



Wisconsin Public Utility Institute

Smart Grid, Smart Meters, Smart People

Thanks to Scott Williams, Research and Education
Coordinator, UW Energy Institute/WPUI

Why do we need a Transmission Smart Grid?

Late 70's a sense that the old world ways of energy consumption were about to change

Efficient grid operation and improved equipment reliability

- ▶ Save money, reduce outages, improve security and reliability of the transmission system to avoid cascading outages

After 1986

- ▶ Integrate variable sources of power (wind, solar, etc.)
- ▶ Integrate distributed sources of power (small-scale wind, solar)



Why is There A Transmission Smart Grid?

- ▶ If you cannot measure it, you cannot monitor it and thus you cannot manage it
- ▶ “It’s about giving utility decision-makers real-time information about the assets and the condition of the network.”

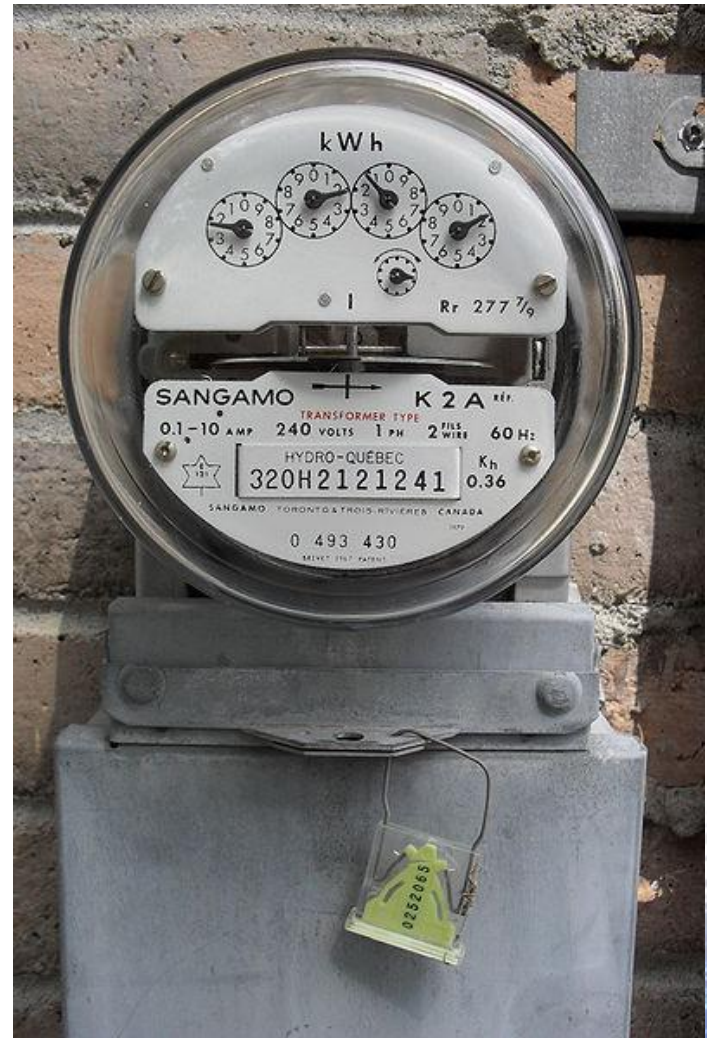


Hmmm, Could We Get Customers to Act Like a Generation Source?

▶ What set the stage?

Since the 1980's a movement to Replace old style meters

Could we take advantage of these changes?

