

Non-Wires Alternatives to Transmission BPA - History

- Nov. 2001 initial TBL study:
http://www2.transmission.bpa.gov/projects/nonwire/nonwiredocs/bpa_tbl_planning.pdf
- Nov. 2002 Kangley/Echo Lake Report:
<http://www2.transmission.bpa.gov/projects/nonwire/NonWireDocs/KELReport.pdf>
- Nov. 2002 Olympic DEMX:
<http://www2.transmission.bpa.gov/projects/nonwire/NonWireDocs/NovemberFact11-02.pdf>

The Search for Alternatives

- PNW
 - Analyses
 - Projects: Puget Sound Reliability & Orcas Island
- US
 - National Transmission Grid Study
 - Distribution level alternatives
- Europe
 - System adequacy becoming an issue

PNW

- Puget Sound Electric Reliability Plan
 - Extensive study with EPRI and others
 - Utilities chose substation construction alternative with aggressive conservation.
- Orcas Island
 - Studied space and water heat controls
 - Successfully kept peak demand $\leq 49\text{MW}$ for 3 yrs.
- PGE Targeted DSM
 - Studied efficiency only – no load control
 - Partially implemented – no deferral accomplished

Elsewhere in the US and Canada (no successful projects located)

- Targeted Demand Side Management Study for Northern Oneonta (New York State Electric and Gas)
- Tri-Valley Project (Pacific Gas & Electric Company)
- Toronto Integrated Energy Study (Ontario Hydro)
- Nashville Electric Project (Tennessee Valley Authority)
- Middletown Tap Project (Orange & Rockland Utilities)

Non-Wires Alternatives to Transmission

Ready or demo'able, 2-5 years out, 5+ years out
by category:

