
Smart Grid – A Business Perspective

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- **NU's smart grid experience**
- **Smart grid – key questions (and answers/ perspectives)**
- **How do we move forward?**

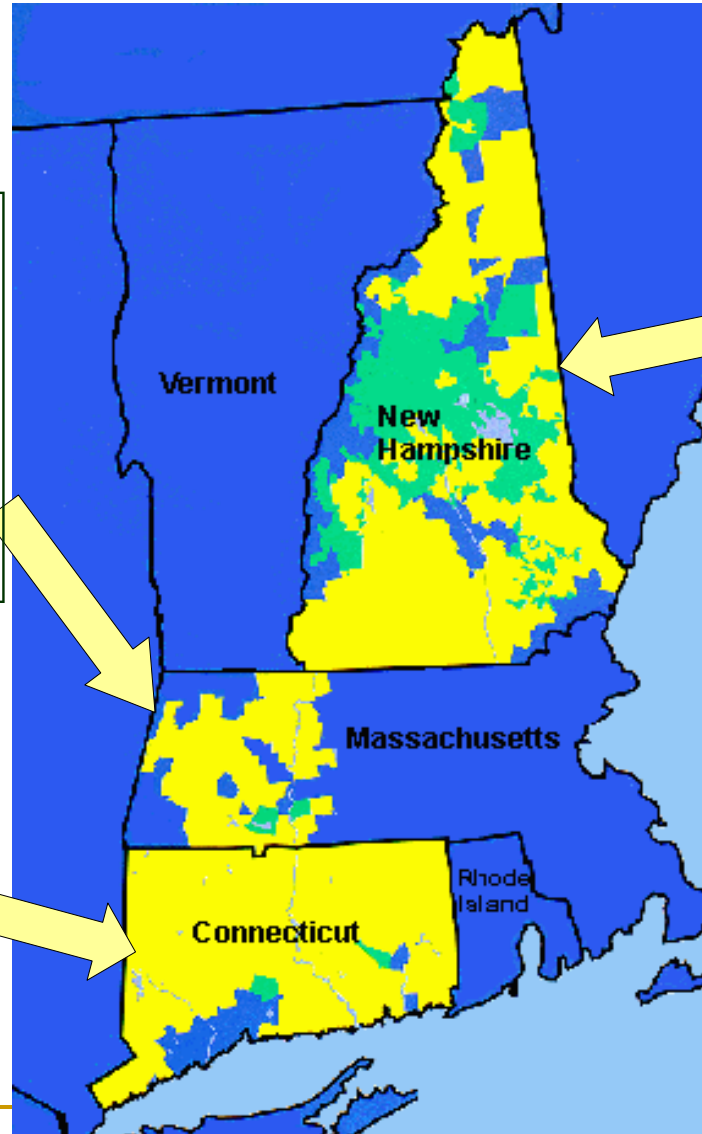
NU Companies and “Smart Grid” Experience

Western Mass. Electric Co.

- BPL Pilot (2004)
- GCA Smart Grid Pilot (low-income focus)
- Limited distribution automation

Connecticut Light & Power

- 500 Meter “Mesh” pilot (2008)
- 3000 Customer Rate Pilot (Summer 2009)
- Remote control for ~ 70% of circuit miles