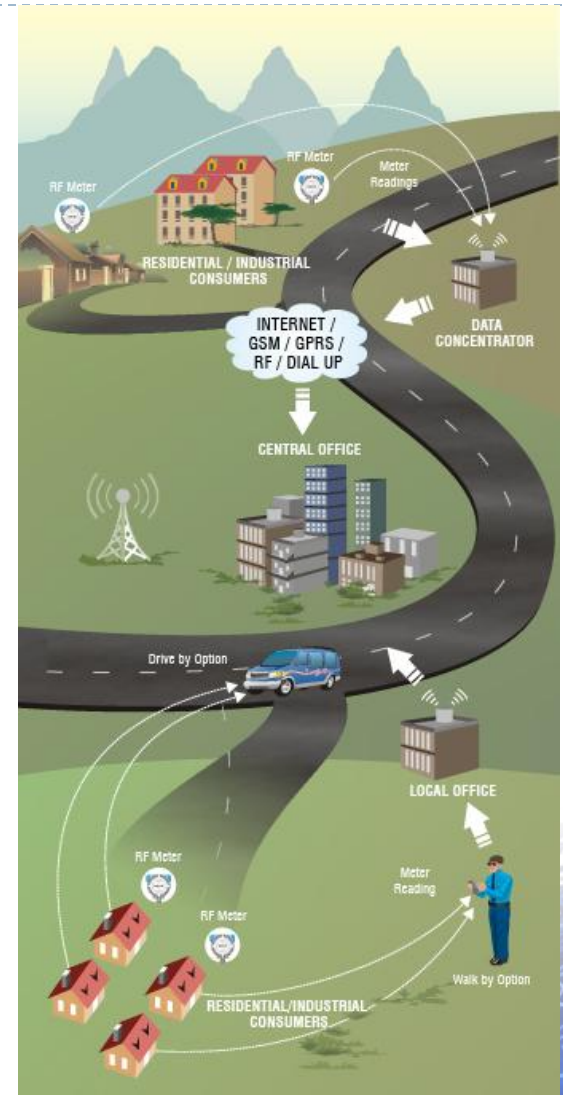


Automated Meter Reading (AMR) to AMI

- ▶ Drive by
- ▶ District collector
- ▶ Office

Then added One Hour reads and turned the AMR into an AMI

- ▶ Enables a host of options such as:
 - ▶ Time-of-Use (TOU) and Dynamic Pricing, Critical Peak Pricing
 - ▶ Better load forecasting



Environmental Concerns

- ▶ Send out prices more reflective of actual costs
- ▶ Multiple strong pushes for distributed power with interruptible options for customers
- ▶ Renewable power not just a novelty

