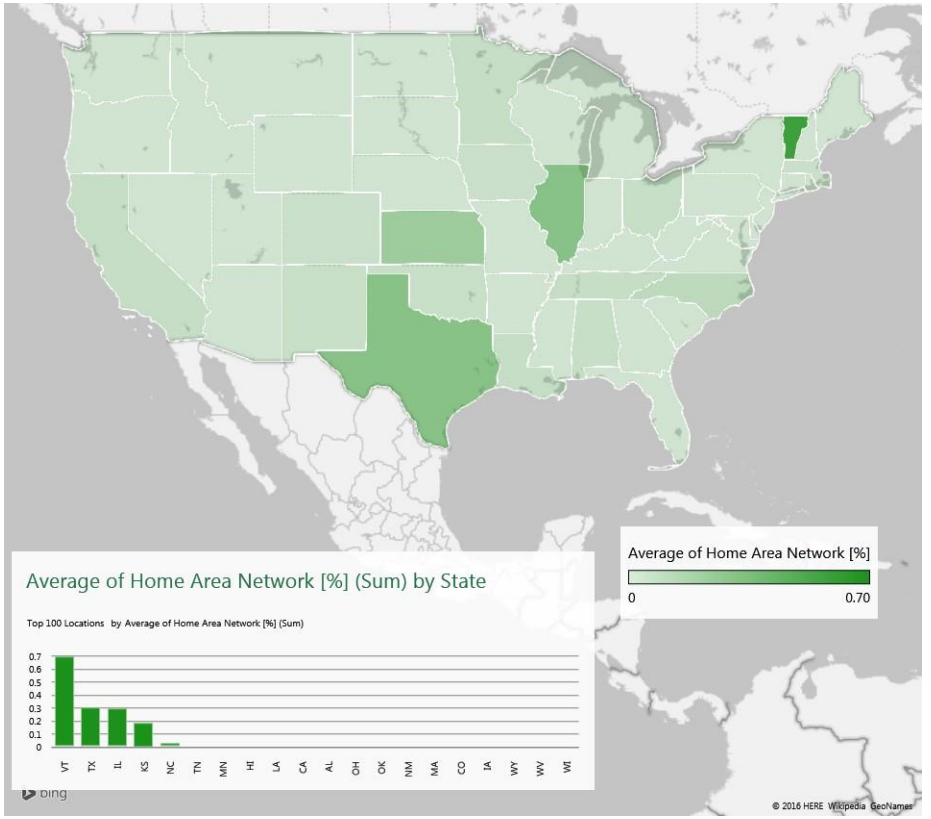
Source: U.S. Energy Information Administration (EIA)

2015 Load Control & Local Network

Load Control (by Utility Program)

