



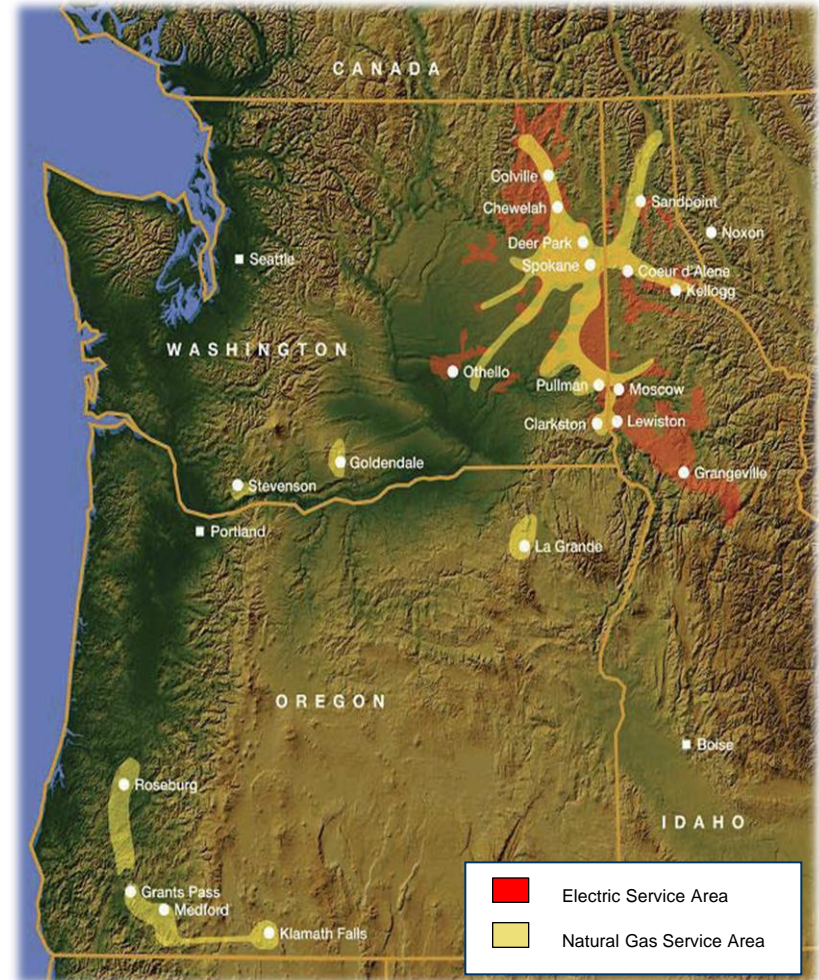
The Northwest's First Smart Grid Community Pullman, WA



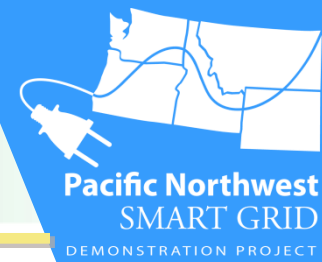
*March 22nd, 2012
Curtis Kirkeby, PE
Sr. Electrical Engineer
Technology Strategy
Avista Utilities*

Who Is Avista?

- Founded in 1889 as Washington Water Power
- Investor-owned, regulated gas and electric utility, headquarters in Spokane, Washington USA
- 1,554 employees serving 359,000 electric and 319,000 natural gas customers in the states of Washington, Idaho and Oregon



Pacific NW Demonstration Project



What:

- \$178M, ARRA-funded, 5-year demonstration
- 60,000 metered customers in 5 states

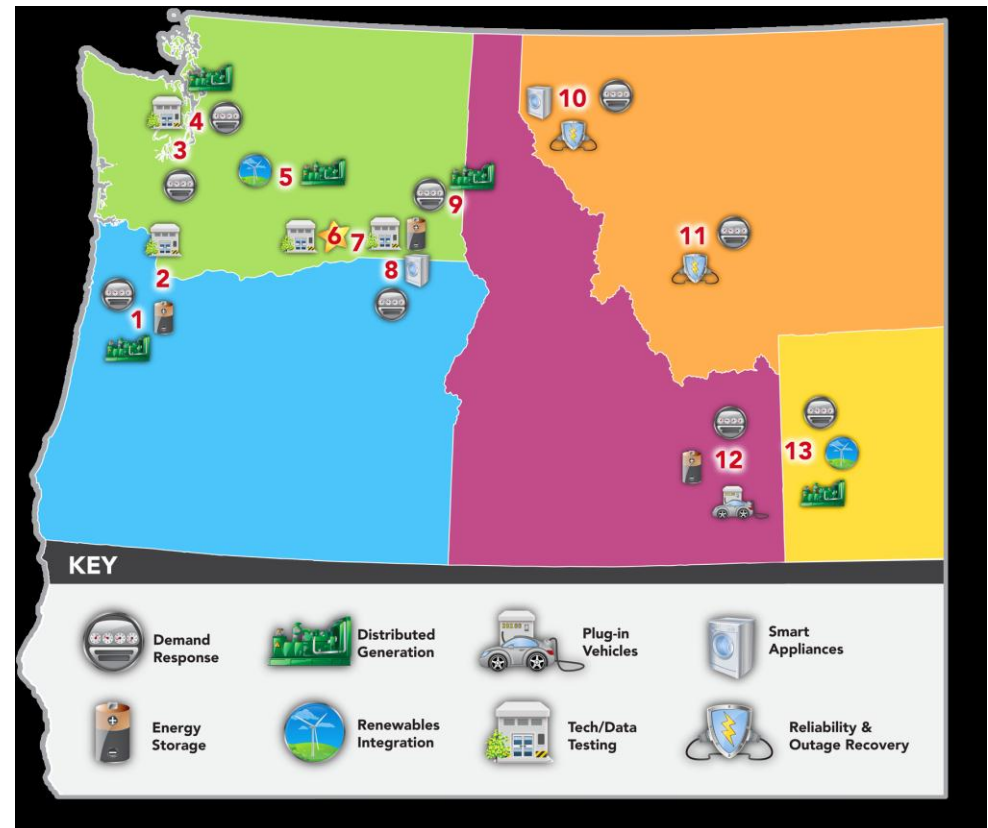
Why:

