Transformation from Regulated Utilities to Smart Cities

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Industry Transformation

Classic Utility



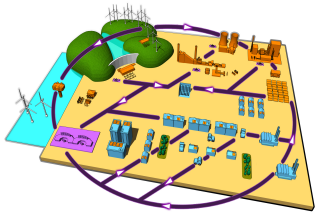
•Vertically integrated
•Cost-based operation
•Physical infrastructure

Competition



•Open transmission access
•Genco divestiture
•Wholesale electric market

Smart-Grid



• Distributed intelligence
• Service valuation
• Prosumer choices

Smart City



• Sustainability
• Resiliency
• Connectivity

1980 1990 2000 2010 2020

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Smart Grid Business Hierarchy for Distributed Energy Resources (DER) Operation

Bulk Power /Market (RTO/TSO)



Integration of VPPs into Bulk Power Operations

Distribution System Operations (DSO)

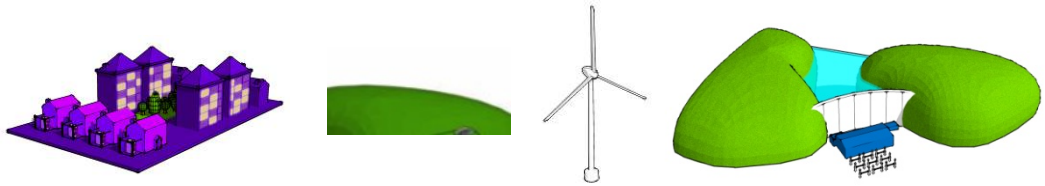


Hierarchical and Direct Control of VPP Resources

MicroGrid & VPP



***DER:** DR, DG, ES, EV, CHP*

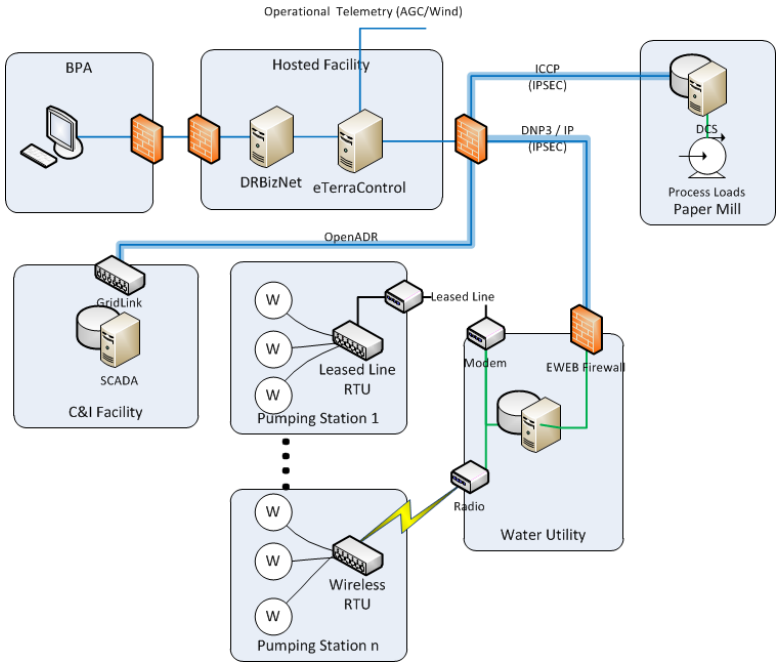


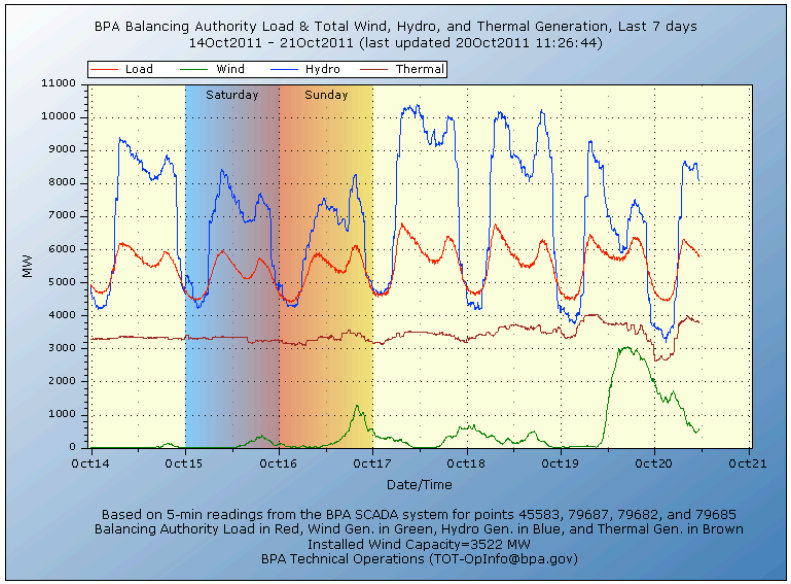
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Smart Grid Demonstration

BONNEVILLE POWER ADMINISTRATION

Balancing Wind Energy with Fast Demand Response





The Pilot intends to :

- ✓ Utilize industrial processing equipment to provide balancing reserves (INC & DEC)
- ✓ Use technology to increase visibility to see Resource availability & movement as well as Confirmation & transparency
- ✓ Experiment w/ DR Platform to rationalize various efforts and centralize DR.
- ✓ Learn how to integrate DR into Asset portfolio

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