Transmission Infrastructure Upgrades

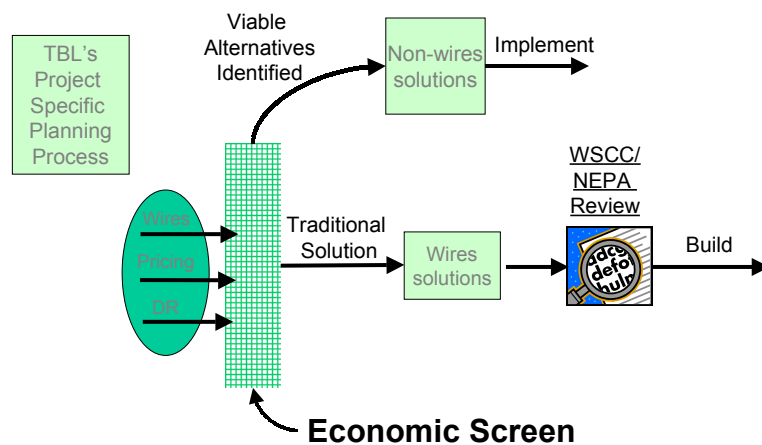
Energy Efficiency

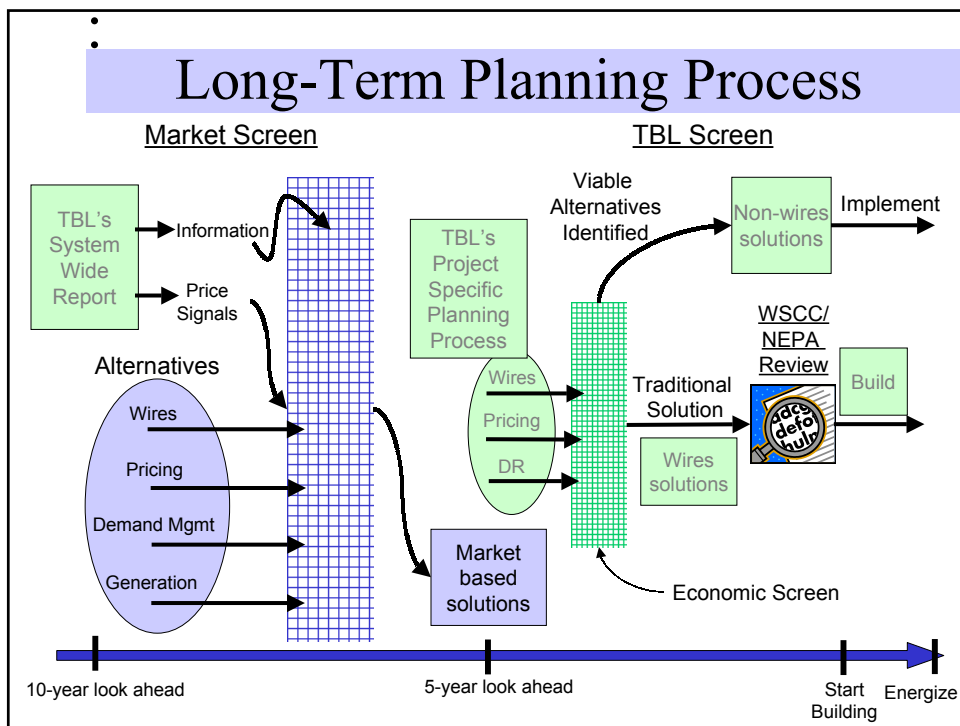
Demand Market

Load Center Generation

Advanced Technology

Current Process TBL Screen





Cost-Effectiveness of Alternatives

- Screen for cost-effective alternatives
 - Calculate benefit/cost (B/C) ratios of non-wires technologies and programs
- B/C ratio > 1 indicates the benefits of the alternative are greater than its cost
 - Potentially cost-effective alternative to the transmission line

“Cost effective to whom?”

Perspective is Extremely Important

	<u>Societal Focus</u>	<u>Utility Focus</u>
UCT (Revenue Req.)	Too Narrow - Undervalues Benefits to Other Parties	Current Practice - PVRR
RIM (Rates)	Predatory Test for Energy Efficiency	Impact on Rates is Important
TRC (Utility+Customer)	Reasonable, but still ignores environment	Too vague - better for who?
Societal (Comprehensive)	Least cost for society	Requires utility rates to implement social policy
Participant	Narrow, must include all reasons for participation	Used to estimate adoptions or success of RFPs

Alternatives to Transmission Expansion

- Demand-side management measures
 - Targeted Conservation
 - Direct Load control
- Distributed Energy Resource
- Demand response programs
 - Price-based dispatch
 - Interruptible / curtailable and demand response contracts
- Generation and distributed generation

Demand Response Programs

- DR solutions directly address the capacity nature of the problem
 - Price-based dispatch programs offer customers incentives to voluntarily curtail load during the peak
 - Interruptible / curtailable rates or direct load control programs are pre-arranged contracts with customers and require a customer to reduce loads during the system peak for a fixed price at BPA's request

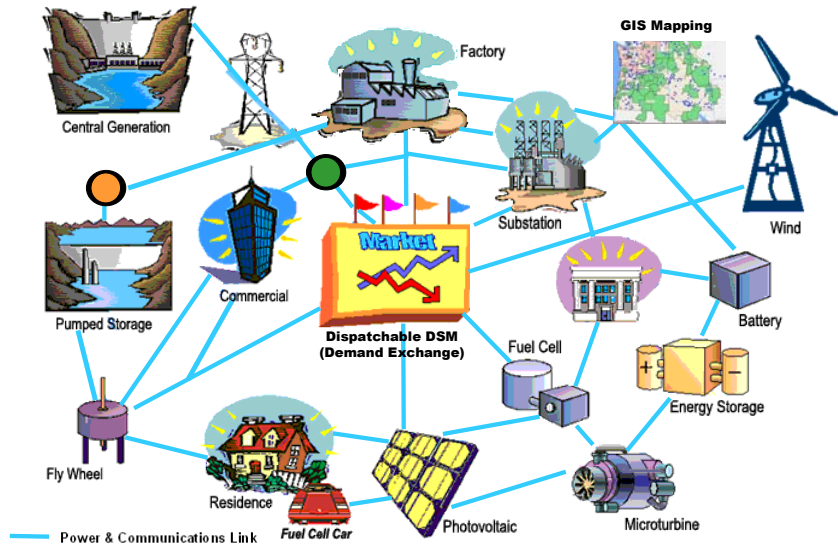
Generation and Distributed Generation

Generators should be available during heavy load hours when an outage would cause an overload on the Covington transformer banks

- Existing generation (not currently included in BPA power flow studies)
- New large-scale generation
- Existing distributed generation
- New distributed generation
- Regional availability of natural gas
- Renewable generation and emerging technologies