- Quantify costs and benefits
- Develop communications protocol
- Develop standards
- Facilitate integration of wind and other renewables

Who:

Led by Battelle and partners including BPA, 11 utilities, 2 universities, and 5 vendors

Website: <http://www.pnwsmartgrid.org/>



Avista's Demonstration Project Scope



- 13 Circuits (59 circuits in Spokane)
- 3 Substations (14 more in Spokane)
- 13,000 Electric Customers (110,000 more in Spokane)
- 5,000 Gas Customers

(Focused on Reliability, Energy Efficiency, and the Customer Experience)

The Opportunity for Reliability

Demonstration Project (40 Months)

All Outages

- 650 Incidents
- 97,074 Customer-hrs
- ~ \$970,740 Customer Cost

FDR Lockout

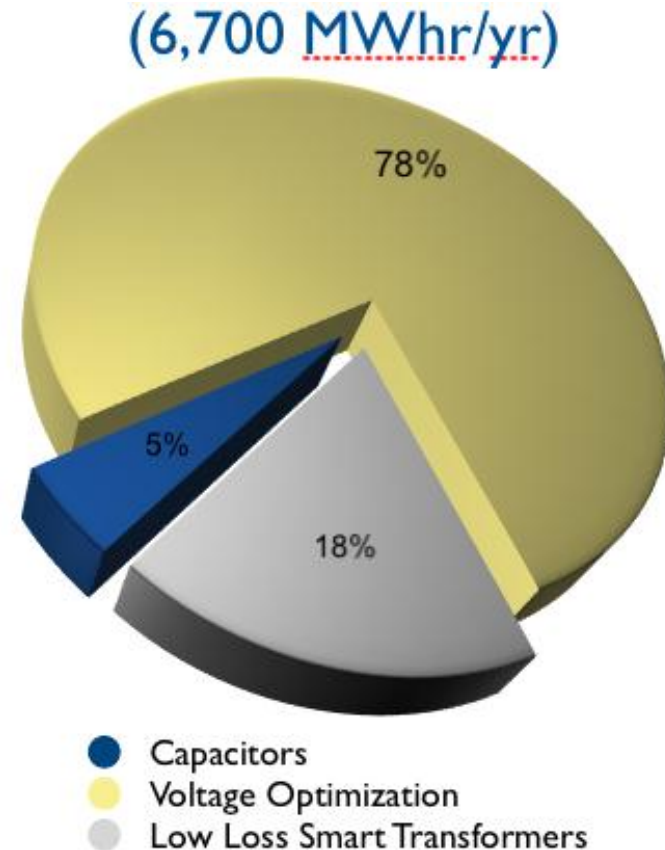
- 24 Incidents (4%)
- 88,201 Customer-hrs (91%)
- ~ \$882,010 Customer Cost

Reduction

- 24 Incidents (4%)
- 44,100 Customer (45%) Outage Hours
- ~ \$440,100 Customer Cost (SAVED)

The Opportunity for Energy Efficiency

- Real-time, all the time
- Approximately 2% savings in load and losses
- Approximately 95% of savings is reduced customer loads
- Small reserve available for demand response
- Automated Optimization via Distribution Management System

