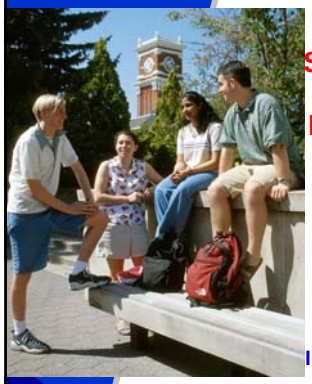
WASHINGTON STATE UNIVERSITY
World Class. Face to Face.



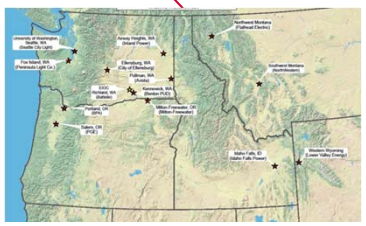
Smart Pullman & WSU Microgrid as part of the PNW Smart Grid Demonstration

Anjan Bose
School of EECS
Washington State University
Pullman, WA 99163

IEEE Northwest Energy Systems Symposium
Seattle, WA
March 2012

NW Smart Grid Demonstration Project

- Battelle NW
- Bonneville Power Administration
- 3Tier
- Areva
- IBM
- Netezza
- Quality Logic



Utility Partners
Avista
Benton PUD
City of Ellensburg
Flathead Electric
Idaho Falls Power
Inland Power & Light
Lower Valley Energy
Milton-Freewater
Northwestern Energy
Peninsula Light
PGE
Seattle City Light

Smart Grid Demonstration Project

Itron
SEL
Washington State University
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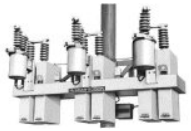
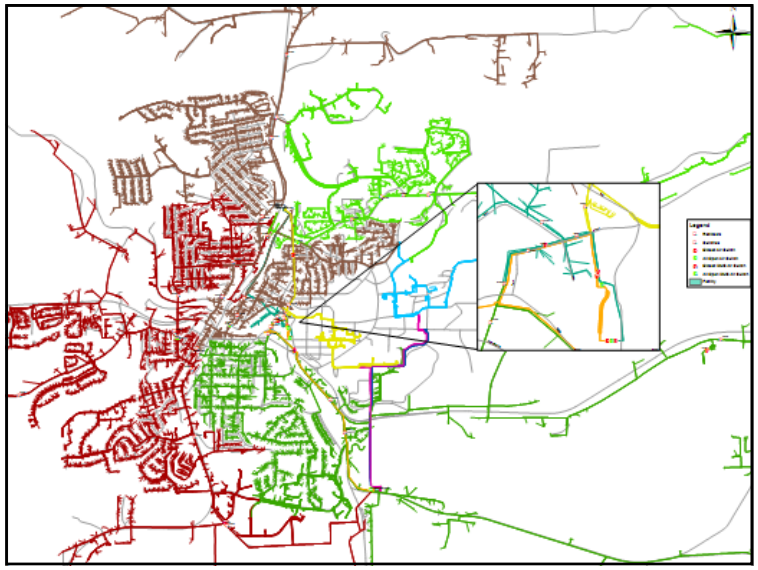
spirae
hp

AVISTA

DMS – Distribution Management System

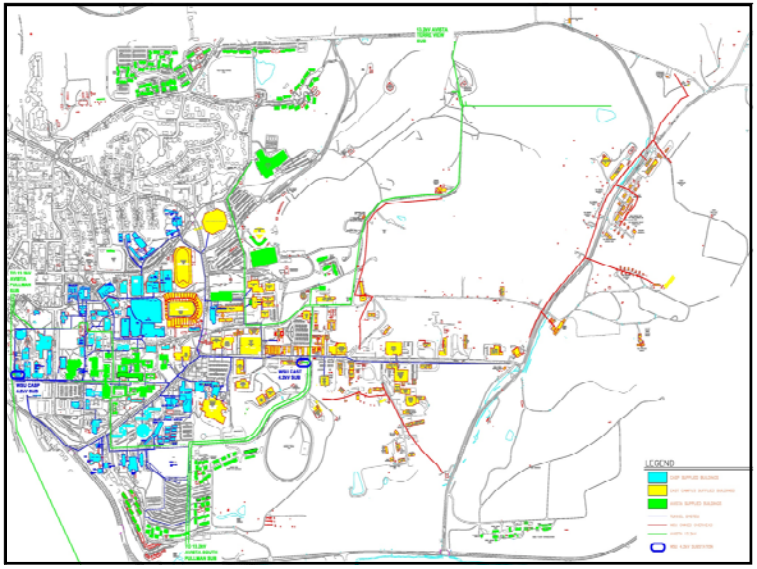
- **Distributed to centralized control**
- **3 substations**
  - **Regulator controls**
  - **Reclosers/relays**
- **13 feeders**
  - **45 automated line switches & reclosers**
  - **20 switched and fixed capacitor**
  - **Fault Indicators**
  - **Low loss transformers w/ telemetry**
- **Wireless & fiber communications**