Public Service of NH

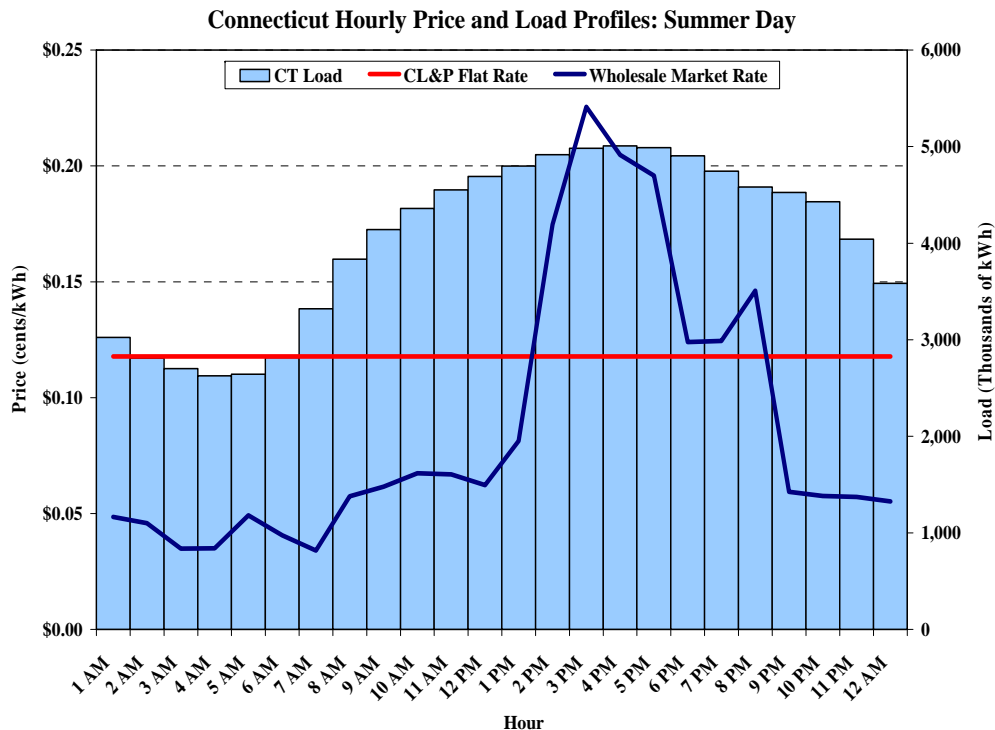
- Traditional system
- Examining smart grid options

NUSCO Initiatives

- EPRI Green Circuits
- Intelligent Universal Transformer
- EPRI Plug-in Electric Vehicles program (GM)
- “First Round” Charging Infrastructure for PHEVs

Why a smart grid? – 5 Good Reasons

1. Enable rates to reflect underlying costs



2. Enable new products/ services

- Risk Management (price and/or volume)
- End-use pricing (e.g., Plug-in vehicles)
- Pre-pay

3. Cost effectively enable “demand management”

- Significant load reductions available with minimal compromise
- Automation simplifies/ enables customer action

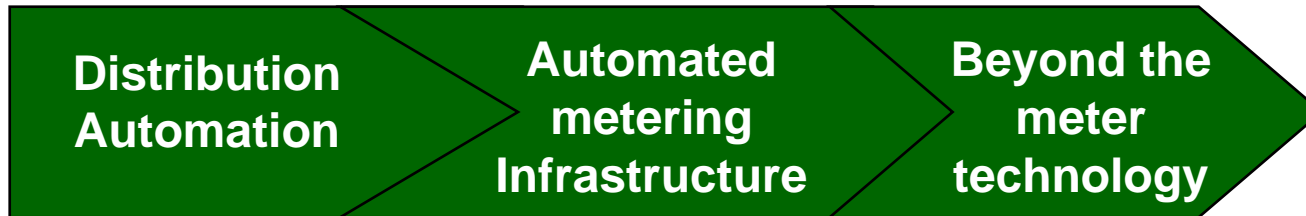
4. Provide real consumption insight (conservation)

- No intuitive way to monitor “real time” energy use
- Only insight comes in form of “ex-post” monthly bill

5. Improve Distribution System design/ performance/ flexibility

- Outage detection/ restoration
- Line loss reduction
- Distributed Generation integration
- Storage/ Plug-in vehicle integration
- Shift away from radial design

What makes a grid “smart?” – 3 key components



Key Components

- DSCADA (remote control system)
- Reclosers (automatic switching)

- Time of use meter
- 2 –way communications network

- Home area network
- “Smart” controls
 - Thermostats
 - Switches
- In-home displays

