NV Energy's Residential HVAC Optimization Program

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Contents

NV Energy Overview

Company

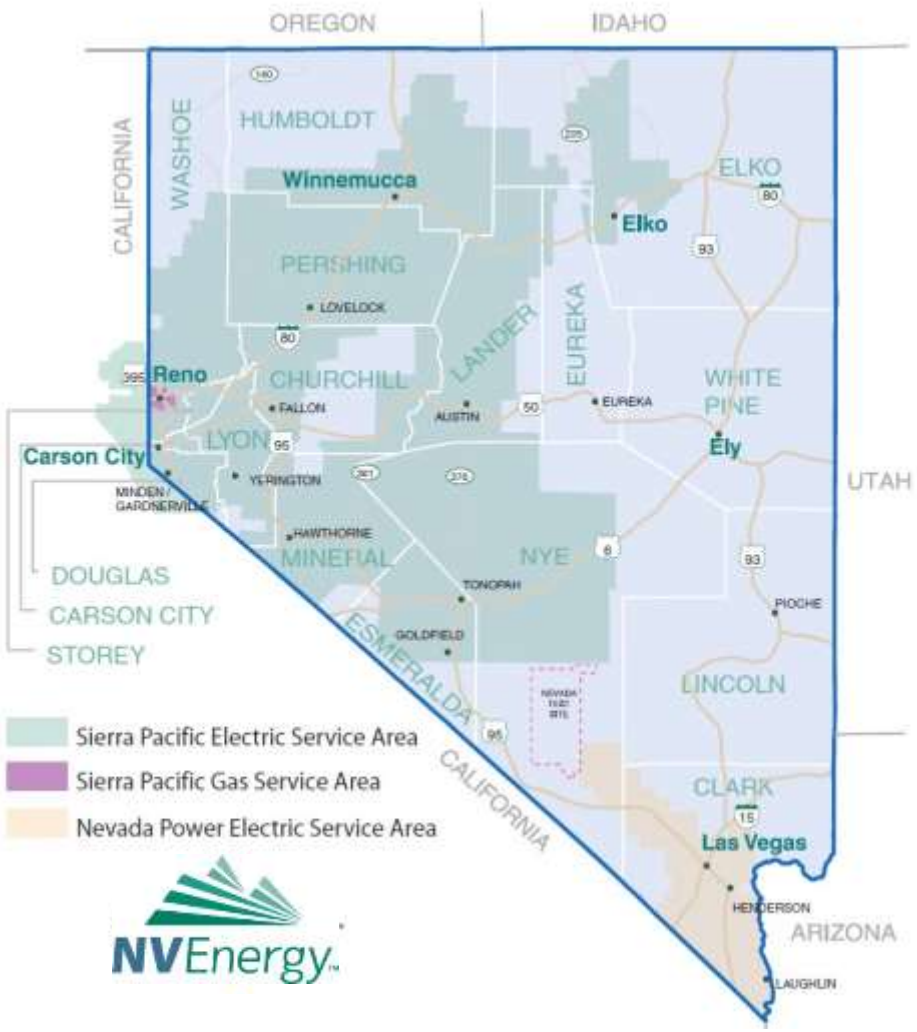
- IOU /Vertically Integrated
- State Commission Regulated
- 1.2 M Electric Customers
- 93% of Nevadans Served
- South: 5,854 MW Peak Demand
- North: 1,720 MW Peak Demand