The industry was starting to look outward for energy solutions

**Make the Distribution System and the
Transmission Grid Aware of Each Other and
work together? YES!**

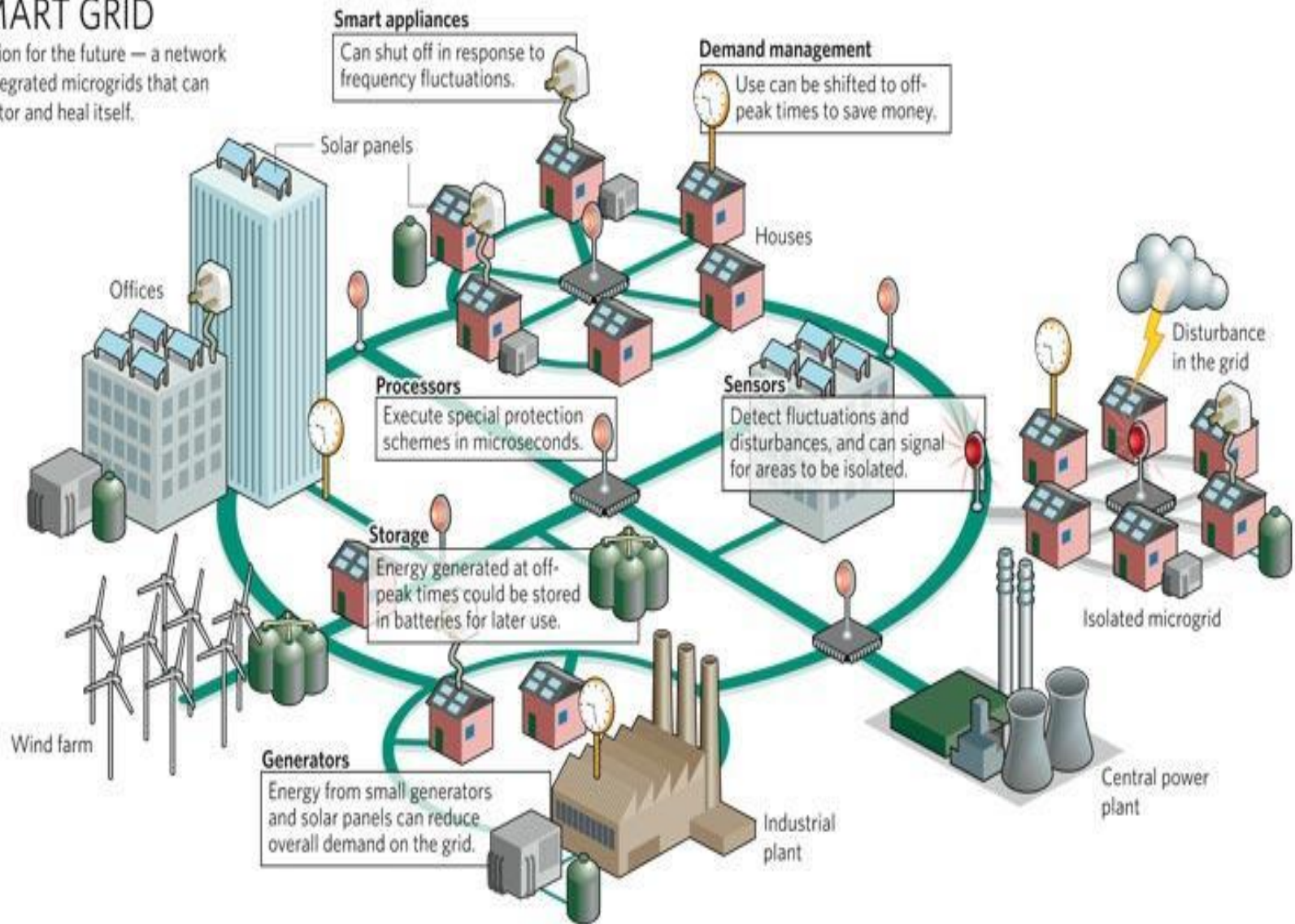


Part 1: Smart Grid

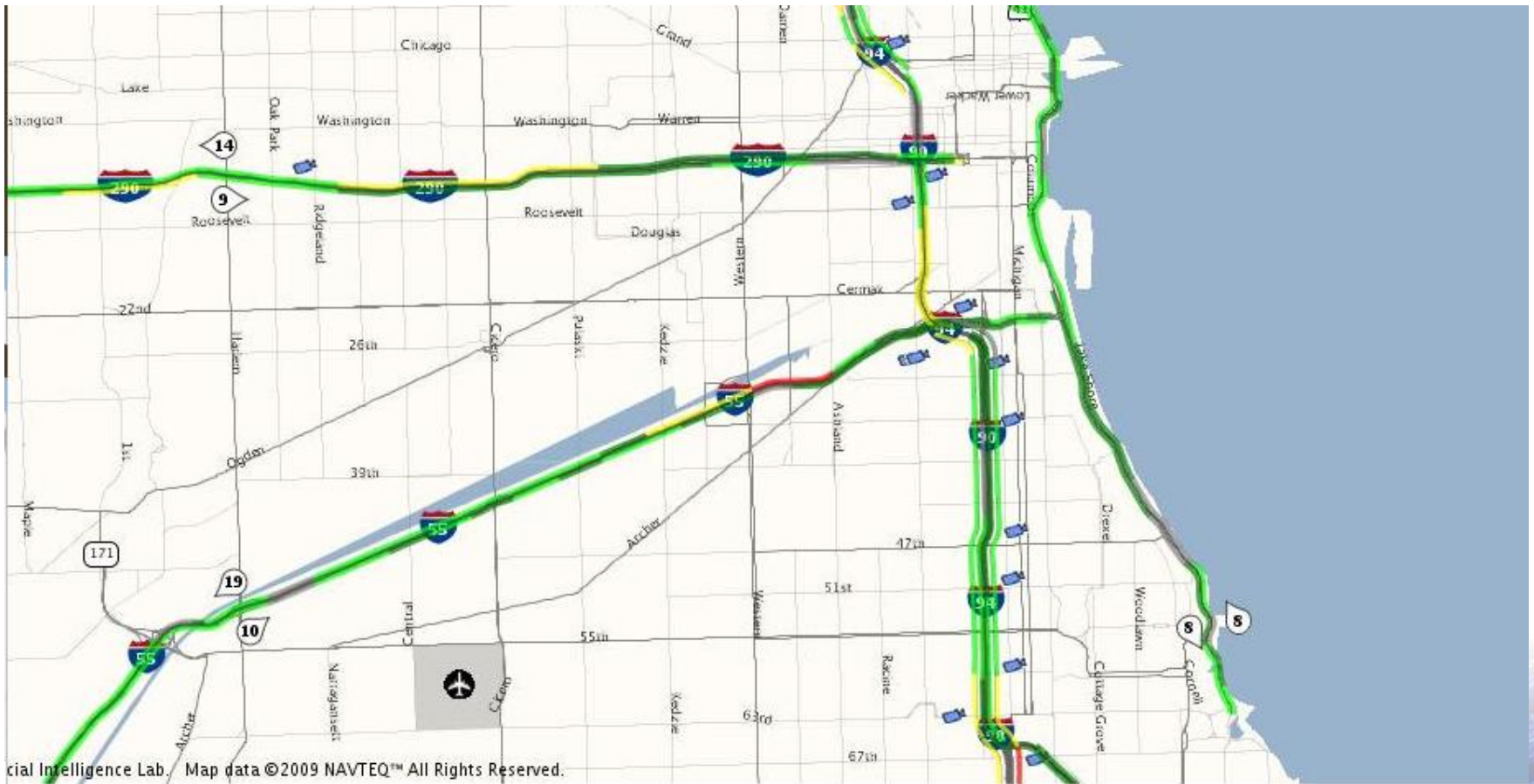


SMART GRID

A vision for the future — a network of integrated microgrids that can monitor and heal itself.



“Like Traffic Cams at Major Intersections”



Benefits of Technologies for both Transmission Grid and Distribution System

- ▶ **Automatically accommodates changing conditions**
 - ▶ Fault isolation, quick automatic restoration
 - ▶ Reroute power flows, change load patterns, improve voltage profiles
 - ▶ Minimal workforce intervention, auto notification for corrective actions and maintenance activities
- ▶ **Lets utilities operate the system with greater efficiency**
 - ▶ Better asset management – optimize grid design
 - ▶ Optimized grid operations
 - ▶ Greater reliability and security



It Takes “Smart” People
or
“There’s an Ap for that”