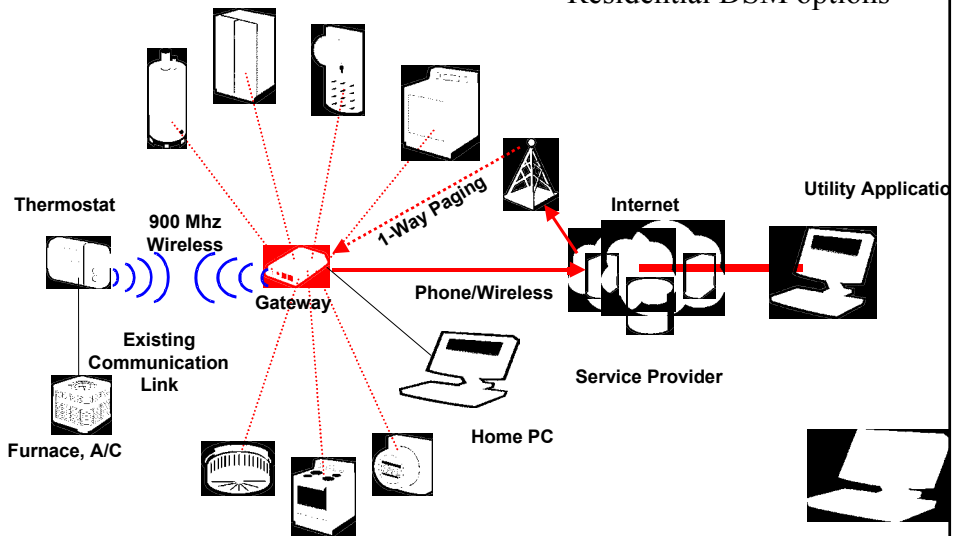
Ready to Demo

EnergyWeb



Ready to Demo

Residential DSM options



Up and running

What is the Demand Exchange?

- A peak load reduction program designed in response to dramatic swings in the market price of power in 1999 combined with a region-wide drought.
- A mechanism through which customers can curtail loads in times of short supply/high demand in exchange for payment
- An Internet-based auction



Energy Efficiency – Ready, off the shelf

Public Benefits

Conservation and Renewables
Discount (C&RD)
Market Transformation
Low Income Weatherization
Energy Web/Tech. Innovations

- Direct Application Renewables
- Distributed Generation
- Smart Meters/Appliances/Etc.

Information/Education/Outreach

Resource Acquisitions

Conservation Augmentation (ConAug)

- Utility Programs
 - Invitation to Reduce Load through Conservation
 - Limited Standard Offer
- Regional Programs (3rd Party)
 - CFL/TFL Rebates
 - Vending Mi\$er
- Federal Programs
 - Corps/Bureau Lighting
 - Quick Start and Reimbursables

Demand Exchange

Energy Efficiency Ready, off the shelf

- **Program options**

- LED traffic lights
- Cool roofs (California)
- Water/Waste Water pumping
- Lighting Upgrades
- Demand responsive buildings (smart buildings)
- Agricultural pumping
- Fuel switching (space heat - hot water to Natural gas or propane on price signal)
- On-Peak renewables
- Demand Exchange – pay for peak reduction (prepay or voluntary)
- Lower system losses (new conductors or transformers, Distribution level)
- Cellular/radio rotation of hot water heaters on
- Backup generation (hospitals, commercial & public buildings – gas fuel)
- Combined Heat and Power (micro-turbines that improve distribution reliability)

Ready to Demo

Load Center Generation

Small (5-20MW) Combustion Turbines near load centers for peaking (expensive & air quality issues)

Combined Heat and Power using small CT or microturbines in commercial buildings (200 Market St. example in next slide)

Conservation Voltage Reduction

- Good Energy Conservation Measure Particularly for small motor loads, like HVAC, not effective for predominant electric space and water heating loads.
- NOT a good measure for Extreme Peak reduction. When the peak is very high the Voltage needs to be raised to maintenance minimum voltage to customers. It is NOT prudent to consider this measure for NCA !!
- Technology
 - Controls at Substation. Can be deployed on a feeder specific basis.
 - Consumer Segment
 - Effective for residential (preferable with gas water and space heating) and small commercial. Should not be applied for industrial and large commercial, detrimental effect on large motors

Advanced Technology (Not ready for prime time, but coming)

Electricity (Energy) Storage (yes you can!)

