



Demand Response Projects: Technical and Market Demonstrations



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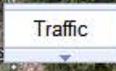
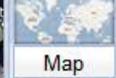
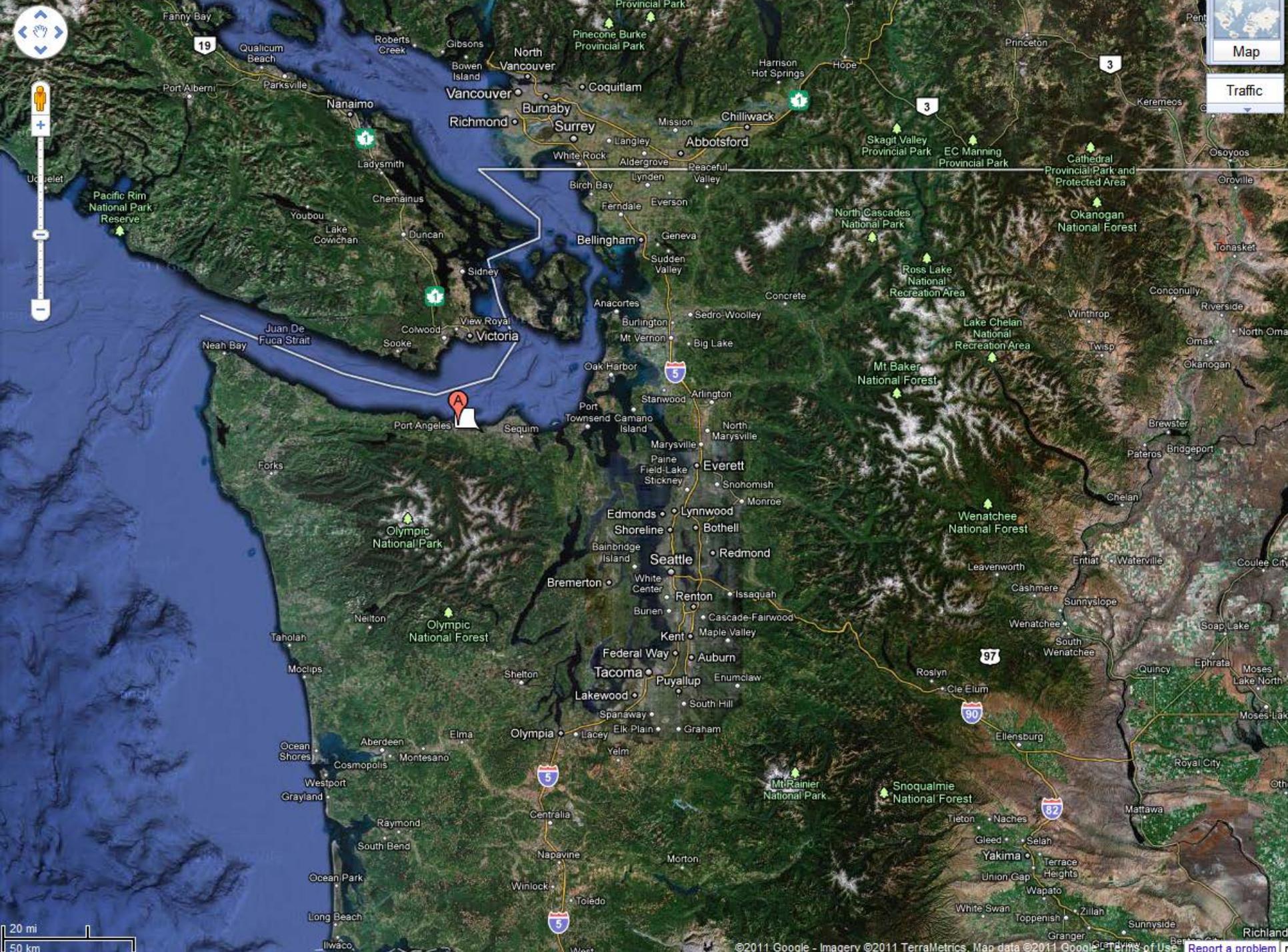