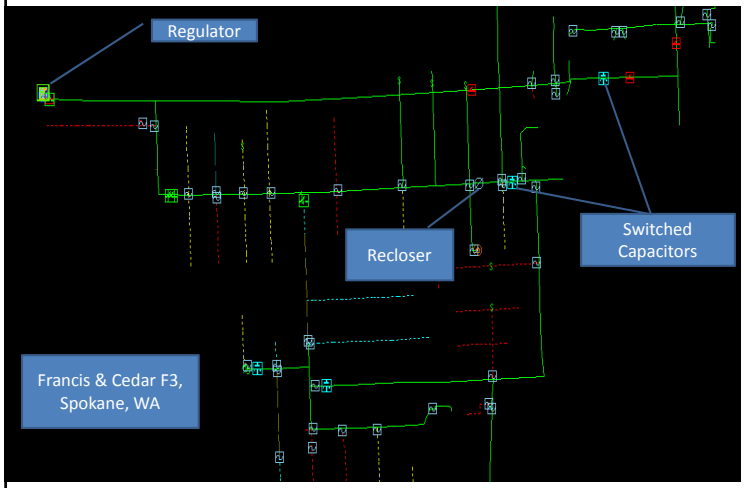
Washington State University

- **WSU Smart Home Research**
- **WSU Analysis & Reporting**



Washington State University

- Grimes Way Generator 1,2 & 3 Dispatch
- Loop Chillers Load Shed
- HVAC Load Shed/EMS/CVR (McKinstry)
- Biotechnology Life-Science Generator Dispatch
- Global Animal Health Backup Power
- College Avenue Steam Plant Automation