Smart Grid Efforts

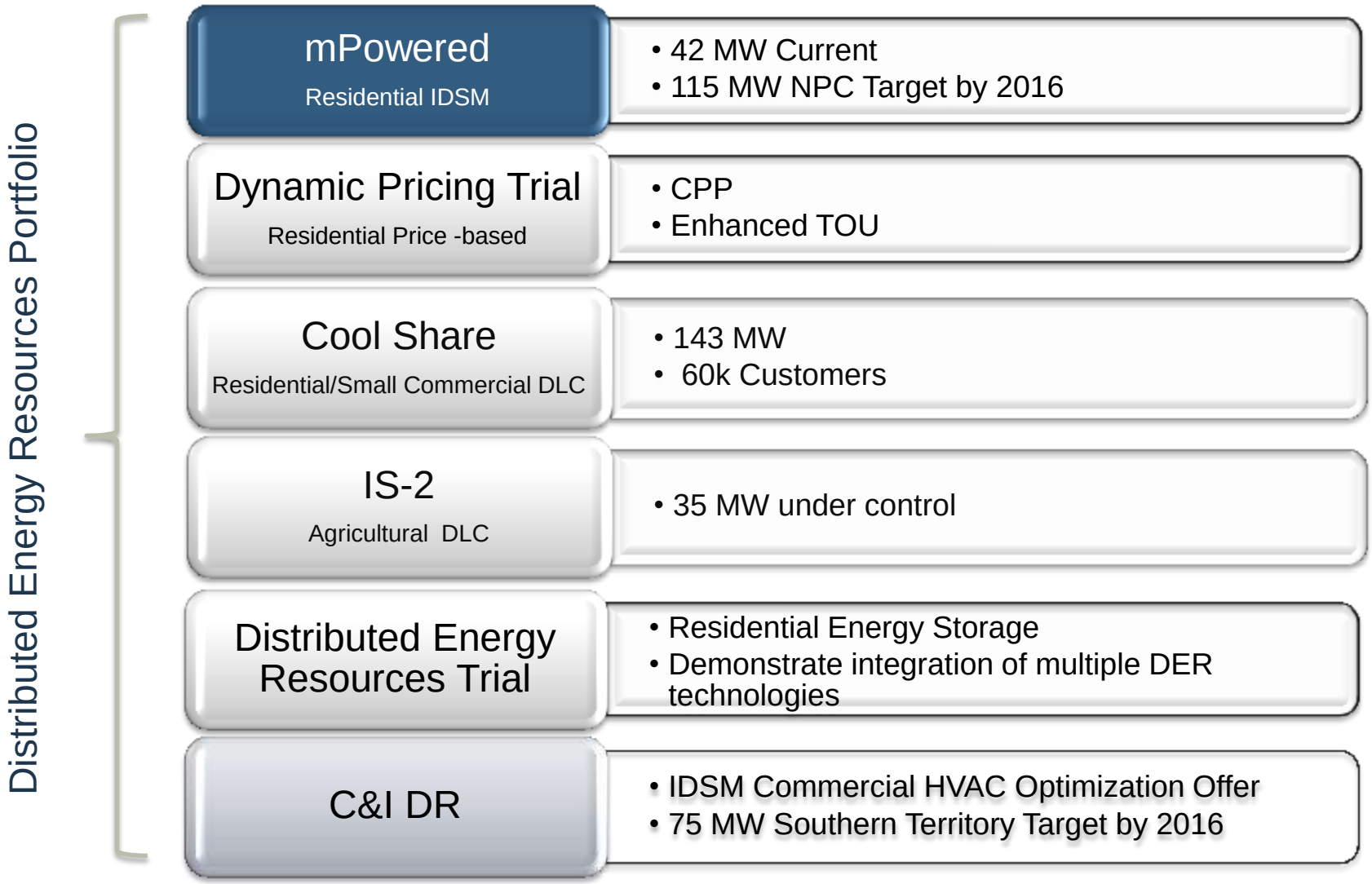
- Statewide AMI Deployment
- Sensus / Smart Meters
- Itron / Meter Data Management
- Aclara / Web Portal
- IBM / SOA

Demand Response Efforts

- 218 MW Statewide
- ~3% of Peak
- Residential, Commercial, Agricultural
- Advanced HAN & DRMS technology