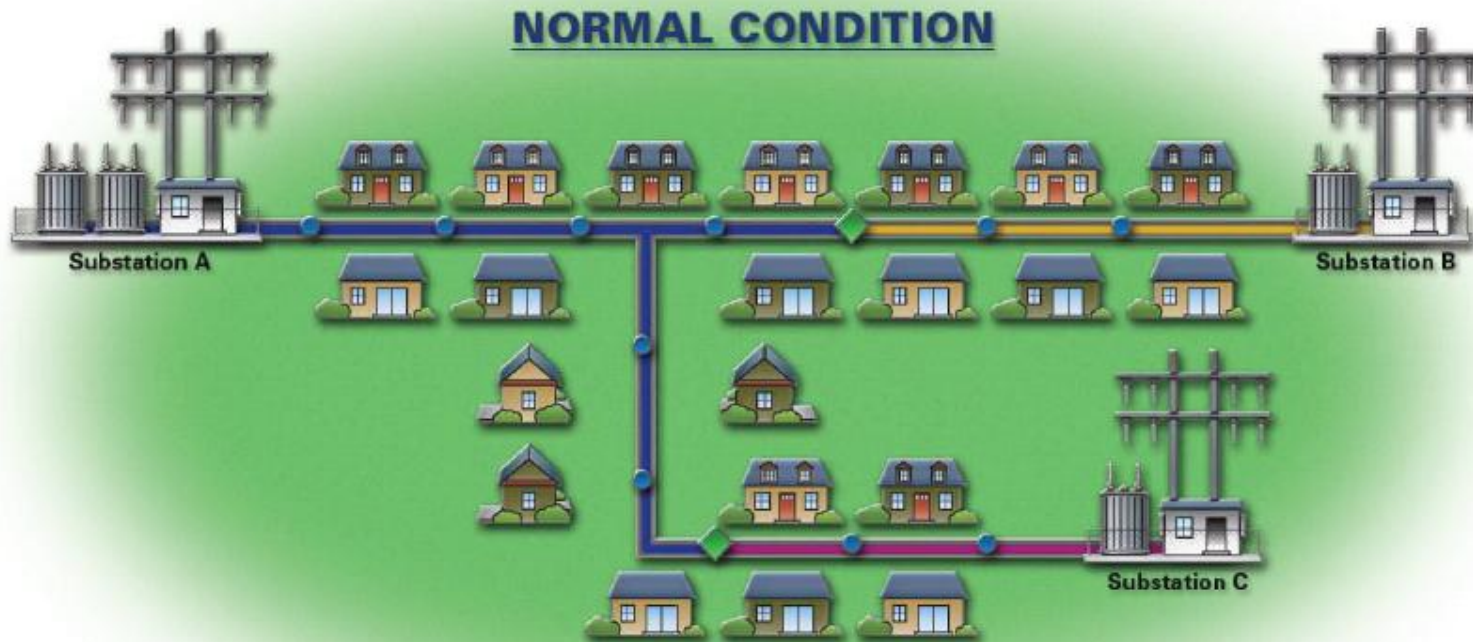


The Opportunity for Customers

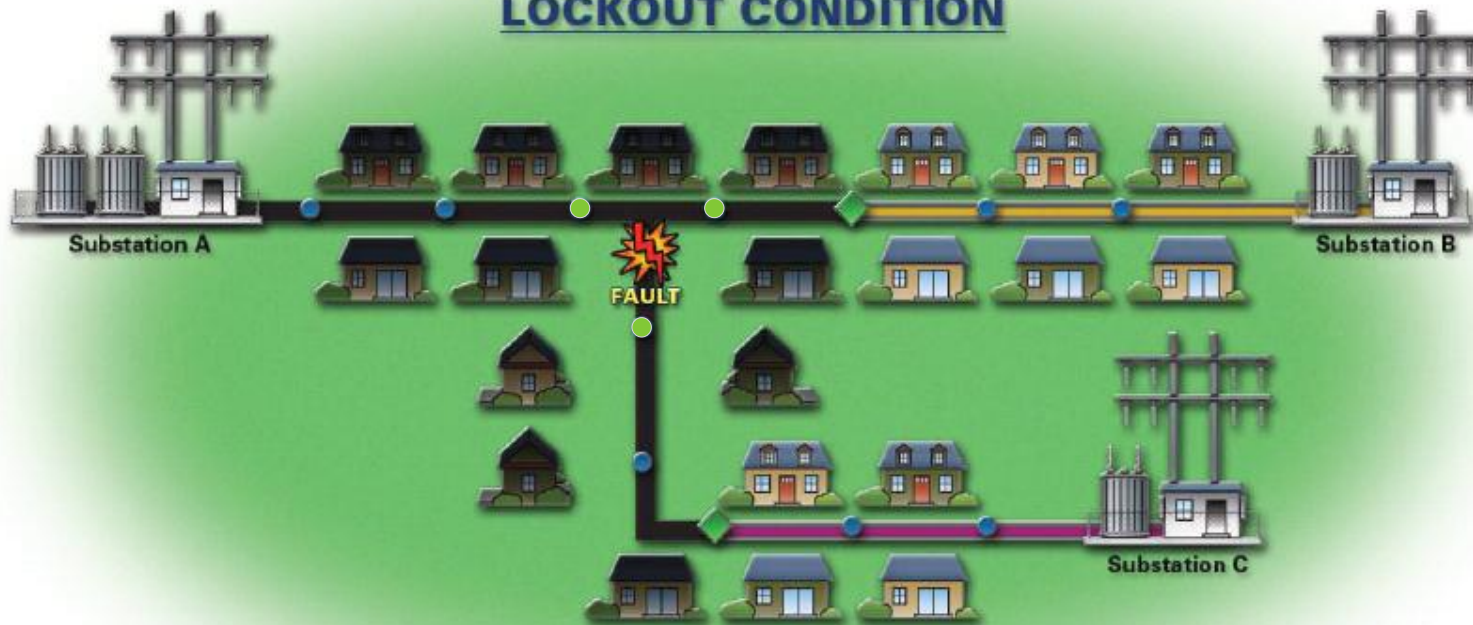
- Understand energy consumption
- Understand how to affect energy consumption
- Gain budget control of energy usage
- Participate in a national experiment for transactive grid response
- Gain insight into energy savings opportunities via home upgrades such as insulation, windows, etc
- Encourage competition between neighbors, friends, blocks, co-workers, etc