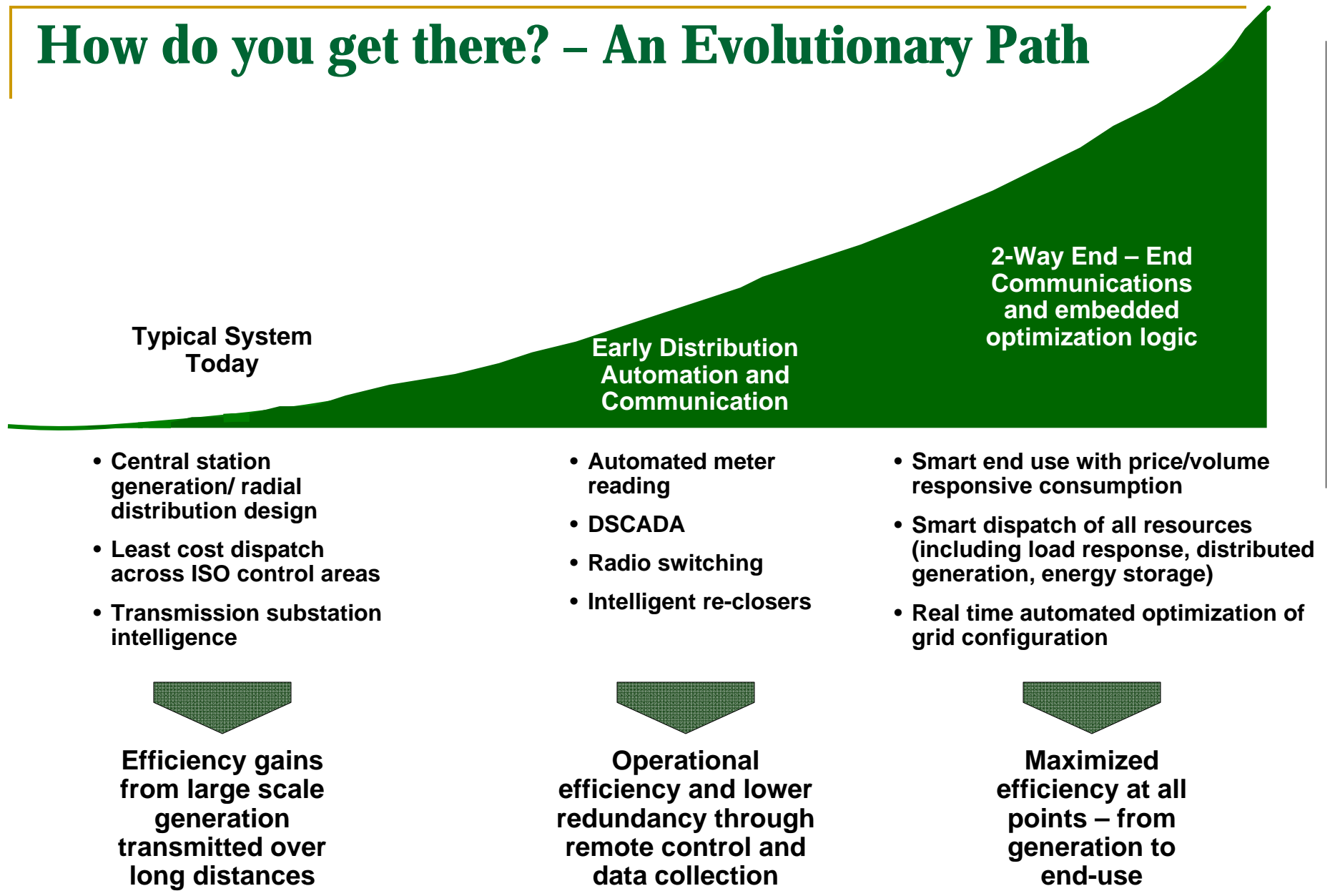
Key Benefits

- Remote control switching
- Automatic restoration of unaffected circuit sections following an interruption

- Consumption data
- Time/volume based pricing
- Distributed resource (generation and/or storage) integration

