NV Energy Demand Response Overview

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Value
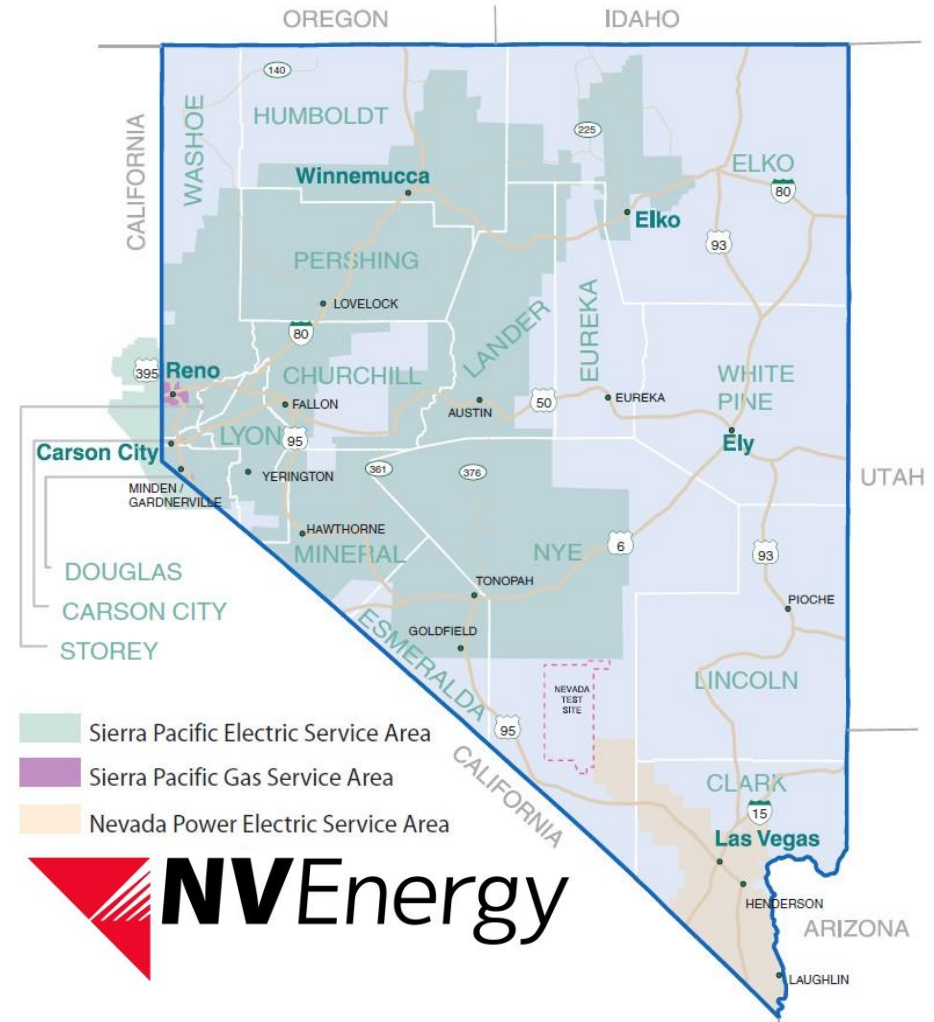
Challenges

Summary

Company

- IOU /Vertically Integrated
- State Commission Regulated
- 1.2 M Electric Customers
- 93% of Nevadans Served
- South: 5,866 MW Peak Demand
- North: 1,743 MW Peak Demand

