

Smart Grid Deployment Experience

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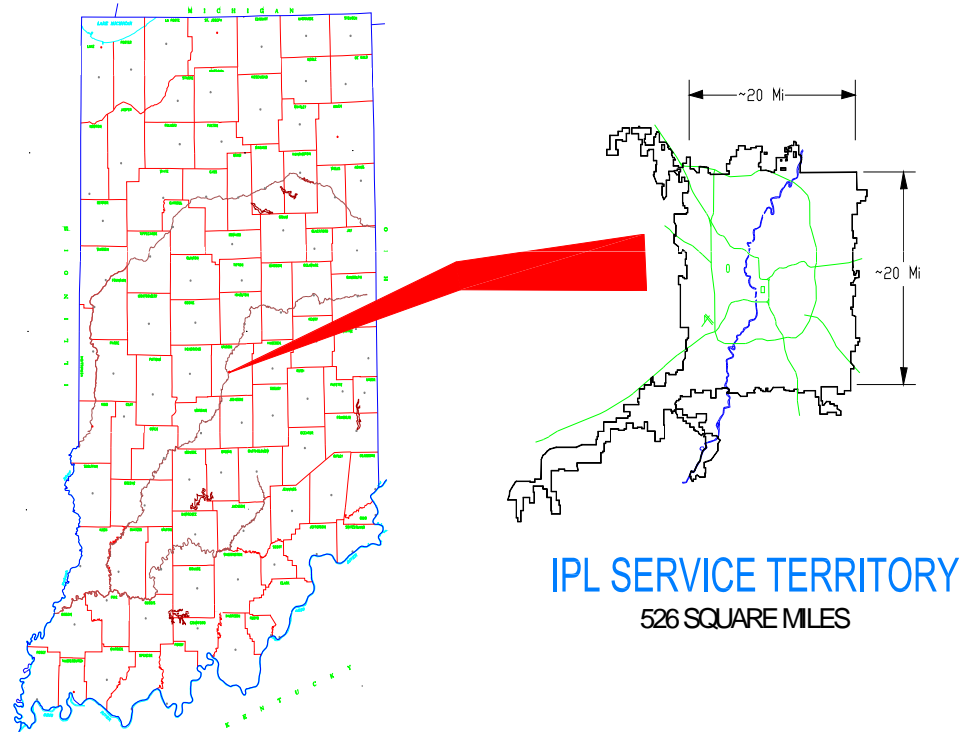
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Indianapolis Power & Light Company

IPL provides electric service to the City of Indianapolis (Marion County) and small parts of surrounding counties.

Parent Company – AES

- Vertically integrated utility
- 528 square mile service territory
- ~470,000 retail customers
- Generation
 - ~3,500 MW
 - 97% coal fired
- 2011 Revenue ~\$1.1 billion
- ~1,400 employees

INDIANAPOLIS POWER & LIGHT



Smart Energy Project

Objective: Improve service reliability, reduce long term maintenance costs and improve energy conservation initiatives and education

3 Areas:

- Smart Metering
- Customer Systems
- Distribution Automation

Currently in month 29 of 36 month schedule

Approximately 88% complete

Smart Metering/AMI

Silver Spring Networks 900MHz network

- Used for both AMI and DA
- All 36 Access Points (meter extraction points) and 47 E-bridges (DA extraction points) installed
- All original designed relays (repeaters) + 20% more installed due to sparse coverage

10,000 meters installed

- All large commercial & industrial meters throughout service area plus 3 pilot areas for residential/small commercial

AMI Lessons Learned

- Initial delay occurred because during testing original meter was unable to duplicate IPL VAR calculation
- Initially ~20% of these meters were not communicating
- Communication remediation completed over 5 months
 - Enabled meter traffic routing of DA e-bridge remotes (capacitor banks)
 - Added antennae and extra relay/repeaters
- Worked through software bug with meter vendor
- Integration between MV90/MDMS/Billing challenging
- **Application**: Remote disconnect/reconnect ~140 trips avoided to date
- Using meter voltage data during CVR tests

Customer Systems

Web Tools

Online Program enrollment and Energy Feedback

- Daily use information (Previous Day)
- Cost of electricity used so far
- View of “average” customer usage (Estimate ~4% drop?)
- AMI meters – 15 minute data
- AMR meters – 1 day data
- Some functionality quoted was not in production anywhere
- Delayed about 12 months

Electric Vehicle Pilot

- Up to 200 chargers with special rates

Electric Vehicle (EV) Project



- 70 customer/fleet premise chargers are installed and participate in EVX rate
 - Seasonal
 - Separately metered
 - 3 tiers in summer (2.3/5.5/12.2 cents/kWh)
 - 2 tiers in non-summer (2.8/6.9 cents/kWh)
- 20 public chargers with keyfob access are installed
 - Flat fee \$2.50 per session

EV Challenges

- Billing was delayed due to AMI issues
- Developed several options for billing including programming in MDMS
- Decided to manually read and bill while this is tested
- Completed wifi troubleshooting in multiple locations. Only 2 were successful.
- Pre-program tools in software were successfully tested after 9 months
- Vehicle deployment is slower than expected

Distribution Automation Projects

1. Central Business District SCADA (315)
2. Feeder Relay Replacements (330)
3. Recloser Installations (184)
4. Capacitor Bank Control Replacements (1300)
5. Load Tap Changer Control Replacements (90)
6. Transformer On-line Monitoring (16)
7. Substation Security & Infrared Monitoring
8. Fiber Communication Backbone
9. Distribution Management System (DMS)
10. Cyber Security Initiatives

DA Lessons Learned

Applications:

- Programming end to end in the “lab” environment with scripts worked very well
- Rolled equipment out by substation master
- Cellular modems from extraction points tended to “lock up”
 - Needed firmware upgrade
- Initial testing of Conservation Voltage Reduction (CVR) resulted in a CVR Factor of ~0.7
- Used remote relay setting function >1,000 times in 6 months (\$50,000 labor savings)

Other:

- Integration for dSCADA challenging
- Cyber security focused approach
- Added battery backed relay/repeaters for DA
- Developing business practices with cross functional teams in process

Continued Opportunities

- Improve reliability & customer power quality
- Voltage Management Program
- Minimize Distribution Losses
- Defer New Capacitor Bank Installations
- Reduce O&M Costs
 - Personnel trips
 - Equipment operations
 - More efficient maintenance
- No Single Point of Failure (software or hardware)
- Better information for root cause analysis
- Emphasis the first two years has been on installing equipment
- Now the importance is to leverage the smart devices and systems

Smart Grid Opportunities (Tomorrow)

- Components Installed for Future Flexibility
- Voltage Management Program Improvements
 - Reduce system peak load
 - Continuous Voltage Reduction (CVR)
- AMI Meter Information
 - Last Gasp Power Outage Notification
 - Meter Power Up Information
 - Meter Voltages
- 15 Minute Customer Usage Information to Consider TOU Rates in Future
- Automatic Fault Location and Isolation
- Further Utilize AMI/DA Network?
 - SCADA Remote Terminal Units
 - Downloading device data
 - Fault indicators