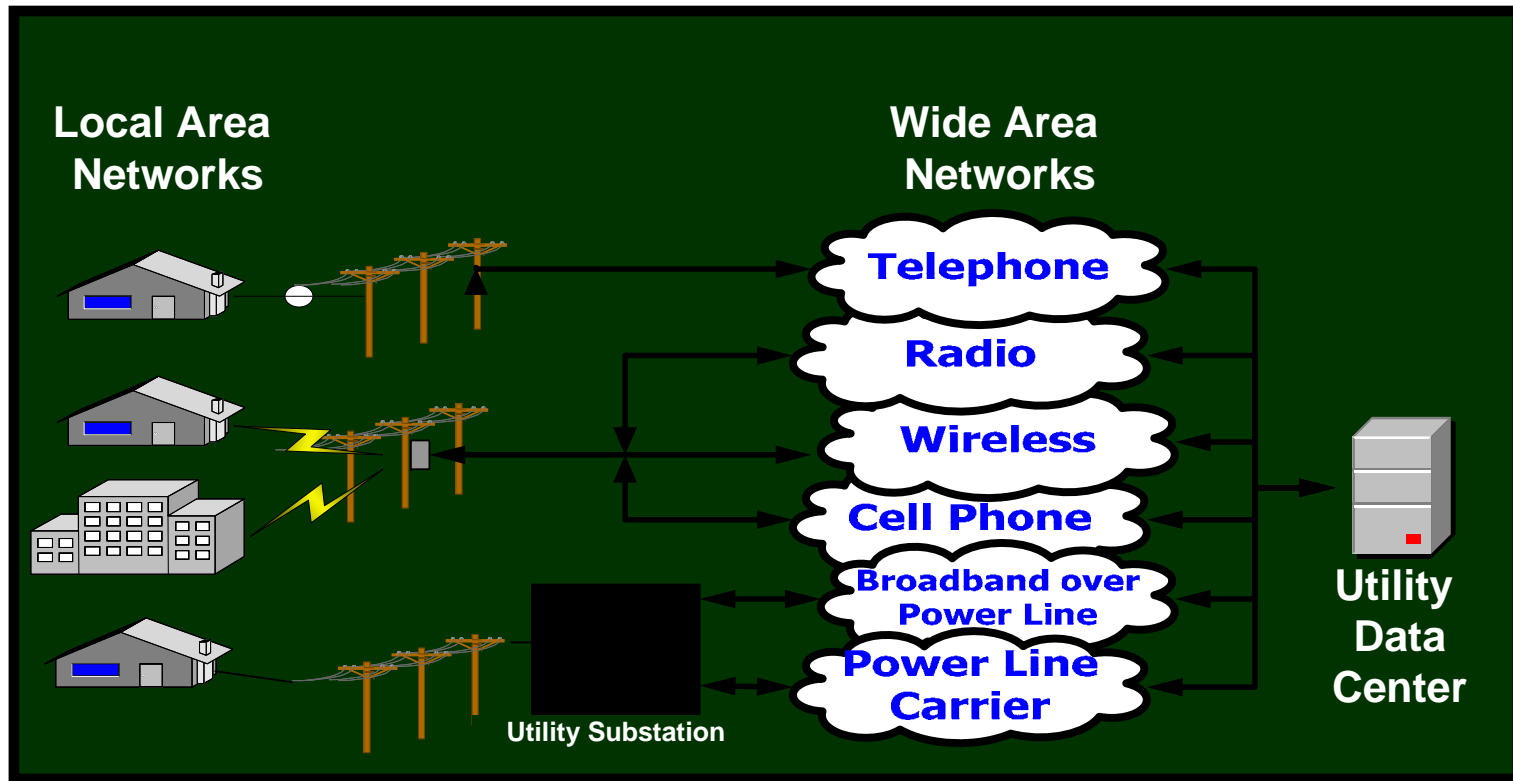
- Customer visibility into consumption rates/ patterns
- “Price-responsive” demand management
- Remote (web-based) energy management

How do you get there? – An Evolutionary Path



What communication infrastructure is required?

– multiple possibilities



Availability in rural areas can be a significant limitation

What have we learned about technology?

Mesh Pilot

- “Worked as designed”
- Meter failure higher than for non-AMI meters
- Meter availability was delayed
- Remote maintenance not commonly available
- Three phase and larger single phase meters not available
- Service activation switch “under the glass” not commonly available

“Plan-It Wise”

- RF AMI “works as designed”
- Smart Thermostats in their infancy (20% had lock-ups due to voltage issues)
- C&I scale smart thermostats not yet available
- Most meter vendor bids were un-tested designs
- Siting radio tower antenna deployments more time consuming than expected

“BPL”

- BPL higher cost than competing technology
- BPL speed (~ 250 kbps) not well suited for ISP applications; adequate for utility remote control
- BPL bandwidth (1 MB) substantially more than needed for meter read (but may be appropriate/required for dynamic energy management)
- CIP requirements likely prevent leveraging utility fiber infrastructure

Do customers want? The evidence suggests “yes!”