Smart Grid Efforts

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

Demand Response Efforts

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

Sierra Pacific Electric Service Area
Sierra Pacific Gas Service Area
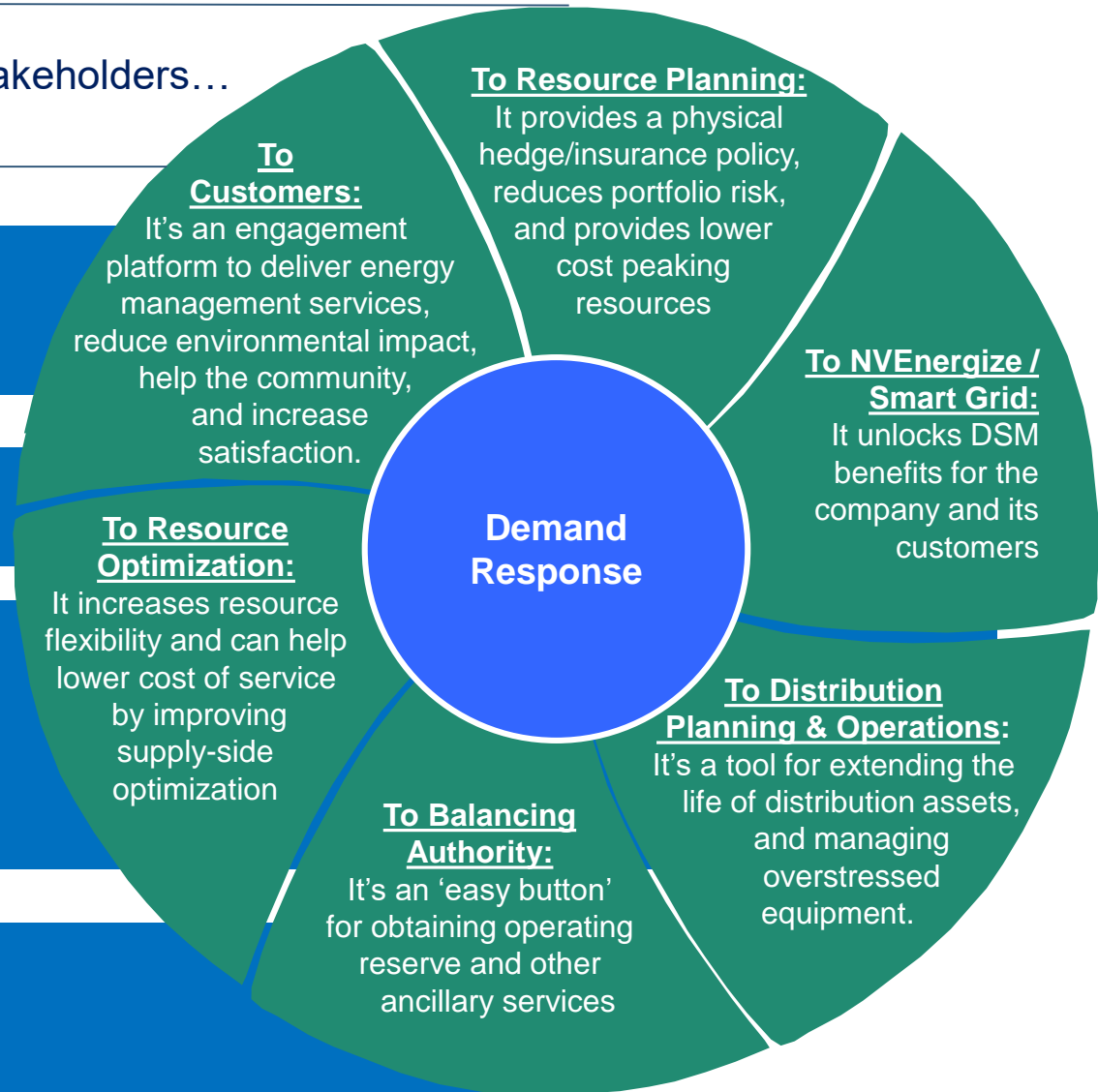Nevada Power Electric Service Area