20 Million Today

**By 2035 Half the
households in the US will have them!**



Customer Must Be Able and Willing to Participate

▶ **Able:**

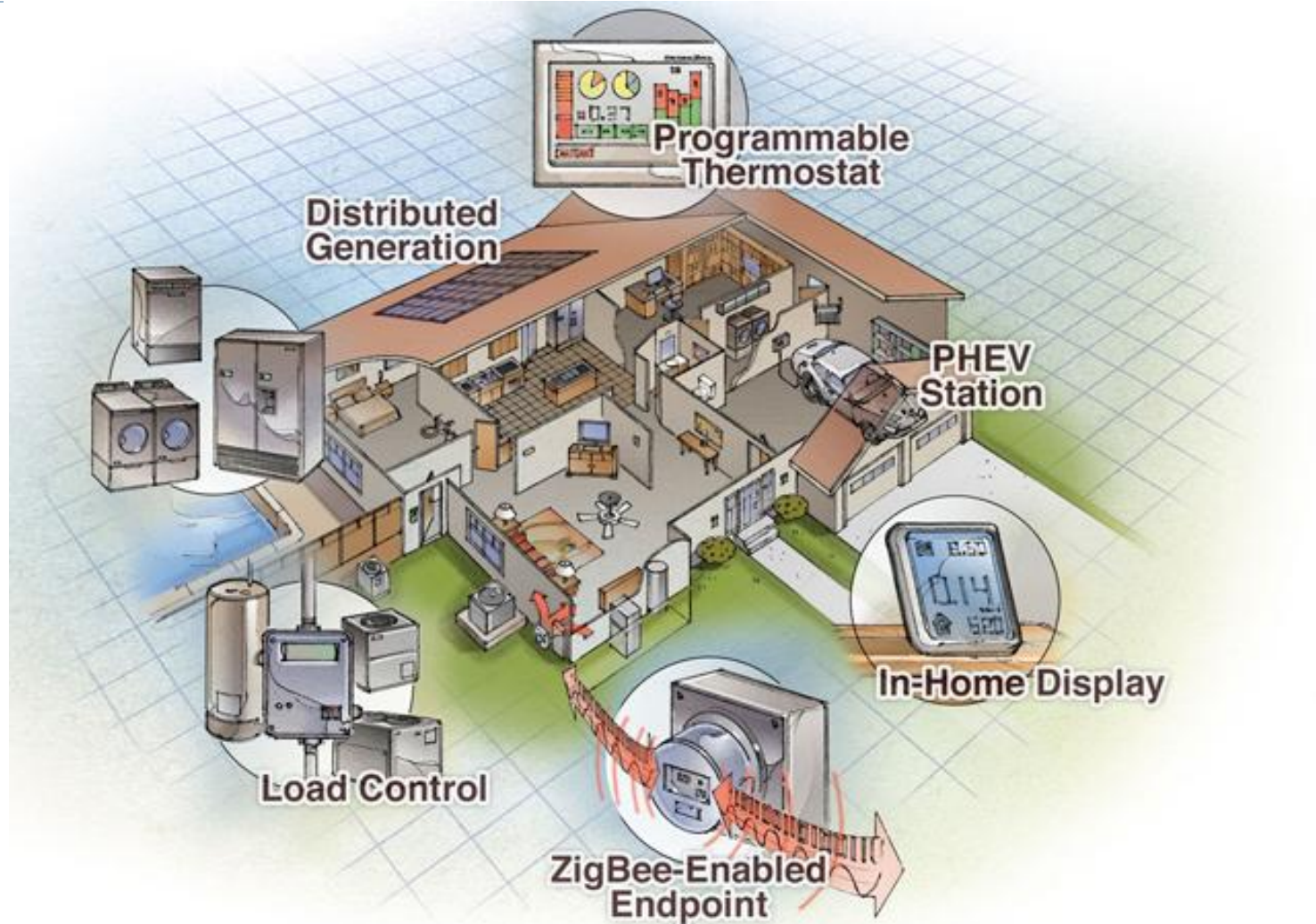
- ▶ Technologies to take advantage of time-differentiated pricing
 - ▶ Smart thermostat
 - ▶ Appliances with smart chips

▶ **Willing:**

- ▶ Customer Education/Marketing
 - ▶ Understand what peak load is
 - ▶ Understand different pricing options and opportunities to save money
- ▶ Energy and money savings must be worth time and inconvenience



Home Area Networks (HAN)



Enabling Technologies

- ▶ Smart appliances
 - ▶ ZigBee Alliance
 - ▶ USNAP Alliance
- ▶ Smart/programmable thermostat
- ▶ In-home display
 - ▶ TED (The Energy Detective)
- ▶ Information accessible by computer or smart phone
 - ▶ Google PowerMeter
 - ▶ Microsoft Hohm
- ▶ Plug-in vehicle
 - ▶ Chevy Volt and Nissan Leaf



Important Concerns



Concerns

- ▶ **Data management**
 - ▶ Where is all this data going and do we have the proper infrastructure to analyze it?
- ▶ **Privacy**
 - ▶ Will I let my utility control my thermostat/appliances?
 - ▶ What third parties will have access to my energy usage information? Can I trust them?
- ▶ **Cybersecurity**
 - ▶ What is the risk of someone hacking into the grid or my home?
- ▶ **Interoperability**
 - ▶ Will everything be able to communicate with each other?
- ▶ **Cost recovery**
 - ▶ Who should pay for these new investments?



Change...Is Difficult



Summary

- ▶ Smart grid upgrades promise to enhance reliability and efficiency of transmission and distribution of power through the use of new communication tools
- ▶ Smart meters change the way utilities and customers interact
 - ▶ Achieving benefits requires informed and empowered consumers
- ▶ Several concerns need to be addressed by government, utilities and manufacturers as new technologies are implemented