Deputy Director for Power and
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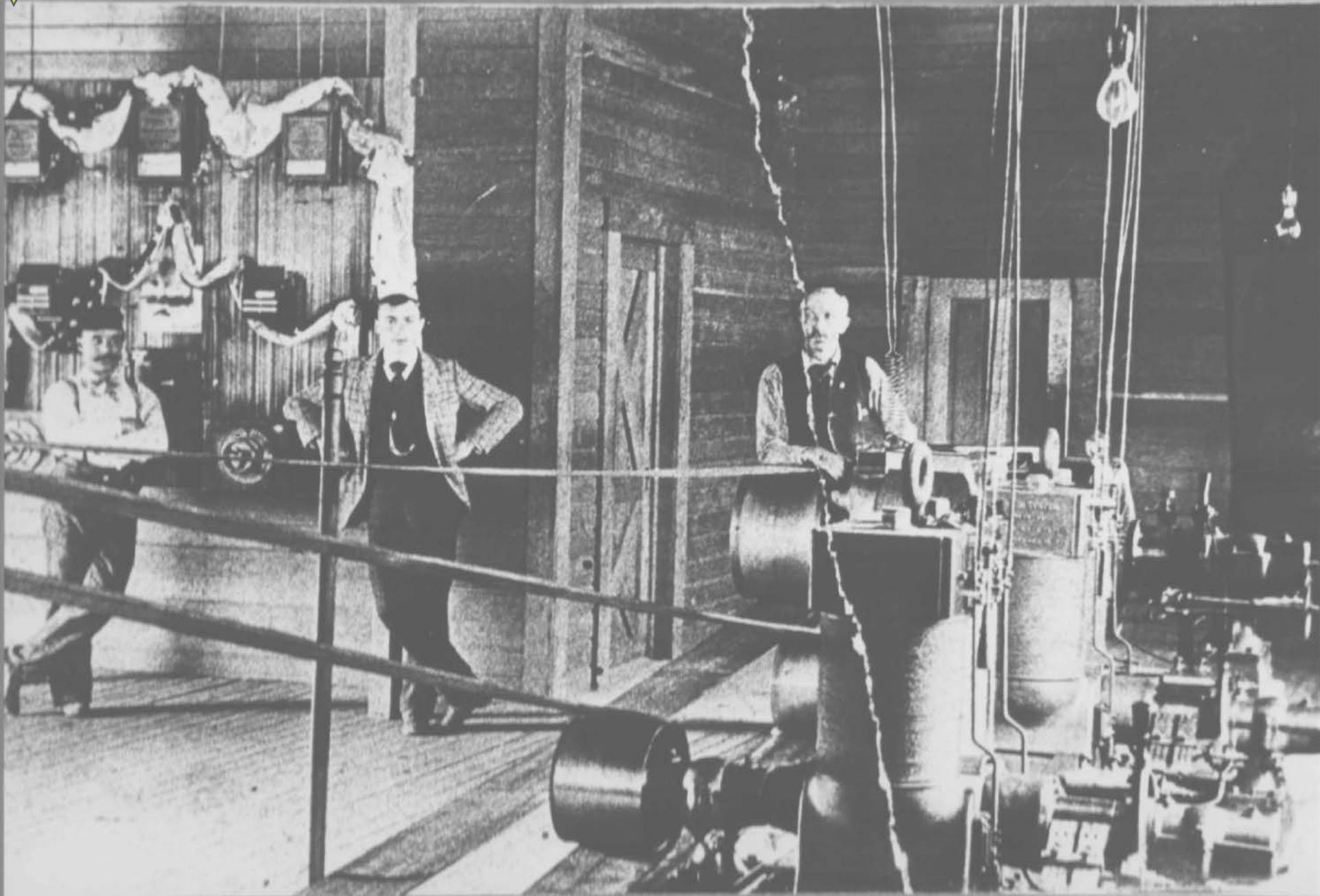
Commercial Energy Analyst

Joey Currie

Residential Energy Analyst



20 mi
50 km



INSIDE FIRST POWER HOUSE

Port Angeles



WASHINGTON.



