



ANNUAL INDUSTRY WORKSHOP
NOVEMBER 12-13, 2014

CLUSTER:
TRUSTWORTHY TECHNOLOGIES FOR LOCAL
AREA MONITORING, MANAGEMENT AND
CONTROL

NOVEMBER 12, 2014

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CLUSTER THEMES

- Key driver is adding more renewable, but less controllable generation will require more participation by the load
- End Users (Load)
 - Requiring more communication and control
 - Increasing use of distributed generation resources
- Distribution Systems
 - New technologies promise better reliability
 - Cyber security of devices is a growing concern



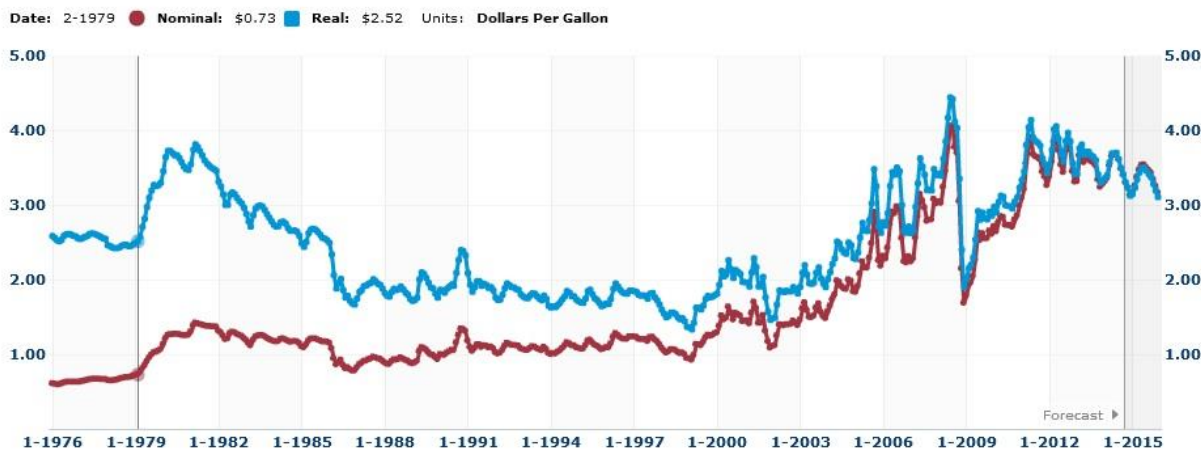
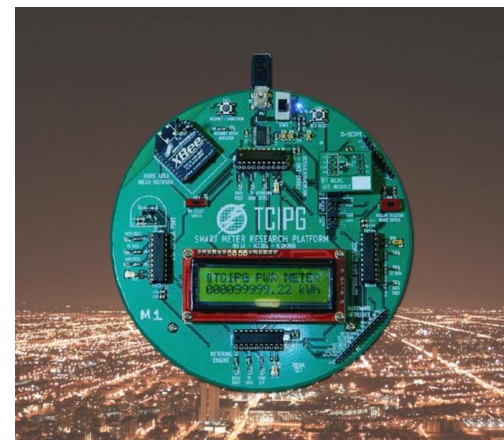
WHERE WE'VE COME OVER THE LAST DECADE

- Grid has operated without a major blackout, though smaller blackouts persist
- Electricity prices are rising a little above inflation
- Renewable energy has come on strong, with wind providing 4.3% of US electric energy in 2014 and solar 0.4%
- Distributed generation is becoming widespread in some locations, primarily solar PV



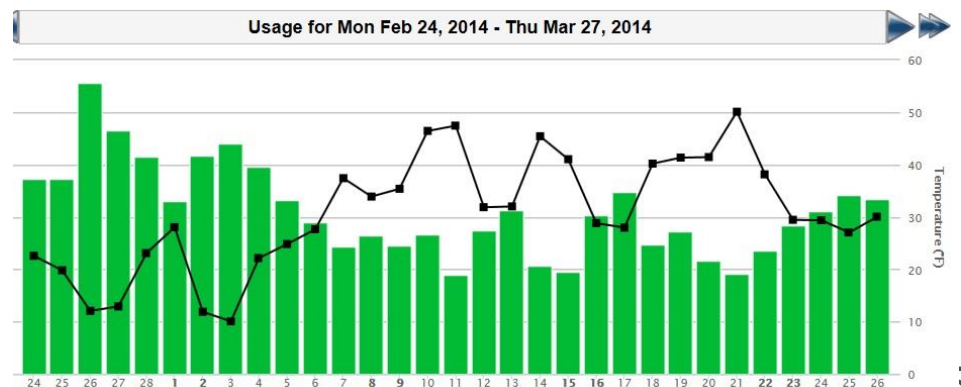
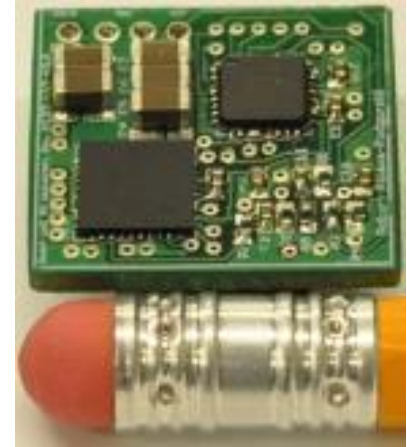
WHERE WE'VE COME OVER THE LAST DECADE

- Smart meters are now deployed in 43% of US homes (more than 50 million)
- Pluggable vehicle sales have risen slowly, and are about 2% of total sales in 2014