1. 2007 JD Power Residential Survey

- **Price – Value index for customers on “opt in” rate plans higher than for customers on basic service (610 vs 545)**

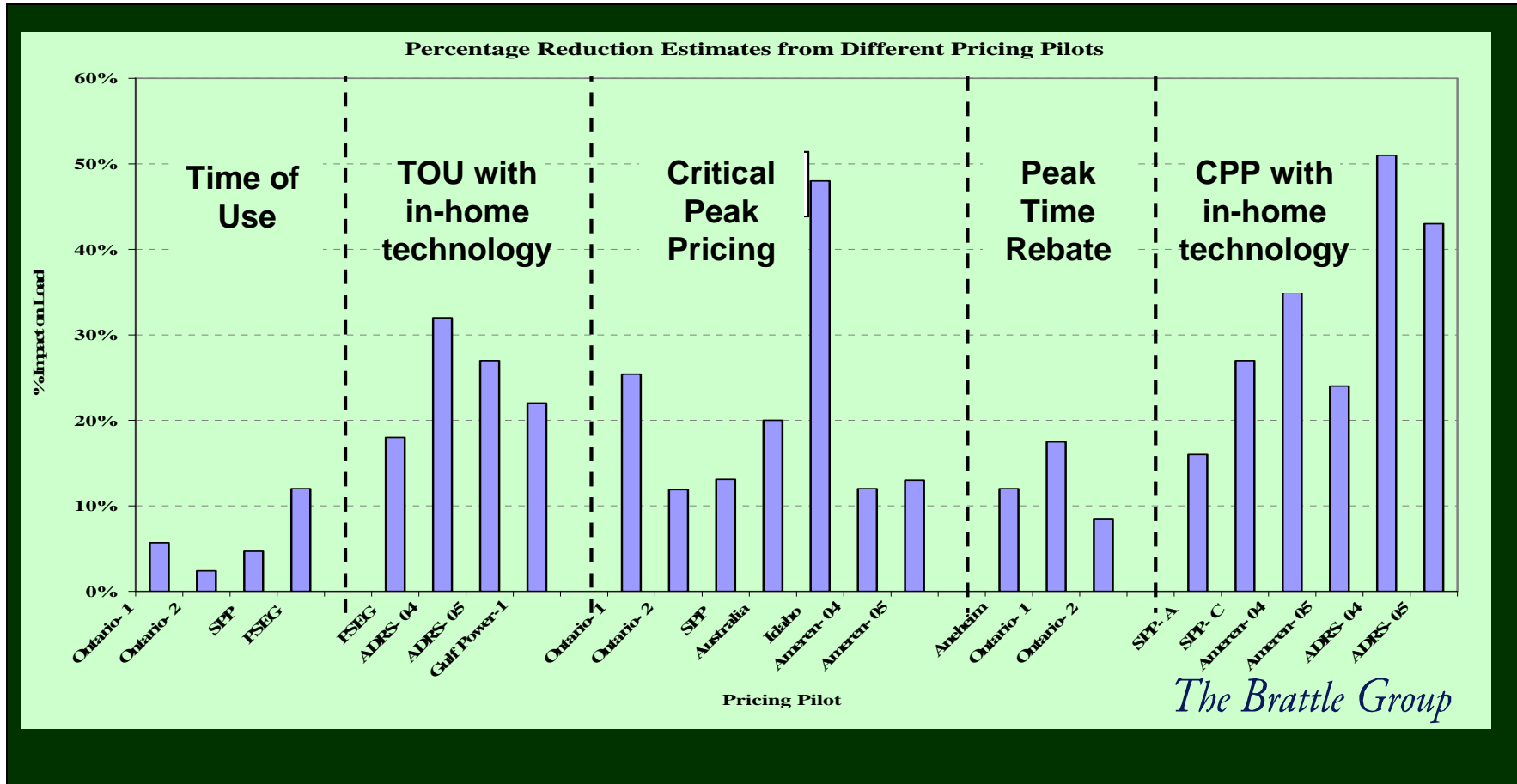
2. CL&P Plan-it Wise Energy Plan pilot

- **3000 Customer Rate Pilot**
- **Fully subscribed ahead of schedule with significantly higher response rate than anticipated**