NVEnergy

DR offers many solutions to many stakeholders…

A customer/end-use load response to supply side conditions…

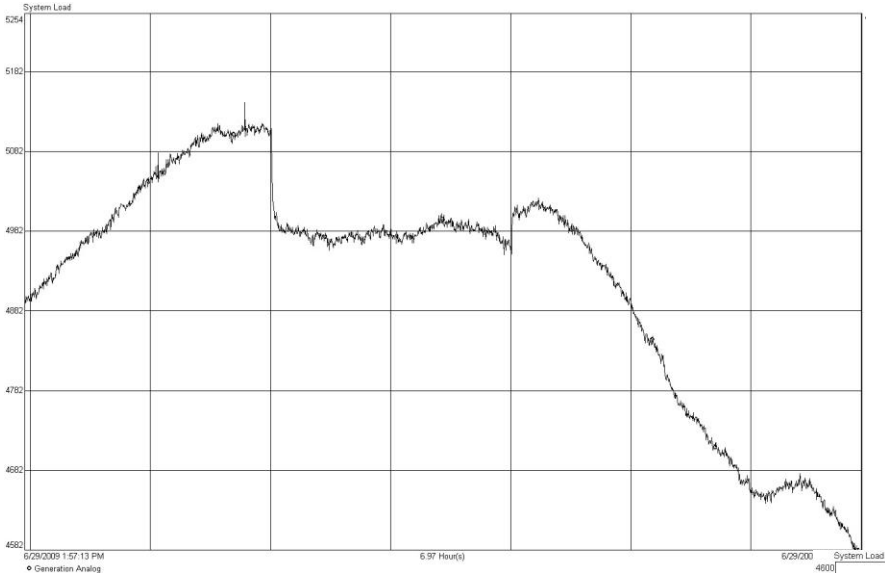…an economic response to market prices.

…an emergency response to grid disturbances such generator problems, transmission or distribution congestion, localized substation or circuit problems.
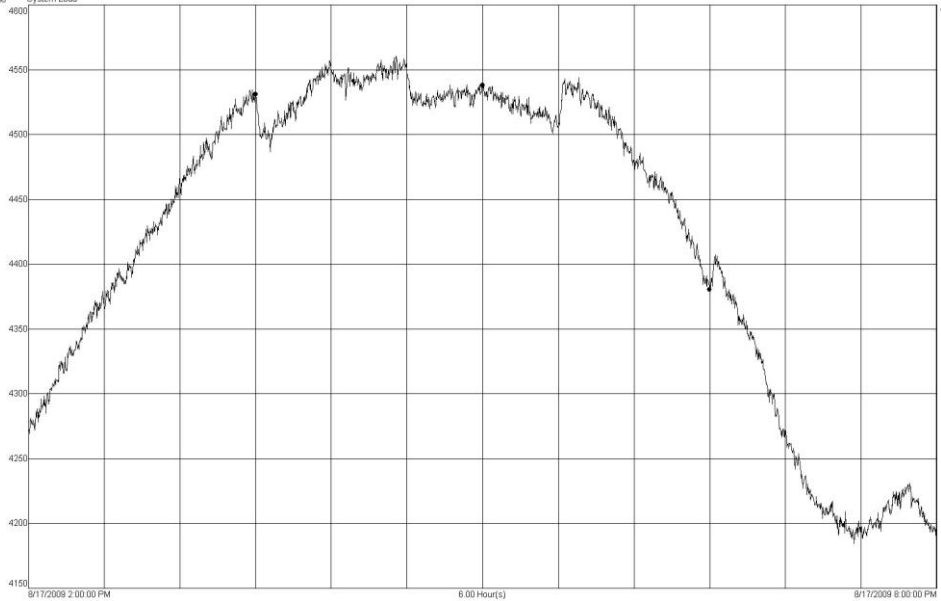
…an optimization response to deal with the renewable resource intermittency issues.

Demand Response

To Customers: It's an engagement platform to deliver energy management services, reduce environmental impact, help the community, and increase satisfaction.

To Resource Planning: It provides a physical hedge/insurance policy, reduces portfolio risk, and provides lower cost peaking resources

To NVEnergize / Smart Grid: It unlocks DSM benefits for the company and its customers

To Resource Optimization: It increases resource flexibility and can help lower cost of service by improving supply-side optimization

To Balancing Authority: It's an 'easy button' for obtaining operating reserve and other ancillary services

To Distribution Planning & Operations: It's a tool for extending the life of distribution assets, and managing overstressed equipment.