Port Angeles' Dual Challenge

- BPA's Tiered Rate Methodology became effective on October 1, 2011
 - Better manage contract demand quantity, load shape, and critical peak periods
- City's electric and water meters are wearing out
 - Many under measure what people use

Advanced Metering Infrastructure Efforts

- All electric and water meters in City's service territory replaced with AMI by the end of 2013
 - 10,600 electric meters
 - 8,400 water meters
- "Turn-key" solution
- Procure and install a complete AMI system using one Vendor with minimum City intervention

Ramp Up Conservation Efforts

- Seasonal rate means that energy is priced correctly in the winter months
 - Higher winter energy rate sends an appropriate rate signal
 - Reinforces conservation program efforts in areas such as insulation and heat pumps
- Voluntary DR projects for all customer classes
 - Avoid exceeding contract demand quantity, maintain similar load shape to BPA, and mitigate critical peak periods

New Electric Utility Rate Design

- **Time-of-Use Rate without demand for residential, general service, and non-profit customer classes**
 - Customer base charge
 - Winter & summer seasons including peak period, off-peak period, and shoulder period energy charges
 - Demand response credits
- **Time-of-Use Rate with demand for general service demand and primary customer classes**
 - Customer base charge
 - Winter & summer seasons including peak period, shoulder period, and off-peak period energy charges
 - Demand charges during peak period only
 - Reduced demand charges for demand response participants?

NEW ELECTRIC UTILITY RATE DESIGN SCHEDULE

- Time-of-Use retail electric rate design
 - Rate design incorporated into AMI System
 - Retail rates determined Fall 2011
 - Retail rates effective 2014?
- Encourages all electric customers to
 - Reduce winter energy consumption
 - Shift peak period consumption to lower-priced shoulder and off-peak periods
 - Participate in voluntary demand response programs

Voluntary Demand Response Efforts

■ Customer-Side*

- Residential DR Pilot (600 customer units)

- Water heaters, smart thermostats

Residential Wind Integration Pilot (41 customer units)

- Water heaters, thermal storage

■ Commercial & Industrial DR Pilot (8 customers)*

- Open Automated Demand Response Communication Standards (OpenADR) communications protocol

- Industrial Wind Integration Pilot (1 customer)