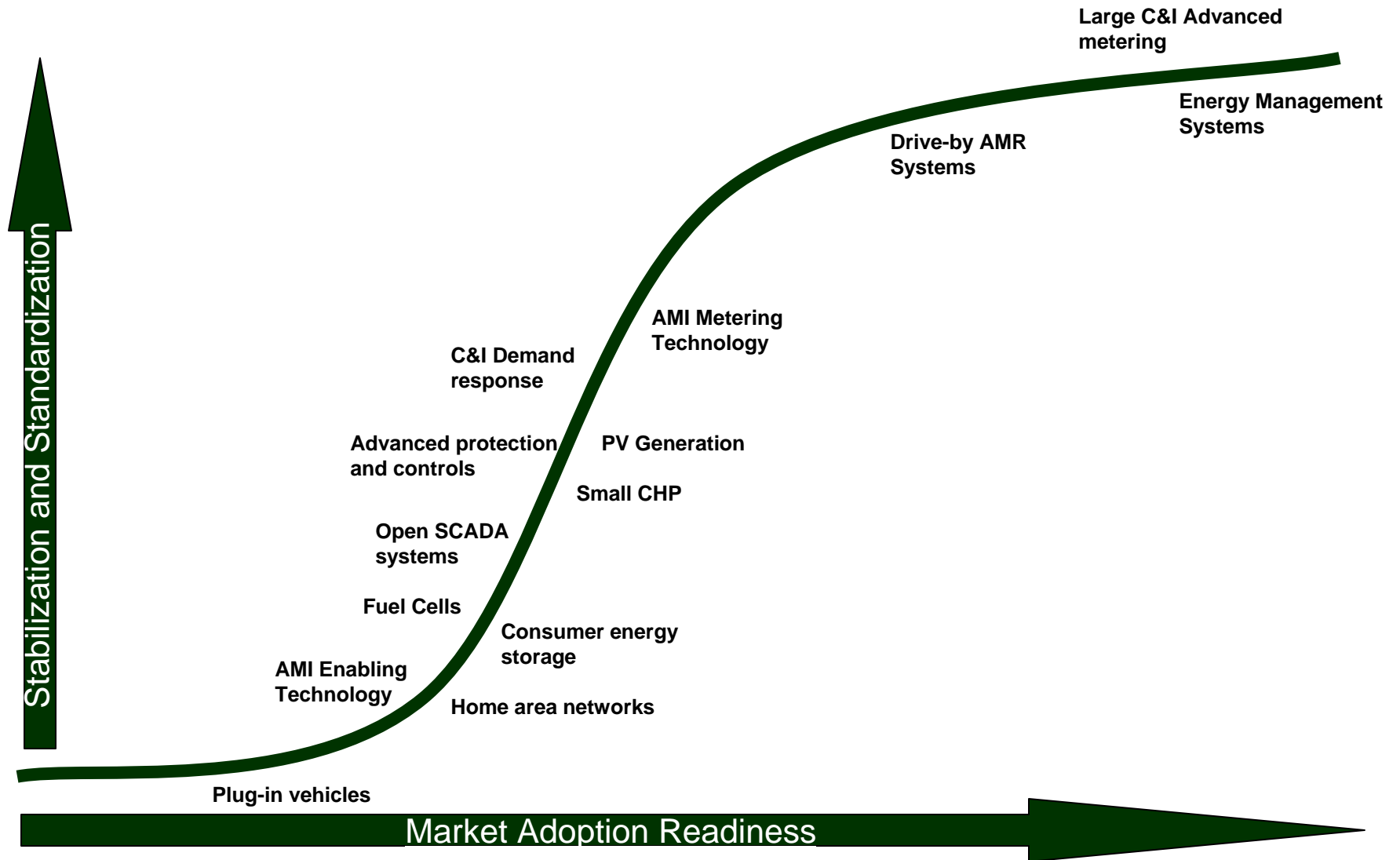
3. Pay As You Go – Salt River Project

- **Over 70,000 customers enrolled on an opt in basis**
- **92% of customers believe they use energy more wisely**
- **84% customer satisfaction**

Is there a value proposition? Experience suggests “Yes!”



Why hasn't it happened yet? – Technology is still evolving!



Where do we go from here?

- From multiple pilots...we know customers are likely to change their consumption habits (in some cases significantly)
- We know that technology will continue to evolve and improve...
 - "at what time should we get on the Technology S curve?" is the real question
 - Understanding and managing the technology risk is key
 - open standards and protocols key to avoiding VHS-BETA problem
- The recent New England shift to AMR systems erodes some of the "hard case logic" for the investment (investment needs to be justified on "softer" savings and benefits, not cost reduction)
- Deployment strategies likely need to weigh multiple variables and be linked to technology choice
- The availability of federal stimulus funds creates a near term sense of urgency for utilities and policy makers to develop a plan of attack