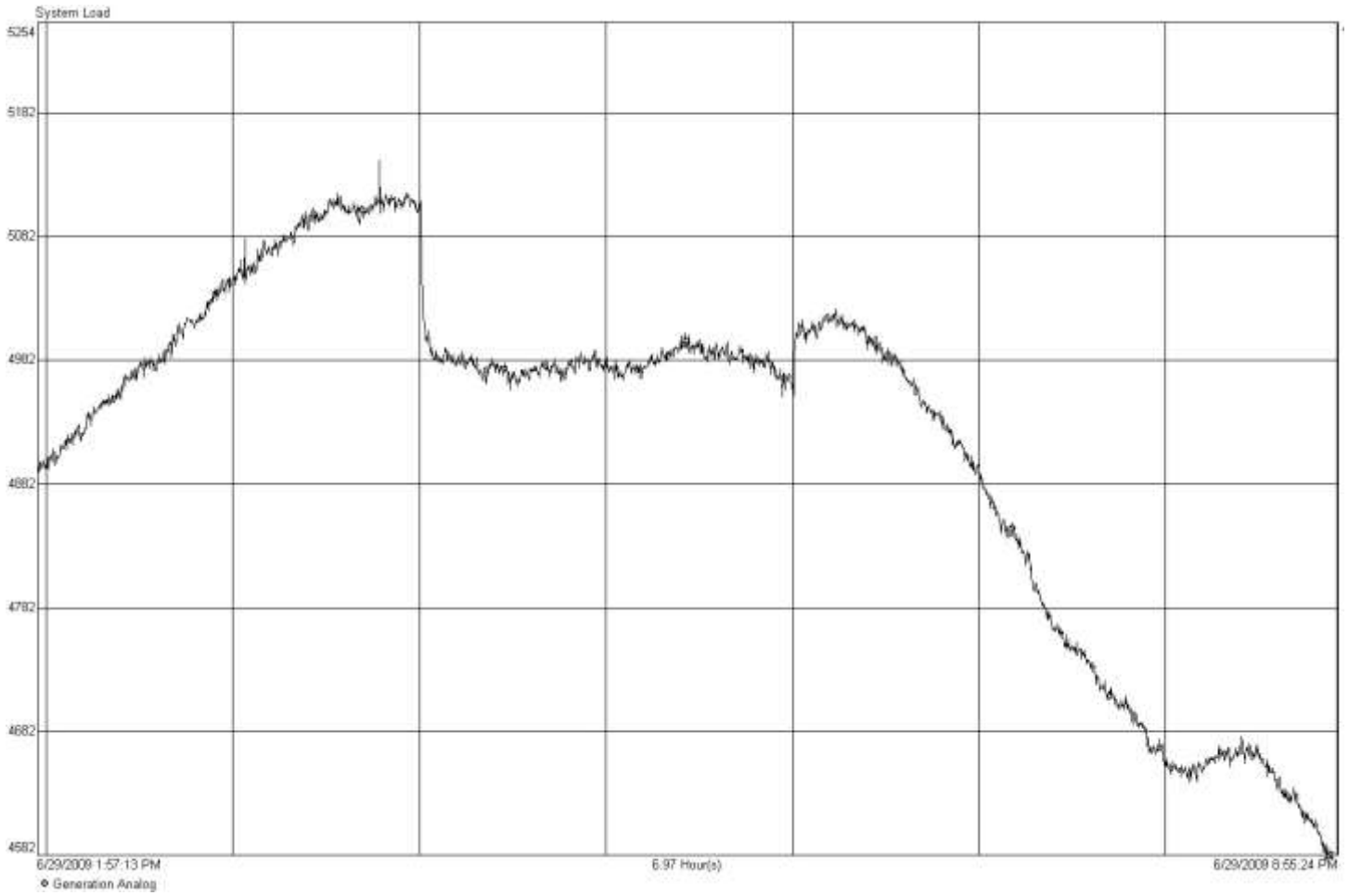


DR & DER Programs Overview



Emergency Event – Full System Load Shed

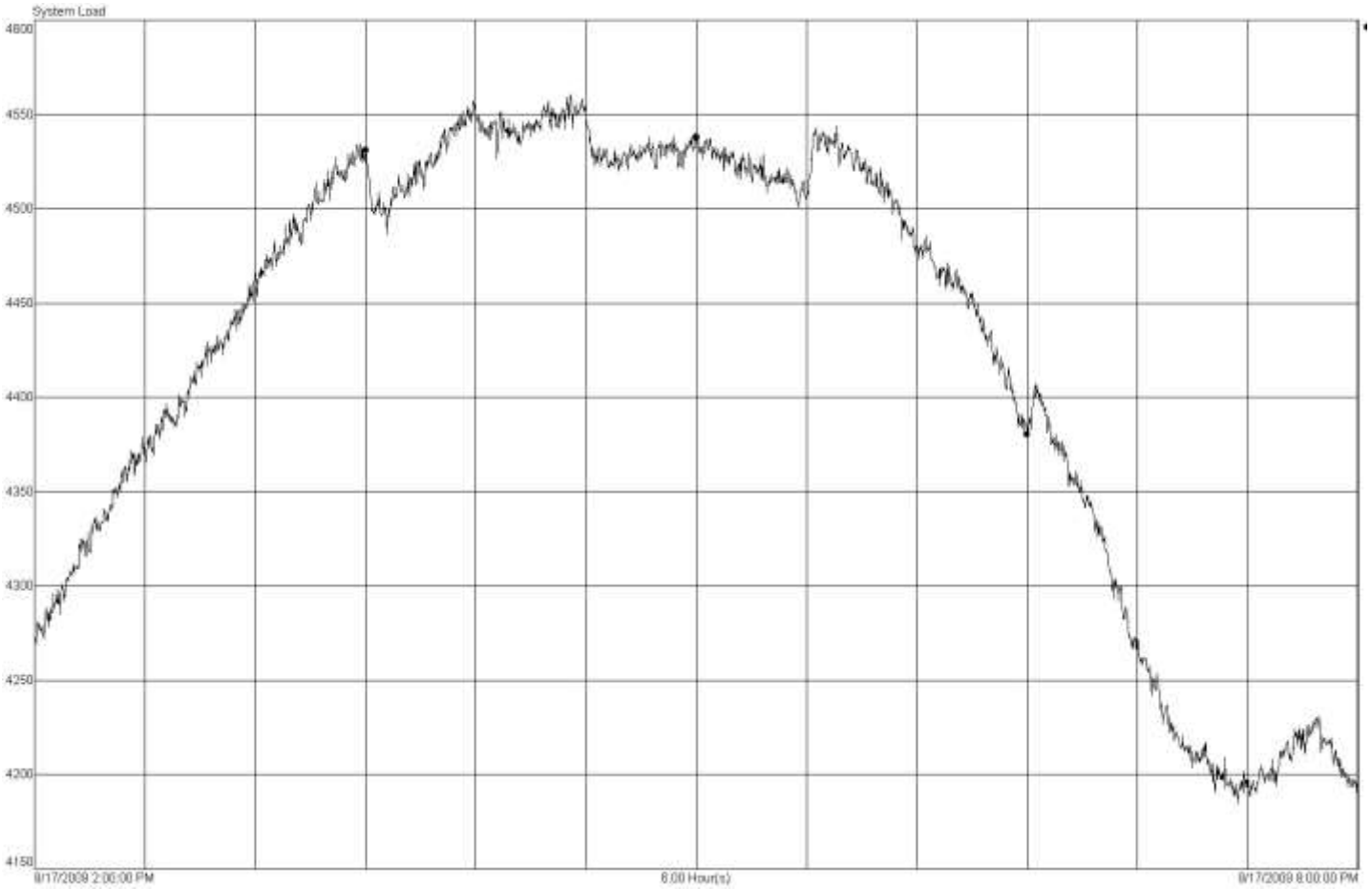
MW



Time

Economic Event – Three Phase Load Shed

MW



Time

Valuation Overview

- Avoided Cost Valuation
- Operating Reserve
- Insurance Value
- Distribution Operations
- Arbitrage and Hedging Opportunities
- Generation Dispatch Optimization
- Portfolio Risk Reduction

Cool Credit & Cool Share

Cool Credit (2001 – 2006)

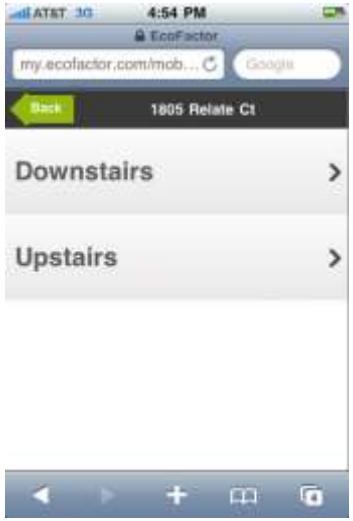
- 20 MW Achieved
- 18,000 residential customers
- 23,000 devices
- 92% receiver switches (1-way)
- 8% programmable communicating thermostats (1-way and 2-way)
- Fixed monetary incentive - $15 per summer month