■ Utility-Side

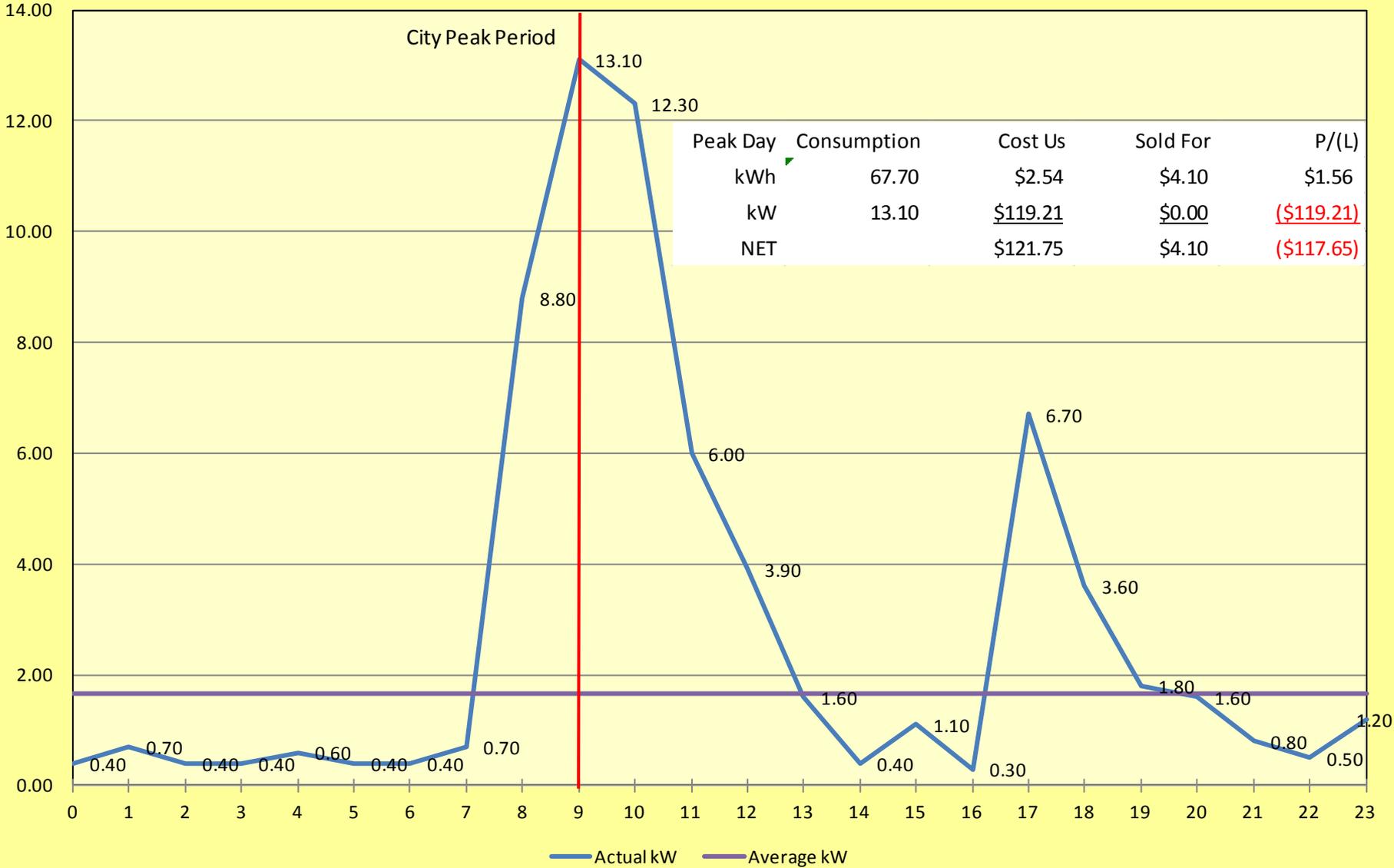
- Voltage Optimization (VO) using manually adjusted line-drop compensation

- Want to deploy fully automated system to monitor and report lowest end-of-line feeder into City's SCADA system

* Made possible with the support of the Bonneville Power Administration

Residential Demand Example Home #1

Customer Peak Day Costs and Sales (March 2012 Worst-Case)



DR Lessons Learned

- Customer's participate based on their perception of received value
 - Incentives help
- C&I load varies widely
 - Determining an appropriate baseline agreement is critical
- Determining DR value is uncertain to both the utility and its customers
 - BPA's HLH period is a DR challenge; load shifting may not decrease costs
 - Potential impacts of BP14 power and transmission rate proposals
 - Can DR mitigate impacts of the proposed transmission rate NCP billing determinant?



Project Direction/Next Steps

- **Demand Response Demonstration Market**
 - Under development with the BPA
 - Goal is to further leverage the DR pilot projects

Demand Response Market Demonstration Project Participants

- BPA PM: Tom Brim
- Project Sponsor: Lee Hall
- Contractor: City of Port Angeles
- Principal Investigator: Phil Lusk & Bob Kajfasz
- Project Stakeholders:

Project Team – COPA and BPA (with Alstom Grid)

City of Port Angeles:

- Phil Lusk – Overall Principal Investigator
- Bob Kajfasz – PM / Commercial Energy

COPA Participating Entities:

- City of Port Angeles City Hall
- Clallam County Courthouse
- Clallam County Housing Authority
- Nippon Paper Industries USA
- North Olympic Library System
- Olympic Medical Center
- Port Angeles Hardwood
- Catalyst Energy Technologies
- The Landing Mall

+

BPA Core Team:

- Tom Brim (PM) – DR Team
- Shannon Greene – Power Acct. Exec
- Jason Gates – DR Team
- Tony Koch – DR Team
- Ryan Redmond - Power – LT Sales/Purchases
- Melanie Parker (COTR) - DR Team
- Matt DeLong (CO) – Supply Chain

BPA Subject Matter Experts

- Power – LT Sales/Purchases, Scheduling
- Power – Requirements Mktg (AE)
- Power – Acct Services
- Transmission – Operations, Dispatch
- Transmission – Marketing/Sales
- Strategy
- Legal

Experts will be brought together to review contract mechanisms (e.g. term sheet), and operationalize (e.g. dispatch, measurement)



Project Synopsis

- City acts as a Demand Response aggregator
 - Develop a more realistic DR market by working out the remaining financial and institutional issues
 - Operate a DR market for INCs and DECAs in order to meet the following objectives:
 - Reduce or shift the City's peak demand
 - Provide regional balancing reserves
 - Determine the market values for INCs and DECAs
 - Develop a commercial ancillary services market using non-generation assets

FAST DR AS ANCILLARY SERVICES?

- Ancillary services defined by the FERC:
 - “...those services necessary to support the transmission of electric power from seller to purchaser given the obligations of control areas and transmitting utilities within those control areas to maintain reliable operations of the interconnected transmission system.”
 - scheduling and dispatch
 - reactive power and voltage control
 - loss compensation
 - load following
 - system protection
 - energy imbalance