TCIPG ACCOMPLISHMENTS IN THIS CLUSTER

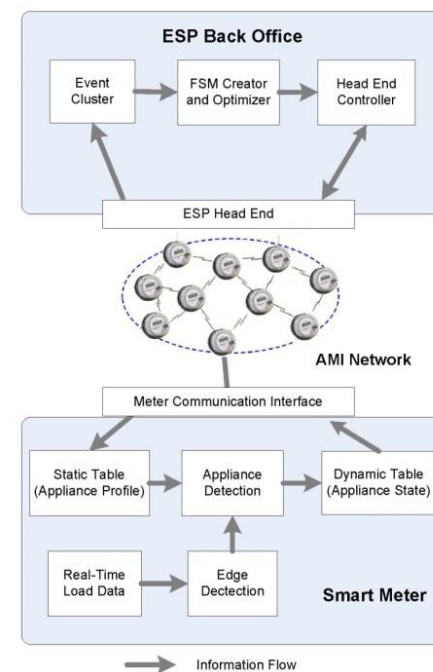
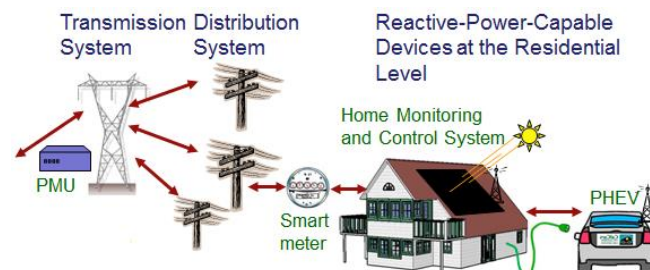
- Loads and Distributed Generation
 - Algorithms for handling large amounts of distributed reactive power sources
 - Consideration of a potential cognitive bias in demand response programs between assumptions on consumer behavior and how consumers actually behave



TCIPG ACCOMPLISHMENTS IN THIS CLUSTER

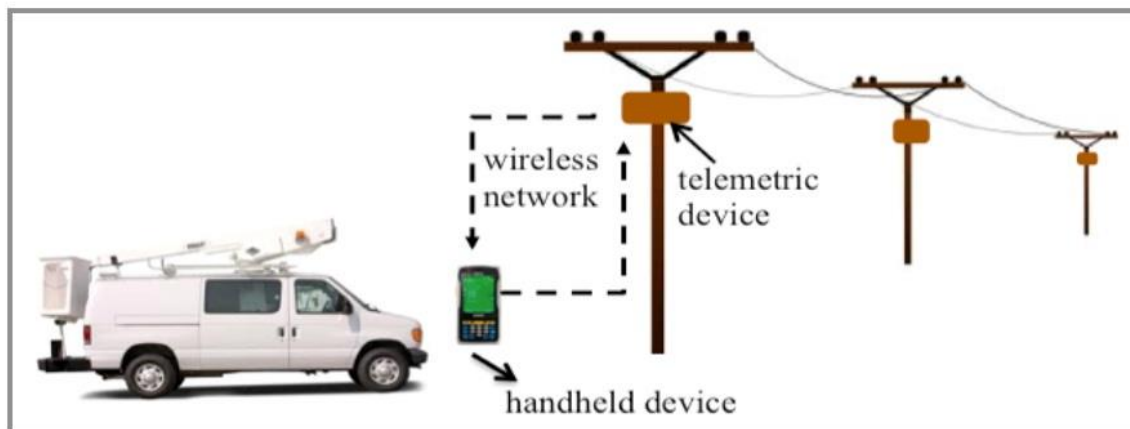
- **Loads and Distributed Generation (cont)**

- An information layer design for the V2G framework implementation
- A trustworthy frame for mobile smart meters
- Algorithms for non-intrusive load monitoring, load identification, load shed verification and privacy protection



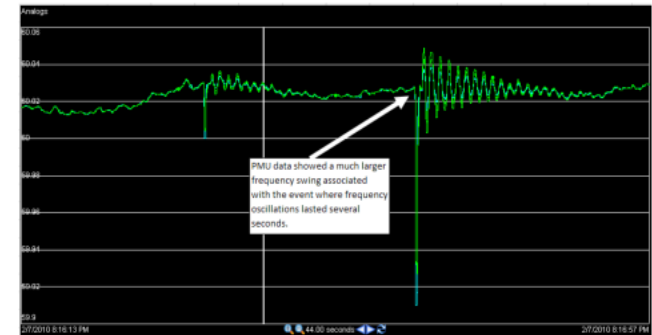
TCIPG ACCOMPLISHMENTS IN THIS CLUSTER

- Distribution Systems
 - Optimization algorithms for large numbers of feeder switches
 - Password changing protocols to handle communication with large numbers of pole mounted devices



CURRENT CHALLENGES

- How do we effectively leverage the vast amount of data that is now becoming available from the load and the distribution system in a secure & trustworthy manner
- How do we securely manage a system in which an increasing portion of the generation resources are distributed in the distribution system



EMERGING OPPORTUNITIES AND CHALLENGES

- System-wide resiliency is a crucial concern, with distributed "micro-grids" and stand-alone systems providing opportunities
- Higher levels of distributed PV generation, with storage being a wild card; what is the pricing model?
- Secure integration of smart meters into the "internet of things"
- Privacy remains a large concern

Blackout misery

50 million affected in Northeast and beyond as power grid fails

Transportation Many 'wait it out' by air and land ■ 4A Scenes Moms in labor, cars stuck in car washes ■ 5A Impact Offices close, ATMs idle, cellphones jam ■ 1B



Brooklyn Bridge: Thousands of commuters in New York look to their feet Thursday evening after a major power outage hit the city and much of the Northeast.