Reliability Scenario



LOCKOUT CONDITION



Reliability Scenario



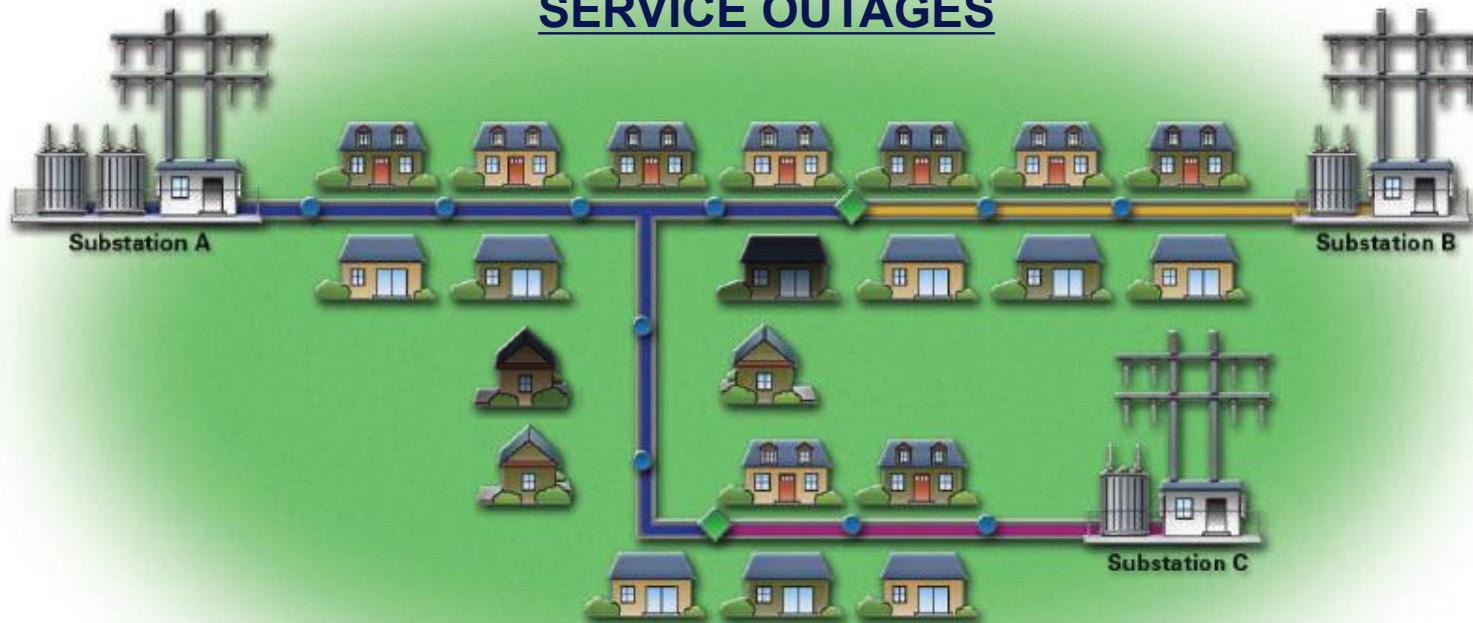
Reliability Scenario

**AMI IDENTIFIES
DOVSERVICEOUTAGES**



Reliability Scenario

AMI IDENTIFIES SERVICE OUTAGES



Energy Efficiency-Smart Transformers

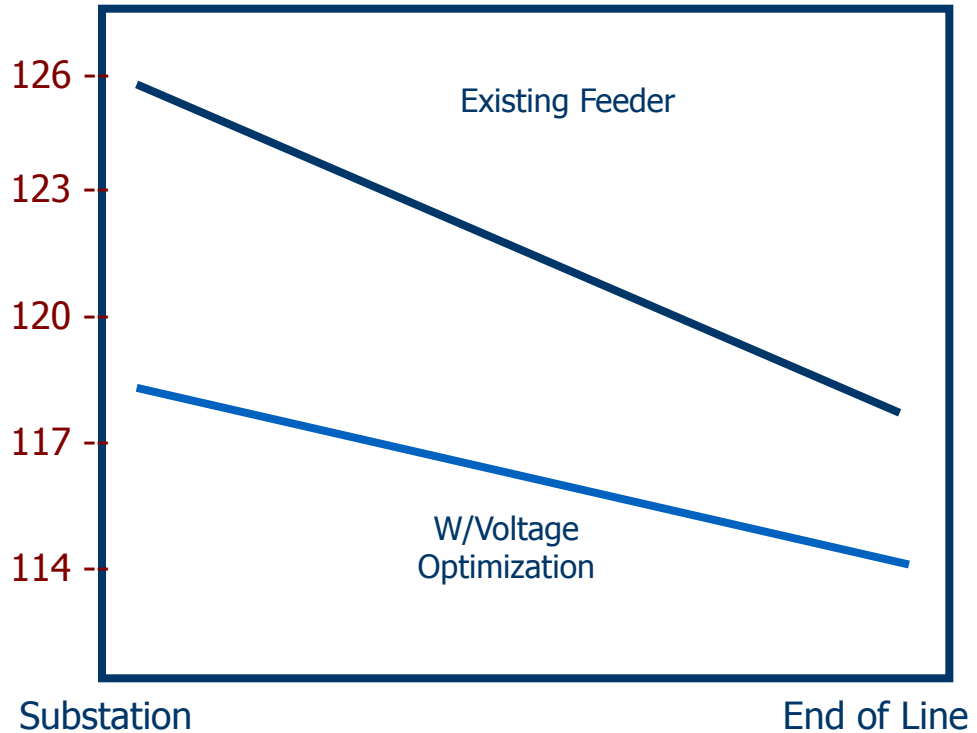
- High Efficiency Exceeding National Standards
- Real-time Sensors for Watts, VARs, Voltage, Winding Temperature, Loss of Life
- Equipped with Wi-Fi Routers to Extend the Control Communications Network



Image: USDA Farm Service Agency
© 2010 Google

Energy Efficiency-Voltage Optimization

- Power Factor Correction to Near Unity (fixed and switched capacitor banks)
- Voltage Regulation on Each Phase at Head End of Feeder
- Measures at Each Switch, Cap Bank, Voltage Regulator, Smart Transformer, and AMI Meter
- Automated Optimization via DMS
- AMI low & high voltage alarms for calibration of voltage optimization



The Customer Experience

- Provide energy consumption data
- Establish and test regional signals
- Understand customer experience, satisfaction, and program participation
- Validate the need for and type of customer incentives
- 1,500 customers in Pullman