Cool Share (2007 – 2010)

- 143 MW (includes converted Cool Credit customers)
- 60,000 customers
- 78,000 devices
- 90% web programmable thermostats (2-way paging)
- Override at Device – 12/8/7 percent consistent override rate
- 4-deg temperature setback
- Participation Based Rebates - $0.33 per event hour
- High Satisfaction and Low Memory Recall of Events

mPowered (2012 – 2015)

- Design
  - High technology incentive for significant bill savings
  - Relatively low event based financial incentive under current market conditions
  - Automation Focus - does not rely on high price signal for behavior change
  - HVAC optimization for year round energy savings
  - Convenience



- Participation Based Event Rebates
  - Peak Time Rebate variant
  - Variable start time/date
  - Variable duration
  - Variable rebate
  - AMI Customer Specific Settlement

Residential HVAC Optimization Customer Solution Overview

Integrated Energy Efficiency & Demand Response Customer Platform

Learning and Data Analytics

the solution collects and analyses large volumes of weather and premise specific data to create profiles of HVAC and building envelope performance

Continuous Monitoring

the service continuously monitors HVAC state, indoor and outdoor weather conditions, and customer preferences and uses these variables in optimization models

Energy Efficiency Optimization

the service automatically controls HVAC operations on a daily basis to save energy while maintaining comfort preferences

Demand Response Optimization

the service automatically controls HVAC operations on DR event days using pre-cooling algorithms to enhance load impact and reduce customer impact

mPowered – Program Stats

NVE South – at scale program

13,500 customers

- 42- 47 MW installed

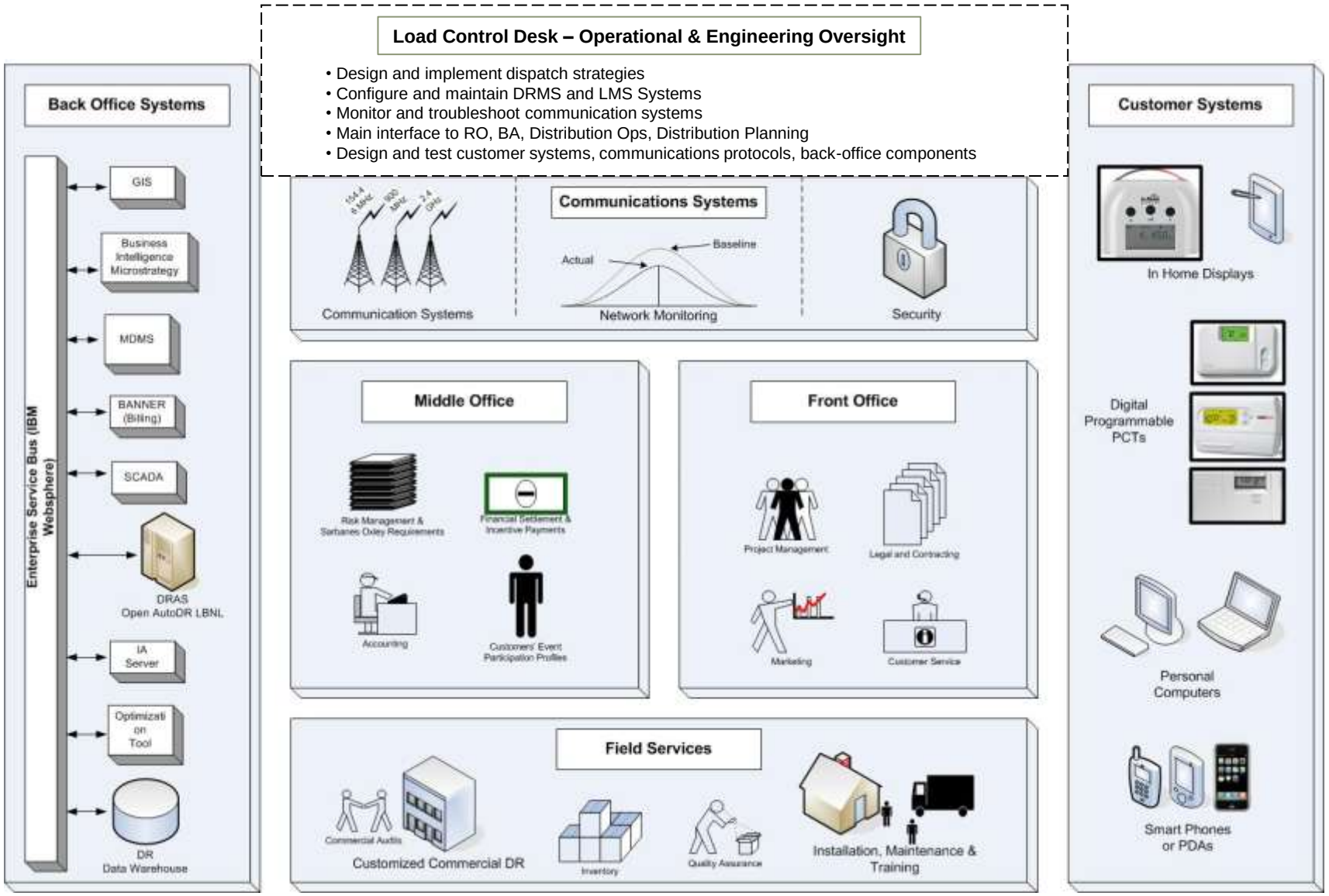
- 13% cooling energy savings on average
- 15-20% cooling energy savings for homes built after 1978