Fast-DR/Renewable Integration Using LI-Battery Storage



Fast-DR/Renewable Integration Using LI-Battery Storage





Refiner Heat
Recovery System

Refiner

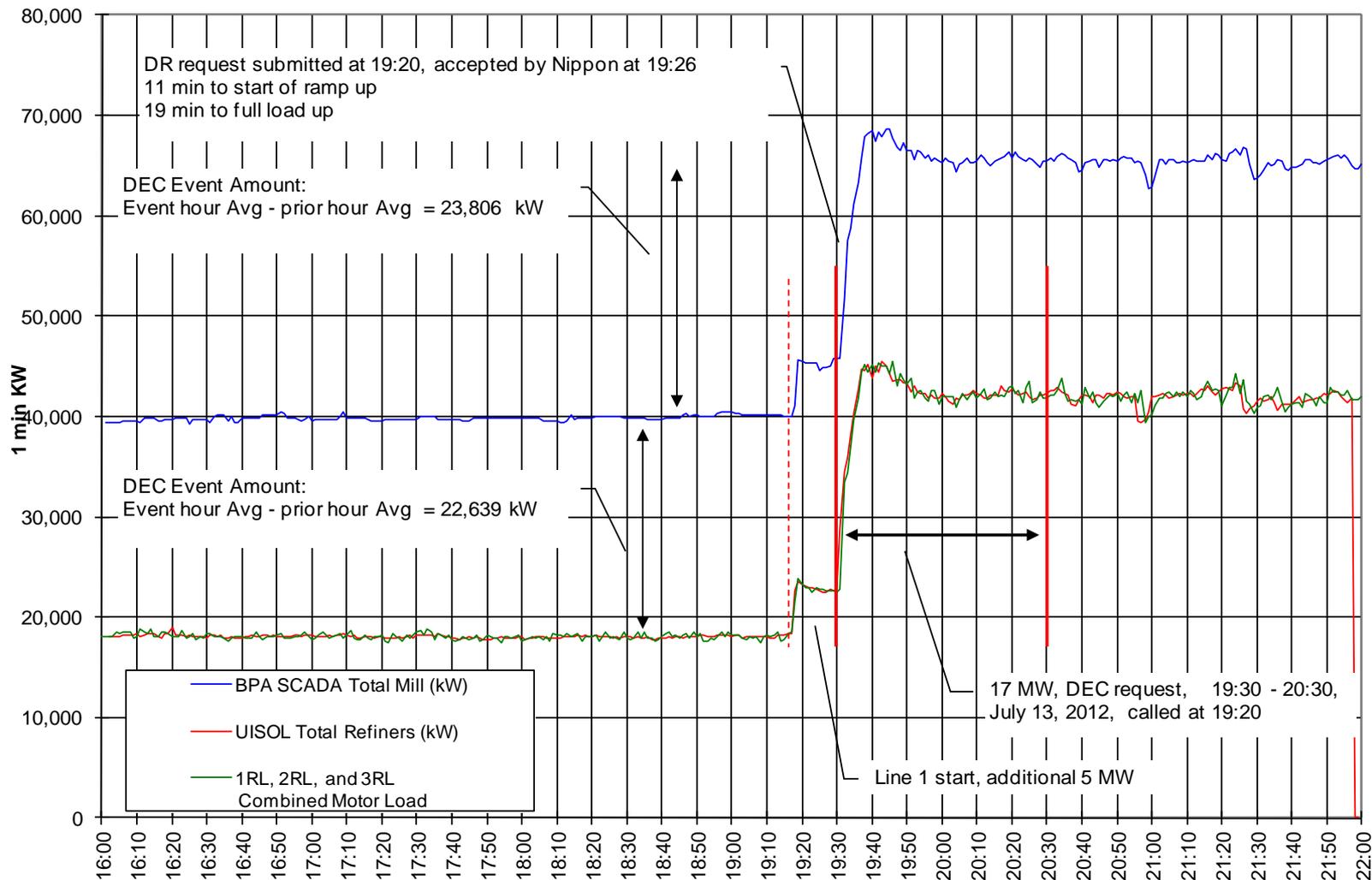
Refiner

Hydraulic Starter Motor for Refiner & 12000 HP Motor



FAST-DR/RENEWABLE INTEGRATION USING MECHANICAL PULPING REFINER LOADS

Total Mill Power (BPA SCADA) and Refiner Loads - DEC Event July 13, 2012



Accomplishments

- City has secured commitments from participants including a large industrial customer
- City has started discussion on contractual agreements with the participants
- BPA and City identified key issues of concern to participants and the utility
- BPA, City and participants are gathering information on event parameters including:
 - Probable event times
 - Event durations
 - Potential risk
 - Payment structure
- BPA has convened a cross-organizational team to discuss contracting strategy, potential items for term sheet, and risk and benefits



Expected Benefits

- Provide increased reliability for regional and local electrical distribution system
- Increase distribution dynamics
- Reduce demand and transmission volatility
- Reduce price volatility
- Delay or eliminate regional and local transmission upgrades



Additional Benefits

- The BPA Administrator has identified DR as a key regional issue
 - BPA faces significant balancing reserve demands due to Balancing Authority obligations to integrate increasing amounts of wind within the next few years
 - Additional renewable development is expected in the BPA Balancing Authority
 - Possible opportunities to avoid or defer contested and costly transmission infrastructure investments
 - In some of these cases, DR may be part of a cost-effective non-wires solution to help delay or avoid transmission construction



Technology Transfer/Application to BPA

- Following project completion, the BPA will
 - Better understand the development of a scalable commercial INC or DEC product
 - Develop business structure with direct applicability for future customer relationships
 - Have tools in place for an ancillary services market using non-generation assets



Project Direction/Next Steps

- Develop model contract between the BPA and the City. Partial list of topics include:
 - Who makes or initiates an event (INC or DEC)?
 - What criteria are used to initiate an event?
 - How is size of event determined?
 - What response time is required?
 - What event size is being committed (kW)?
 - Is the event size fixed or variable?
 - Does a partial response (size of delivered DR or duration) to the event qualify?



Project Direction/Next Steps

- Develop model contractual agreement between the City and the project participants. Partial list of topics include:
 - Payment structure.
 - What happens if we participants don't deliver committed quantity (i.e. penalties)?
 - How does partial delivery effect performance payments?
 - Do project participants retain ability to opt out of participating in an event request?

An aerial photograph of a coastal town and harbor. The water is a deep blue, and the town is built on a peninsula. A large industrial facility, possibly a power plant or refinery, is visible in the foreground. The sky is clear and blue.

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