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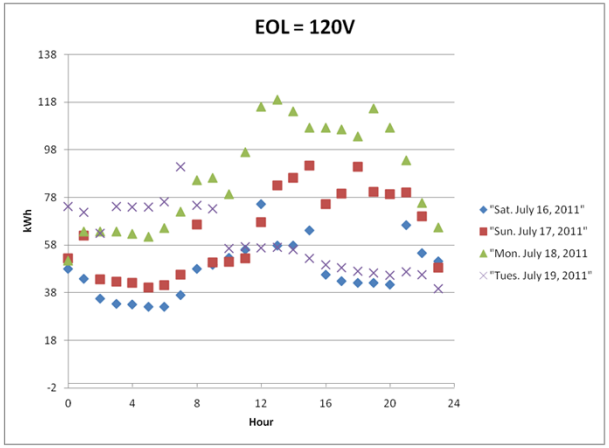
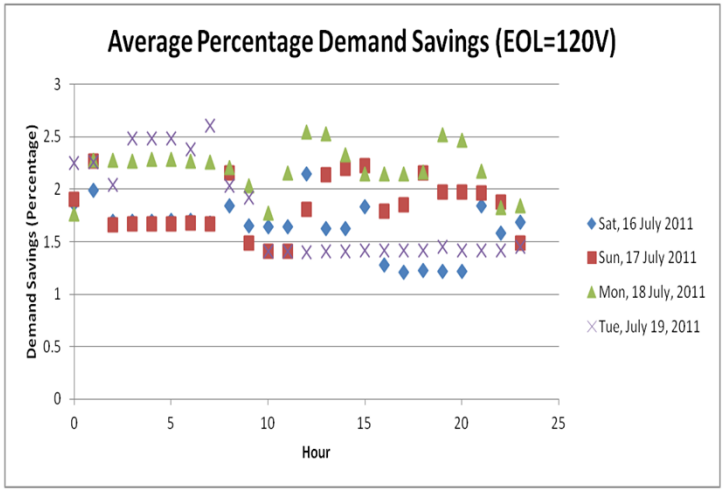
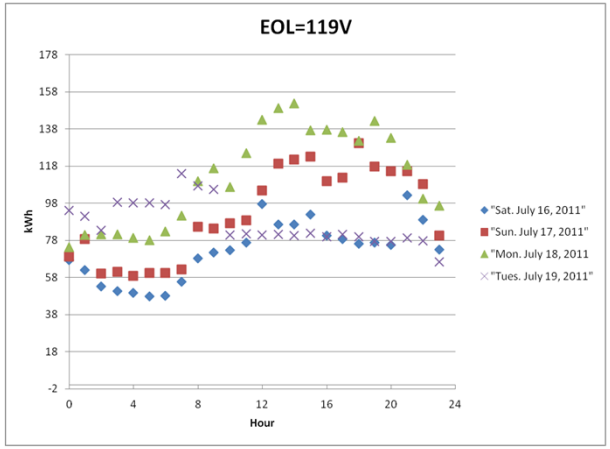
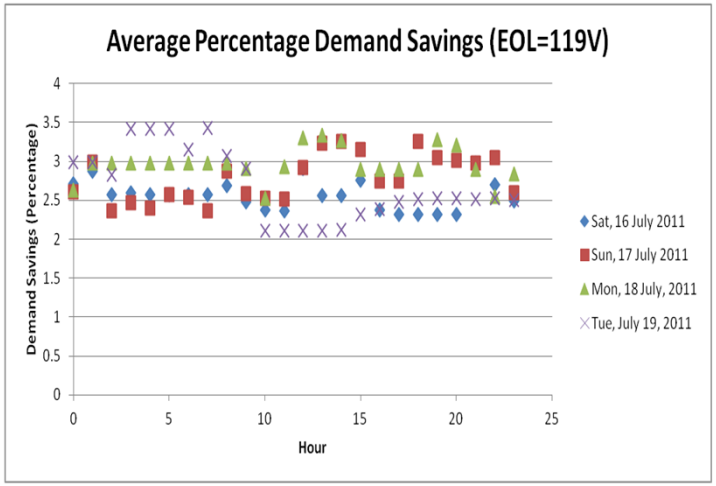
Feeder F3 with 38.3R, 39.8C, 21.9I