- Avg. Electric Energy Savings: 1,100 kWh/year/home
- Est. Gas Energy Savings: 15 therms/year/home
- DR Event Load Impact: 3.1 to 3.5 kW/home

NVE North – pilot program

- Est. Electric Energy Savings: 300-450 kWh/year/home
- Est. Gas Energy Savings: 27 therms/year/home
- DR Event Load Impact: ~2.0 kW/home

Major Business Domains & Group Functions



DRMS Functions

Customer / Program Management

- Tracks customer device associations
- Tracks customer program enrollments
  - Cool Share 2.0
  - Cool Share 1.0
  - C&I
  - NDPT
  - IS2
- Settlement calculations

Dispatch Strategy Management

- Predefines event strategies based upon load impact strategy
- Functions as "easy button" for Grid Ops and Balancing Authority
- Provides visibility of load shape strategies to internal user groups
- Integrated to GenMan and Tesla for Economic Dispatch and System Load Forecast Correction

Forecasting

- Near real-time forecast of load drop/shaping capabilities
- Granularity to:
  - Substation
  - D-bank/Feeder
  - Device
- Independent variables include weather /historical system loads
- Establishes confidence levels for ancillary services (e.g. 10-min or spinning reserves)

Workforce Management

- Call Center Service Requests
- Field Service Requests
- Customer Installation Scheduling
- Manages service request processes from open to close

Optimization

- Determines optimal resource dispatch according to strategic objective functions:
  - Avoided Capacity
  - Economic Dispatch/Cost Minimization
  - Manage renewable resource volatility
  - Facilitate distribution operations

Event Manager

- Capable of dispatching, modifying and cancelling an event
- Ability to dispatch an event to strategic groups with granularity to:
  - Substation
  - D-bank/Feeder
  - Device
- Ability to track event progress (e.g. receiving acknowledgements and overrides)

Reporting

Event Reports:

- Internal – Participation, Load Shed, etc.
- External (Customer) – Participation, Rebate, etc.
- Vendor Information
- Remote Maintenance (Device States)
- Customer Information
  - CS 2.0
  - CS1.0, NDTP, C&I
  - IS2

Device Manager

- Stores geospatial/feeder information
- Manages connectivity and communications protocols
- Manages C4 HAN & Device provisioning
- Open ADR
- Legacy LMSs (Cool Share 1.0 & IS2)
- Additional HAN & Meter head ends

Approvals/ Notifications

- Capable of sending notifications/approval requests to internal and external groups
- Tracks event approvals
- Ability to send customer notifications using their preferred contact method
- Notify MDMS of CPP Events

Summary

Tangible Benefits Realization

Utilize to DR value streams to Invest in EE

Networked Platforms with Rapid Communications

Automated DR

Forecasting

Optimization

Analytics