Testing, Understanding, Learning

The Customer Experience

Experiment	Battelle		Enabling Technologies				
	Req	Battelle ID	Web Only	Web + Real Time	Web + Tstat	Web + DR	Web + DR + Full Analytics
This asset would provide tools to the customer to decrease their energy consumption and will also measure reduction in load due to customer behavior modification (Behavior Conservation)	yes	AV-05-3.1	X	X	X	X	X
Transactive signal will provide automated demand response through AMI (Automated direct demand response)	yes	AV-05-1.2				X	X
Transactive signal will provide automated real time response through AMI (Automated Real Time)	yes	AV-05-1.4					X
Avista will conduct survey for customer acceptance of the load control devices. (Customer Acceptance)	yes	AV-05-4.1				X	X
Avista will conduct survey for customer acceptance of load control devices if incentives are provided. (Customer Incentives)	yes	AV-05-4.2				X	X
Avista will conduct survey for customer acceptance of the load control devices if incentives are provided. (recruitment practices)	yes	AV-05-4.3				X	X
AMI can help in customer behavior modification by providing real time info of their energy usage. This asset would provide tools to the customer to decrease their energy consumption and will also measure reduction in load due to customer behavior (Behavior Conservation)	yes	AV-06-3.1		X	X	X	X

Customer Web Presentment

Sharen R Rabl
Account #: 7

Sharen R Rablin
Account #: 770047314

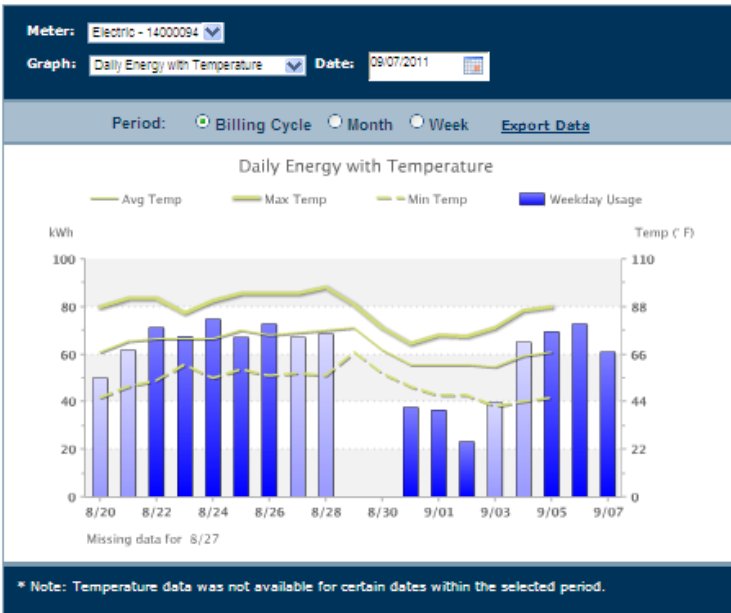
Service address at:
23323 E Desmet Ct., Liberty Lake, WA 99019

My Energy
Check out your energy usage charts and tips. To change your chart view, make new selections from the options below.

My Energy Usage

Check out your energy usage charts and tips. To change your chart view, make new selections from the options below.

Meter: E
Graph: A



Look for trends or irregularities in the actual daily usage bars, relative to one another and to the average. Does a bar stick out as especially low? Was there some particularly good energy practice on that day that can be applied to others? If a bar is significantly high

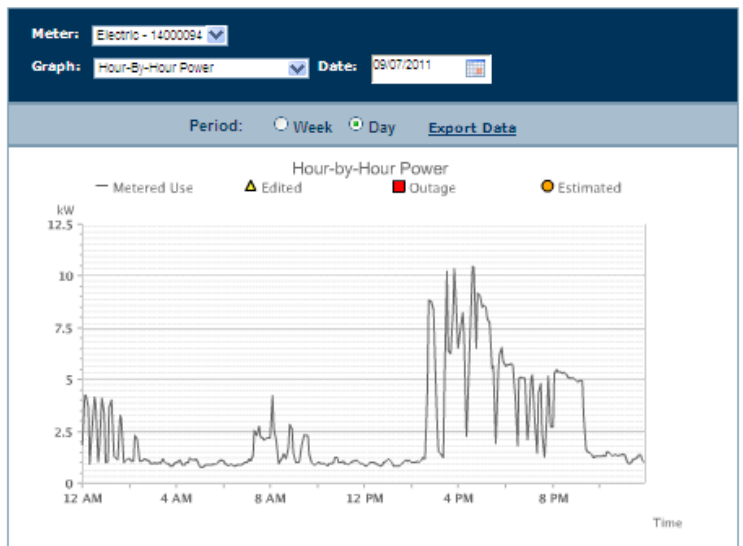
Look for trends or irregularities in the actual daily usage bars, relative to one another and to the average. Does a bar stick out as especially low? Was there some particularly good energy practice on that

Sharen R Rablin
Account #: 770047314

Service address at:
23323 E Desmet Ct., Liberty Lake, WA 99019

My Energy Usage

Check out your energy usage charts and tips. To change your chart view, make new selections from the options below.



Use your daily charts first to identify the days with the highest energy usage, then continue to these hourly charts to identify key hours of energy usage. Look for trends or irregularities in the actual hour-by-hour usage. What are the top 3 hours of energy usage? Does this vary from day-to-day? What key

Look for trends or irregularities in the actual daily usage bars, relative to one another and to the average. Does a bar stick out as especially low? Was there some particularly good energy practice on that

Customer Empowerment



Current	Eve	Night	Morn
73° ☀️	72° 🌙	53° 🌙☁️	64° ☀️
Mainly Sunny	Clear	Partly Cloudy	Partly Cloudy
CURRENT	POP 30%	Humidity 44%	Wind E 11mph
Tue	Wed	Thu	Fri
☁️	☁️	☁️	☀️
H77° L53°	H79° L63°	H70° L57°	H67° L54°
Mostly Cloudy	Drizzle	Drizzle	Partly Cloudy
30%	55%	POP 40%	30%
67%	89%	HUM 76%	81%