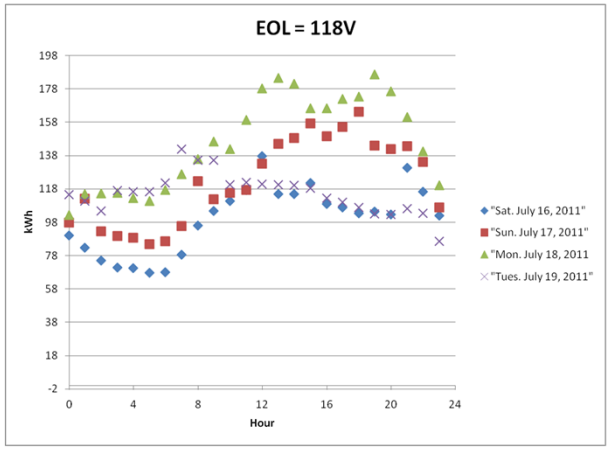


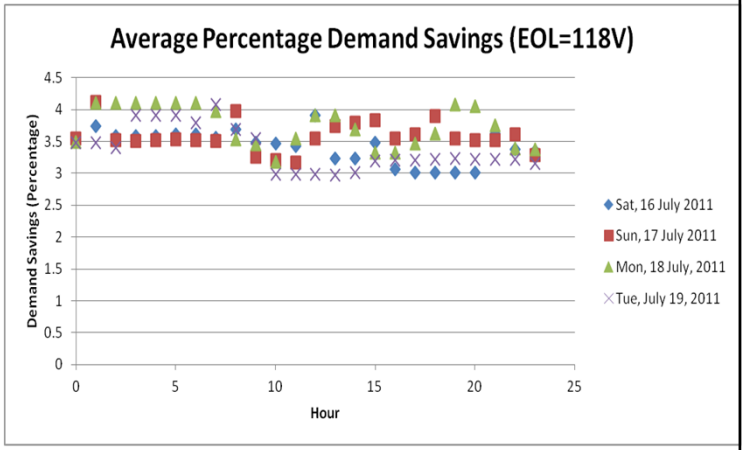
Feeder F3 with 38.3R, 39.8C, 21.9I



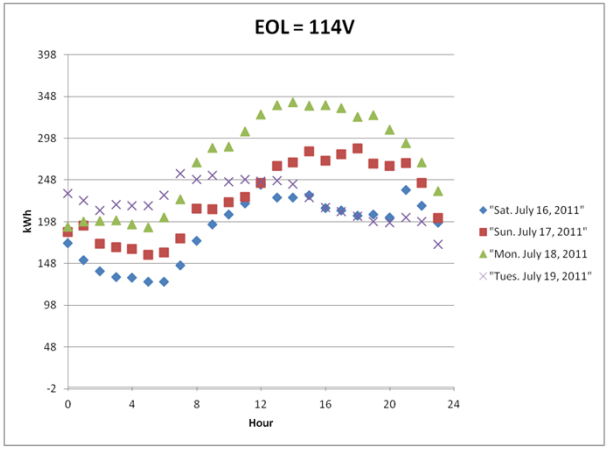


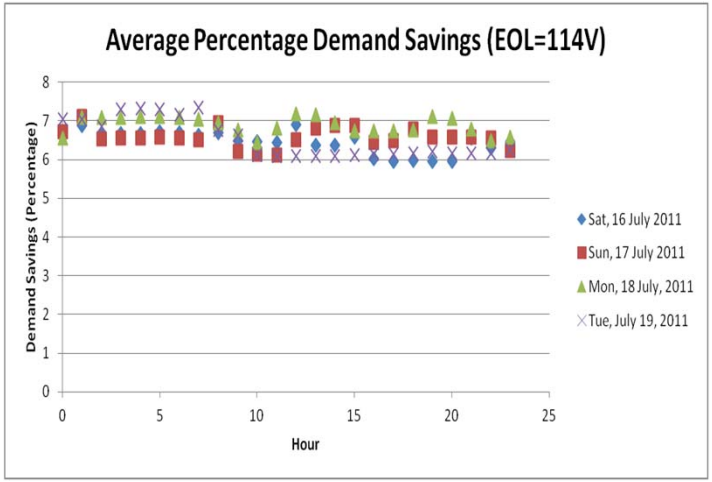
Feeder F3 with 38.3R, 39.8C, 21.9I

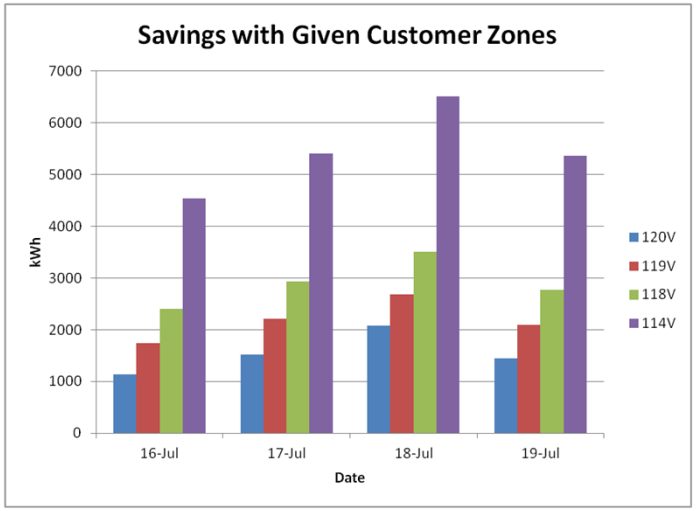




Feeder F3 with 38.3R, 39.8C, 21.9I

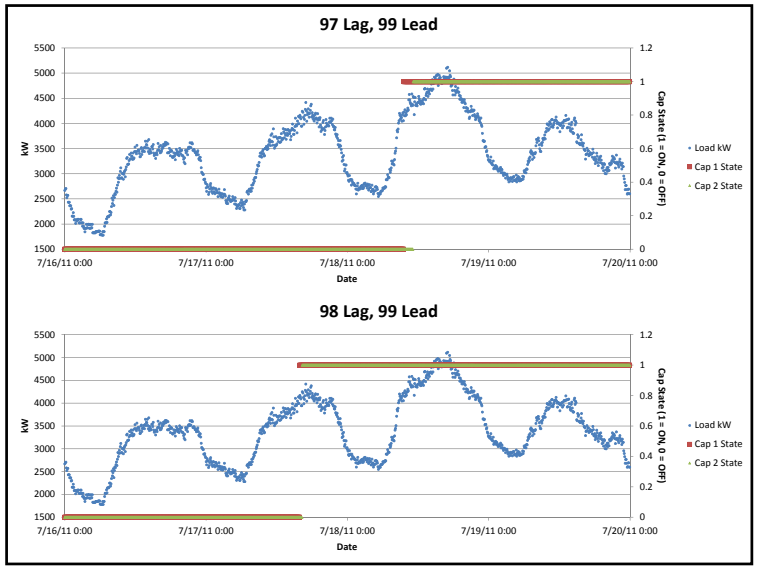


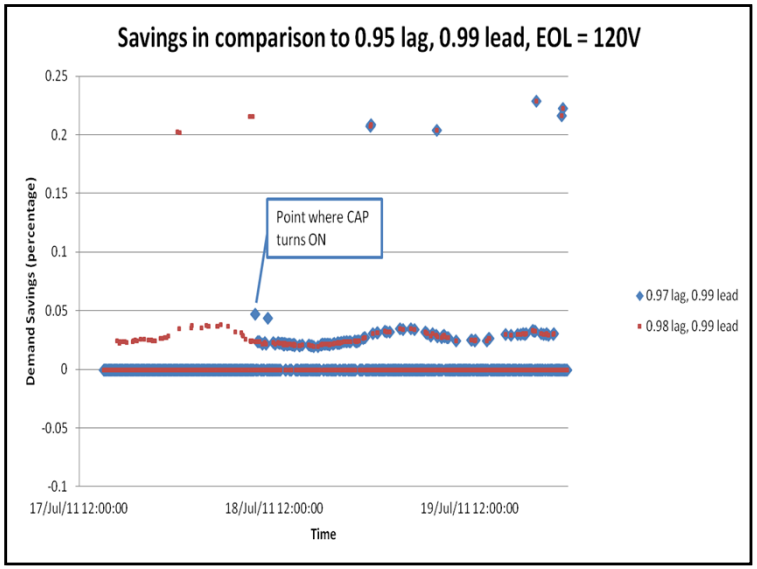




Average Percentage Demand Savings for July 16, 17, 18, 19

	EOL = 120 V	EOL = 119 V	EOL = 118 V	EOL=114V
F3 (38.3R, 39.8C, 21.9I)	1.86%	2.64%	3.53%	6.61%
F6 (56.9R, 43.1C, 0I)	1.60%	2.39%	3.14%	5.85%





18th July 15:15 (peak savings with load = 1650kW)

EOL (V)	Tap Setting (for all phases)	Demand(kW) (manual) – with both caps ON	Our results (kW) (simulation) - no caps ON	Diff (kW) (manual – simulation)
120	-3	4834	4843	9
119	-4	4805	4814	9
118	-5	4776	4785	9

18th July, 00:30 (lowest savings with load = 973 kW)

EOL (V)	Tap Setting	Demand(kW) (manual)) – with both caps ON	Our results (kW) (simulation) - no caps ON	Diff (kW) (manual – simulation)
120	-4	2895	2884	-11
119	-5	2877	2861	-16
118	-6	2860	2837	-23

Preliminary Conclusions

- CVR may save about 3% of energy
- IVVC may not save significant energy
- Automatic and remote switching sectionalizers will improve reliability

- Load control by WSU can provide efficiency on campus (other customers)
- Load control by Avista can provide emergency assist
- Generation control by Avista can provide emergency assist