Flow batteries, ultra capacitors, flywheels

Fuel Cells

Stationary (small & large), mobile (cars)

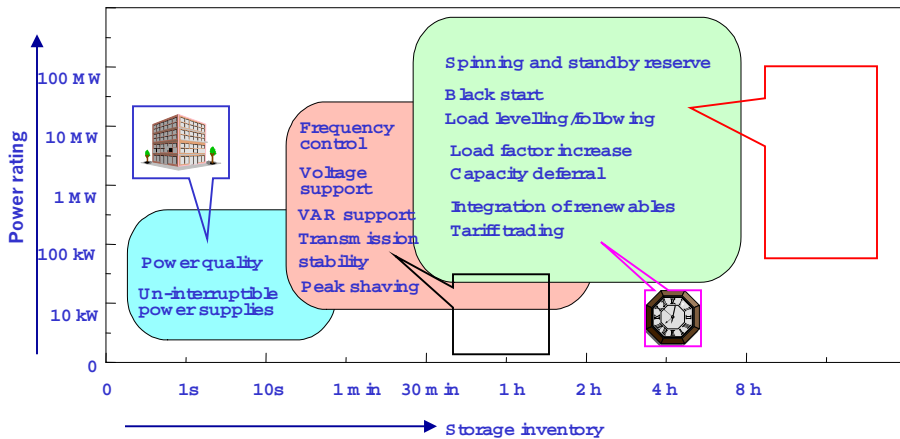
Smart Appliances

Peak shaving, system stability, convenience

Energy storage applications

Power quality and reliability applications

Energy management applications



Regenesys Plant Design - Little Barford, UK



2-5 years

Fuel Cell Demo'able, but 2 –5+years out

- Solid Oxide (SOFC)
 - 250kw up for power plant & 1-5kw residential
- Molten Carbonate
 - 250kw up (King county 1mw - \$18million)
- Phosphoric Acid
 - 250KW (UTC is the only “commercial” product)
- Proton Exchange Membrane (PEM)
 - 500 watts – 250kw (vehicle & stationary power)
- Direct Methanol (batteries for phones & laptops)

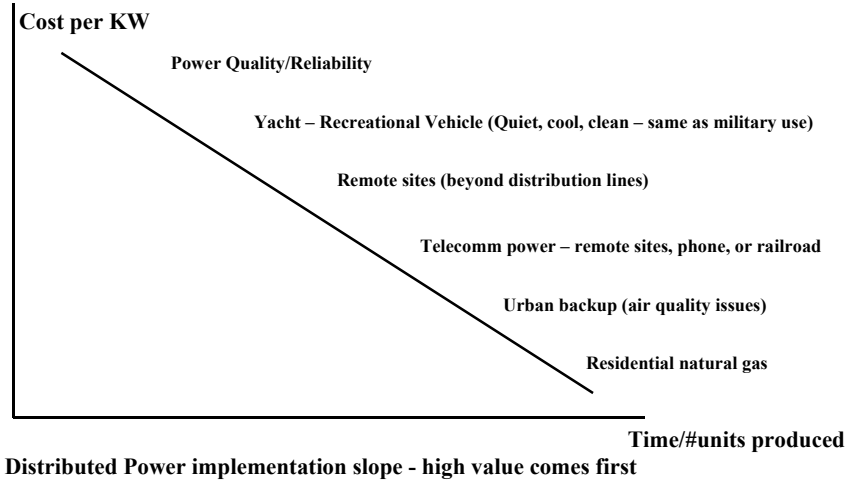
Demo'able, but 3-5+ years out

Fuel Cells

Ballard 250kw Ballard 1kw Coleman 1kw Avista 1kw

H Power 500w IdaTech 3kw Plug Power (GE) 7kw Proton 3kw

Possible adoption curve < 10KW fuel cells



Demo'able - just takes \$

Smart Appliances

Home network and Internet: the enablers

Home network and Internet allow the integration and the management of the overall power consumption. In particular, we can curtail energy on demand, we can share energy among devices, we can get data and we can monitor the energy consumption.