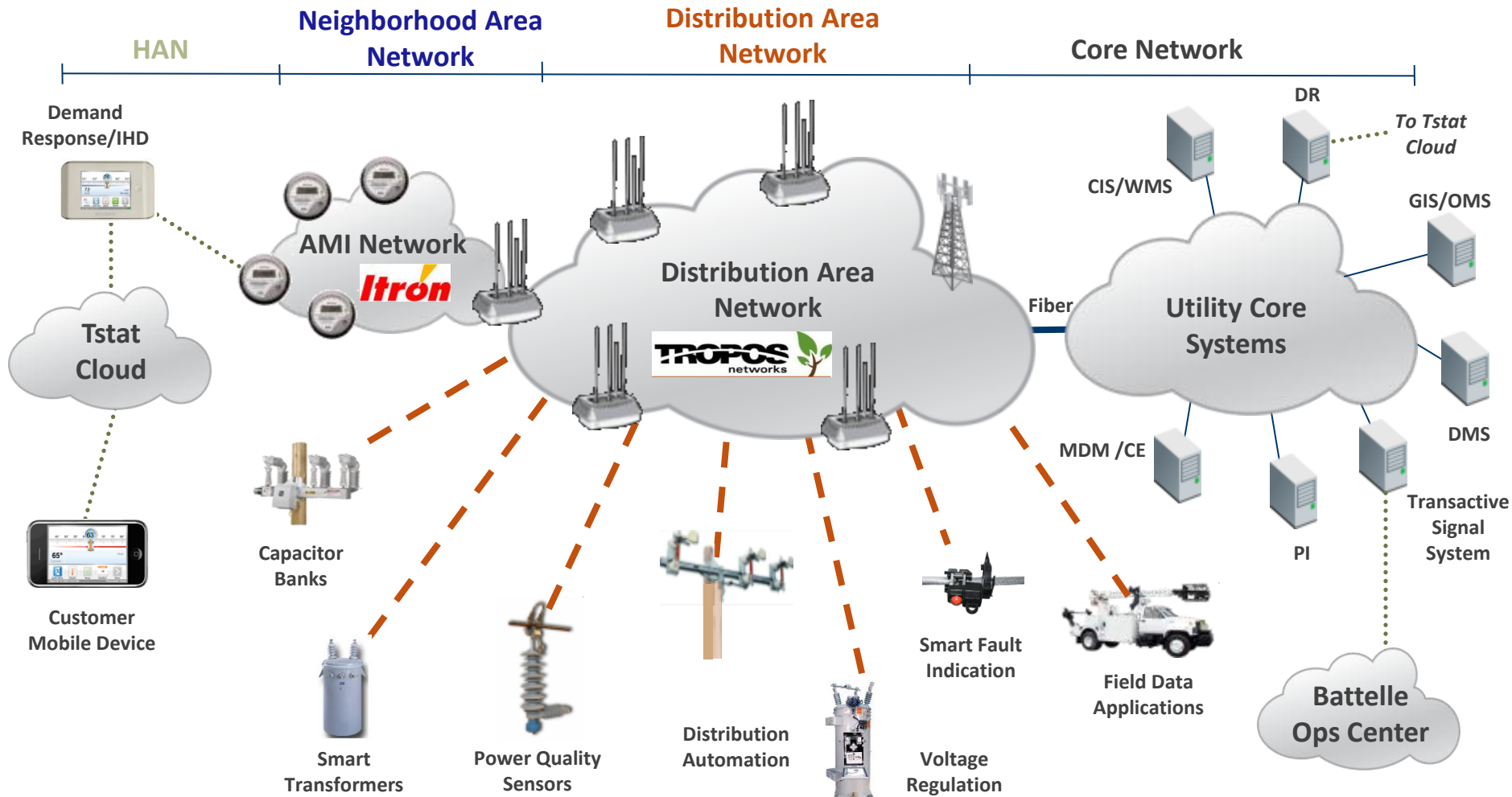


The Components

- **43** Smart Reclosers
- **31** Switched Capacitor Banks
- **39** Advanced Voltage Regulator Controls
- **400** Smart Transformers
- **300** Smart Fault Indicators
- **3** Smart Switchgear
- **13,000** Electric/**5000** Gas AMI Meters
- Advanced Demand Response System
- **1500** Advanced Programmable Thermostats
- Customer Web Portal and Mobile Tools
- WSU Chillers (**9**), Generators (**4**), and Air Handlers (**39**)
- Transactive System for Distributed Energy Resource Management
- Advanced Communications Network
- Advanced DMS
- Security Design and Risk Assessment
- Advanced Analytics Engine