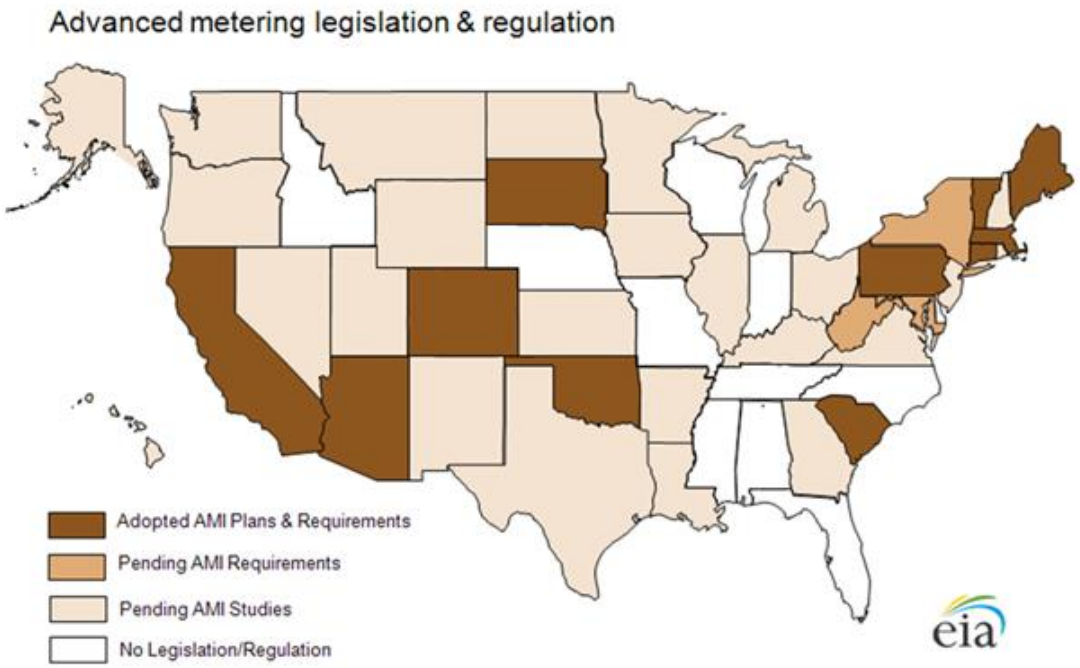


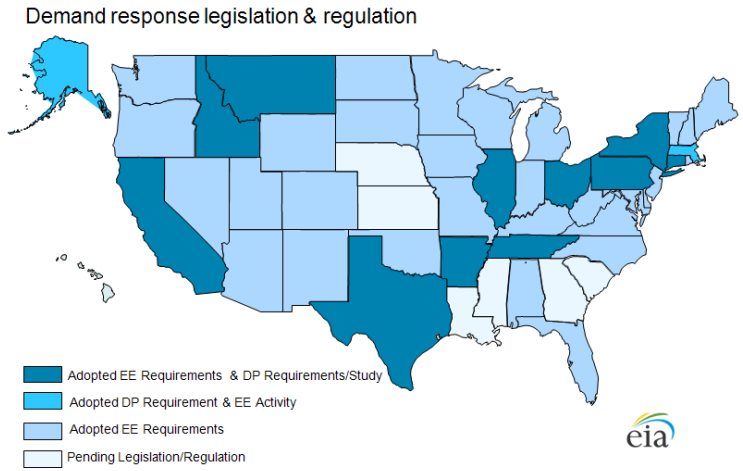
HAN Gateway Enabled

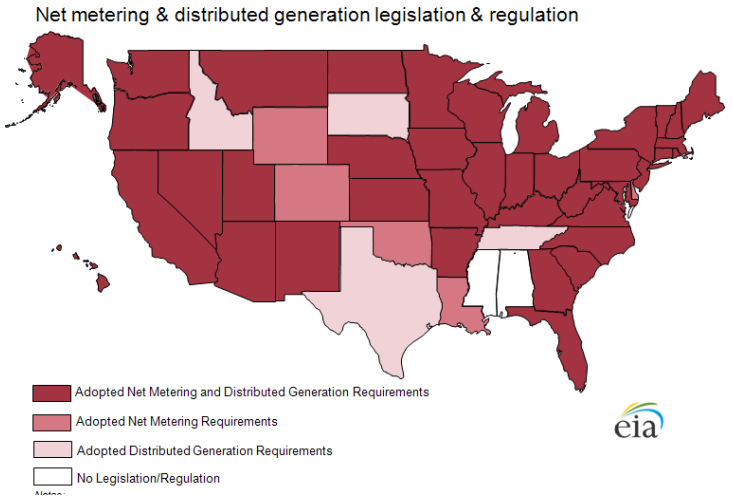


Source: U.S. Energy Information Administration (EIA)

Regulation Overview







Source: U.S. Energy Information Administration (EIA)

Regulation Impacts

British Columbia, Canada (100% AMI)

- 1.9 million smart meters, 100% IPv6
- BC Energy Plan and Clean Energy Act mandated 100% AMI by 2012
- Vision for Multiservice Grid Network

Maine (91% AMI)

- 820,000 customers statewide
- $96 million in Smart Grid Investment Grants (American Recovery & Reinvestment Act)

California (82% AMI)

- 12.5 million AMI meters statewide out of 15.2 million total meters
- San Diego Gas & Electric awarded $28 million in SGIG / ARRA funds; Sacramento Municipal Utility District awarded $127 million
- Widespread implementation of Green Button initiatives
- Commission funded Pacific Gas & Electric HAN pilot in 2013, ~5000 customers

Illinois (38% AMI)

- Largest relative increase (>20%) in AMI penetration from 2014-2015
- Energy Infrastructure Modernization Act (EIMA) of 2011
- Ameren Illinois investing in IoT infrastructure & testing
- Offering HAN integration, vetting technology

Wisconsin (24% AMI)

- Heterogeneous mix (>90 utilities)
- Madison Gas & Electric awarded $5 million in SGIG / ARRA funds
- No major regulation regarding AMI / IoT

Indiana (17% AMI)

- 5 large utilities, greatest AMI penetration is 7%
- No major regulation regarding AMI / IoT

Massachusetts (3 %) vs. Rhode Island (0% AMI)

- One electric utility operates in RI
- Same utility operates in MA - AMI & data access available

Key Take-Aways

1. IoT energy technology is dynamic ecosystem – signs of convergence are appearing
2. IoT energy infrastructure is spreading at varied rates
3. Regulation is helping to drive adoption and growth; lack of regulation *may be* hindering adoption & growth
4. Demand Side Management & Energy Efficiency professionals must plan for future, mitigate risks

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CADMUS

Andrew T. Machado, PE, CEM, LEED AP

Senior Associate, Energy Services

Office (617) 673-7110

Andrew.Machado@cadmusgroup.com

Facebook.com/CadmusGroup

@CadmusGroup

Linkedin.com/company/the-cadmus-group