Emergency Event - Full System Load Shed

Economic Event - Three Phase Shed Load Shed

Portfolio and Program Overview

Distributed Energy Resources Portfolio

Program	Details
mPowered Residential IDSM	• IDSM deployment of HVAC optimizing Home Area Network (HAN) on top of Advanced Meter Infrastructure • 92 MW Current
Dynamic Pricing Trial Residential Price -based	• CPP and enhanced TOU pilot with various treatments including education and technology • ARRA SGIG Funded
Cool Share Residential/Small Commercial DLC	• Programmable Communicating Thermostats (2-way paging) • 111 MW current
IS-2 Agricultural DLC	• Emergency Pump Control w/ 35 MW under control • Advanced Technology Trial with 1.5 MW under control
Distributed Energy Resources Trial	• Residential Energy Storage (Villa Trieste Pilot) • Demonstrate integration of multiple DER technologies
Commercial & Industrial DR	• IDSM Commercial HVAC Optimization Offer • 2015 rollout of small and medium commercial offers • Industrial Trial of advanced "Fast DR"

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)

- 142 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 – present)

- Status
  - 92 MW and growing

- Design
  - Integrated Energy Efficiency and Demand Response Program
  - High technology incentive for significant bill savings
  - Relatively low event based financial incentive under current market conditions
  - Automation Focus, i.e. does not rely on high price signal for behavior change
  - HVAC optimization for year round energy savings

- Technologies
  - Upgradable Home Energy Management Platforms
  - Broadband Gateway/Smart Meter communications
  - Optimization Solution Deployed (EcoFactor)
  - Real-time Energy Info Solution Forthcoming

- Participation Based Event Rebates – $/kWh "real-time rebate"
  - Schedule OLM-AS, variant of a Peak Time Rebate
  - variable start time/date – allows participant phasing
  - variable duration - typically 2-hours
  - variable rebate – equivalent to system marginal supply cost
  - Leverages AMI infrastructure and smart meter data for fair and customer specific event compensation

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Consumer Information Gateway Development and Integration
to Enable Price-Responsive and Direct Load Control

- **Department of Energy RDSI Grant:**
  - Grant extends through 2015
  - Goal of 65% peak demand reduction compared to code built homes

- **Partnership among:**
  - NV Energy
  - Pulte Homes
  - UNLV

- **Project site Villa Trieste**
  - Sales launched 1/10/09
  - 185 homes planned
  - 120 homes completed

- **Demonstrate integration of:**
  - Advanced Smart Meters
  - Distributed Generation -2kW PV Systems
  - Residential Energy Storage Units - 10kW Lithium-Ion
  - Energy Efficient Construction Techniques
  - Consumer Display of Aggregated Energy Information
  - Demand Responsive Thermostats
  - Automated Intelligent Agents

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"mPowered for Commercial" (2012 – present)

- Status
  - 5 MW and growing

- Design
  - Integrated Energy Efficiency and Demand Response Program
  - Trades energy efficiency investment for demand response event participation
  - Dollar value of energy savings is larger than typical "cash for kW" programs
  - Establish service provider relationship to engage customer into additional demand response and energy efficiency upgrades
  - HVAC optimization for year round energy savings

- Technology
  - OpenADR communications via NVE DRMS
  - Overlay to Existing Building Energy Management System
  - Software-as-a-Service based HVAC Optimization

- Incentive Structure
  - Technology Incentive - up to $20,000 in upgrades to Building Energy Management System
  - 5% savings guarantee
  - 5 events (minimum) – customer shares 50% of measured energy savings above the first 5% in savings
  - 15 events (max) – customer keeps 100% of measured energy savings