Advanced Smart Grid Infrastructure



The Smart Grid Brains



Facility Management &
Outage Management Tool



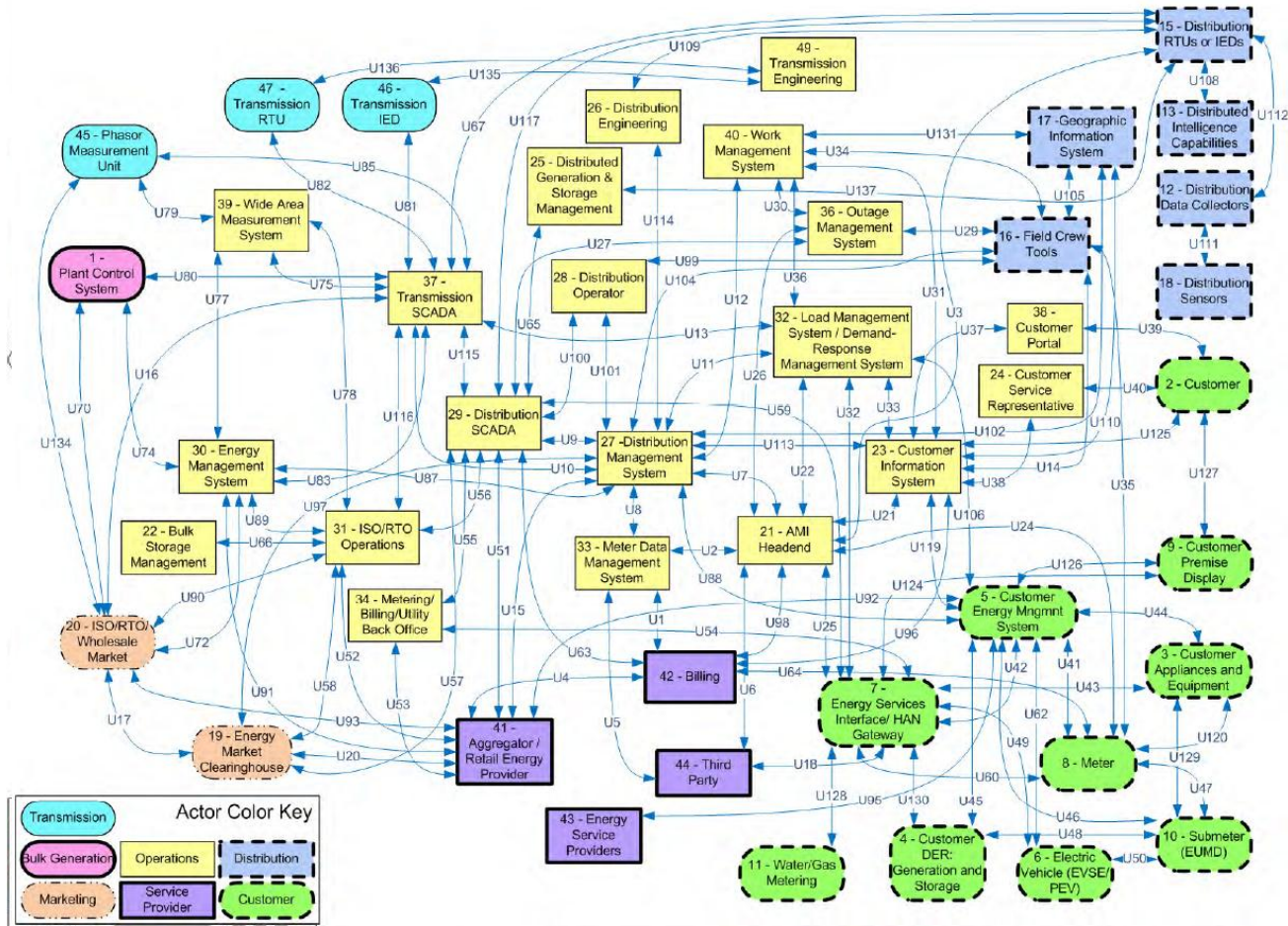
The image displays two software interfaces side-by-side. The left interface is 'Avista Facility Management (SDEPROD) - Session: Untitled'. It features a 'Layers' panel on the left with a list of equipment types such as 'Outage 1', 'Abnormal Device', 'Electric', and 'Transformer Bank'. The main map area shows a network of yellow and orange lines representing power lines, with nodes labeled '1500' and '1500'. The right interface is 'efacec Advanced Control Systems Distribution Management System'. It shows a map with green dashed lines and red circular markers. Below the map is an 'Alarms' table with the following data:

Time	Station	Point	Status Pair	Value	Priority	Message
04/13/11 16:30:48	SYSTEM	OPER INTERFACE #2	ON-LINE	0		
04/13/11 16:36:16	SYSTEM	OPER INTERFACE #2	OFF-LINE	0		

At the bottom of the right interface, there is a status bar showing 'Real Time', 'Normal', '1065 Alarms', and a timestamp '11:59:12 04-13-2011'.

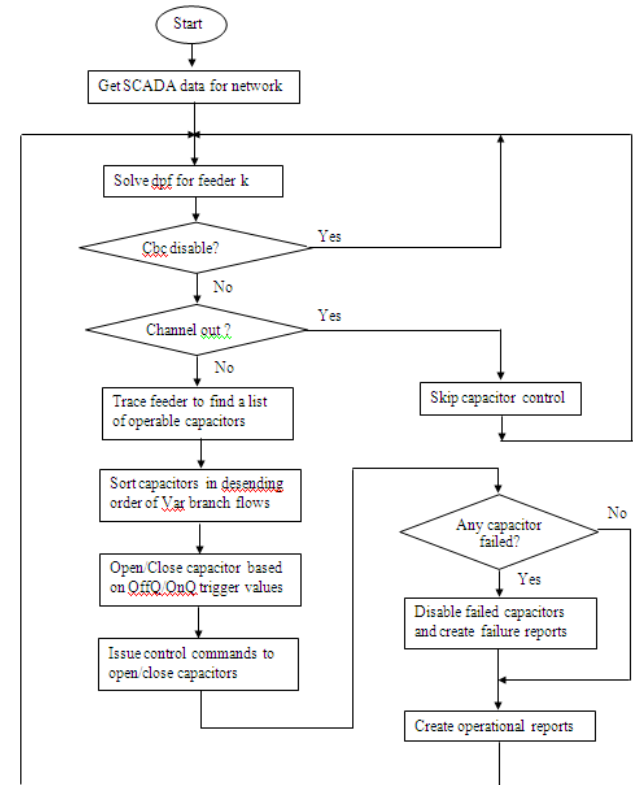
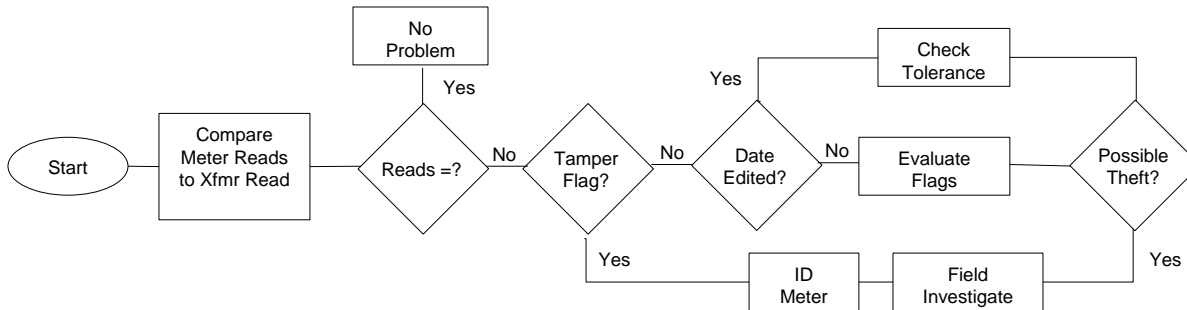


The Matter of Security



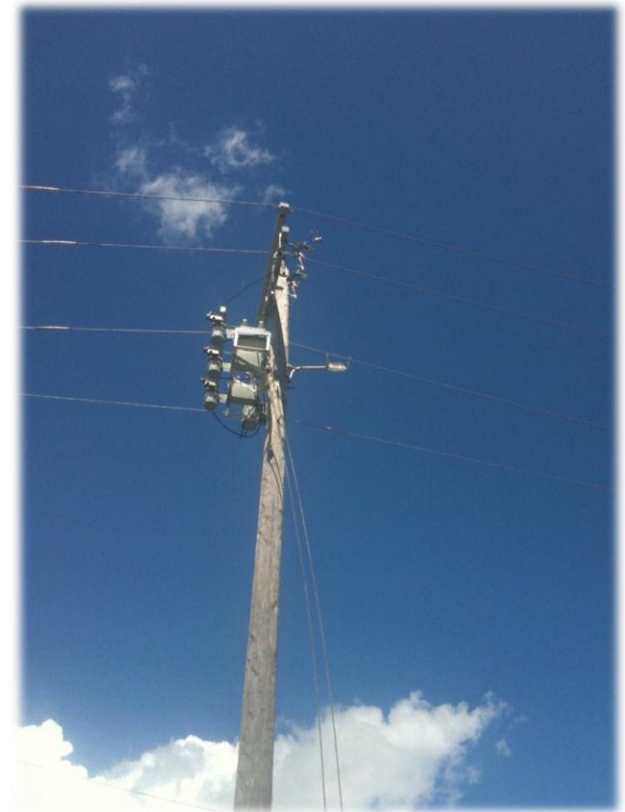
Analytics for Results

- Real-time Calculation of Results
- Elimination of Manual Analysis
- Automated Work Order Creation for Trouble
- Identification of Outage Scenarios
- Revenue Protection
- Loss Savings Validation
- Customer Energy Savings
- Condition Based Maintenance Program
- Grid Optimization Automation



Challenges

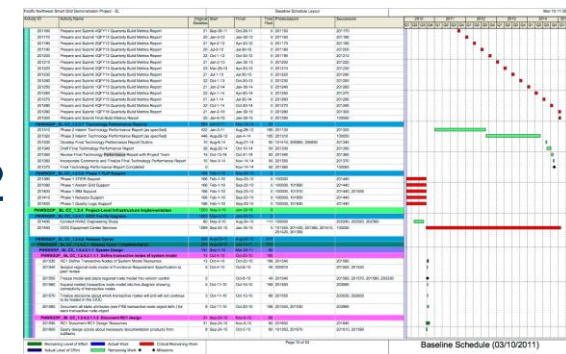
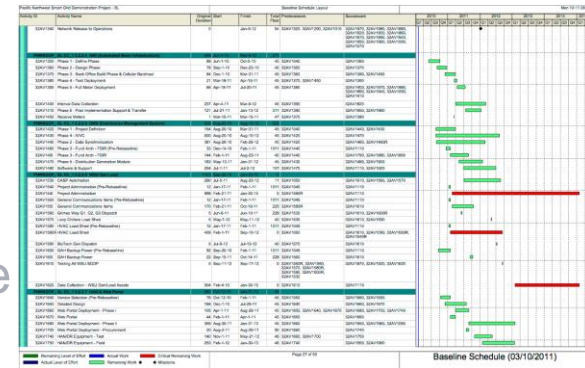
- Project Management and Hard Deadlines
- Change Management
- Documentation of Decisions, Designs and Processes
- Procedures and Organizational Structure (Roles & Responsibilities)
- Cross Functional Teamwork and Governance
- Partnership Relationship with Vendors
- Security
- Communication to Customers
- Massive Quantity of Data to Process/Analyze



The Project To-Date



- AMI complete includes meters, MDM, and collection engine
- Smart switches and switchgear installed.
- Capacitor banks installed
- Voltage regulator controls installed
- DMS in production for field measures and remote control
- Tropos Wi-Fi network complete
- Customer Community Builder Tools Deployed
- Smart transformers scheduled for delivery
- Analytics engine being installed
- Customer bill analytics web tools 2nd quarter 2012
- DR and transactive signal system in design
- Tstat recruitment to begin in April 2012
- All systems live end of August 2012



Avista's Future

	2011	2012	2013	2014	2015
Efficiency	Active Volt Var Management	Automatic Service Switch	Adaptive Fusing		Grid Optimization
Reliability	Remote Operation & Control	Fault Location & Automatic Restoration			
Asset Management	Feeder Rebuild Coordination Smart Transformers	Smart Grid Work & Asset Management			
Customer Participation	AMI Demonstration Customer Web Portal	Home Area Network Demonstration Demand Response Demonstration	Distributed Generation	Electric Vehicles Trusted Energy Advisor Services	

Questions??



Contact Information:
Curtis Kirkeby, P.E.
telephone: (509) 495-4763
email: curt.kirkeby@avistacorp.com
website: <http://www.avistautilities.com>