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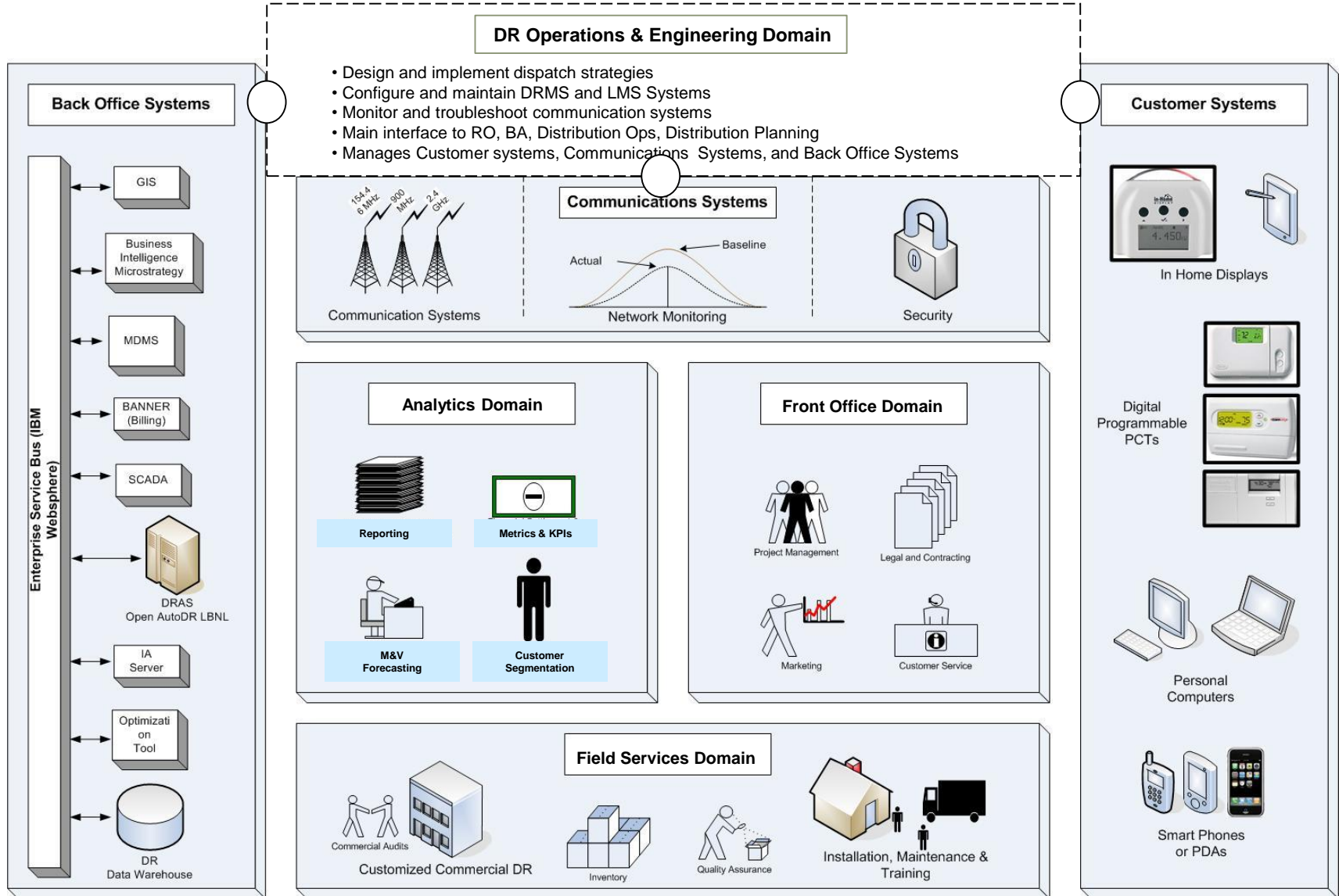|					
Small & Medium Commercial	Networked Thermostats	Trial 2014 / Production 2015	This is a direct install program similar to the mPowered Residential Home Energy Management Program; however, it focuses on delivering networked thermostats that are appropriate for commercial customers in order to control packaged rooftop HVAC units. The thermostats will provide both dispatchable demand savings during demand resposne events and well as energy savings via improved climate controls.	Pelican Wireless	Facility must have dedicated thermostat-controlled HVAC equipment with an aggregate cooling load greater than 40 kW. Provide outbound Internet access to OpenADR2.0 gateway device over port 443.
	Package Rooftop A/C Demand Limiting Controls	Trial 2014 / Production 2015	This is a direct install program that targets LGS-2 customers that could be moved back to LGS-1 via a well defined demand limiting strategy. The control technology directly interfaces with package rooftop HVAC units. NVE provides the customer with demand limiting strategies and a web-based control portal for the customer to monitor the operation of their HVAC units.	REGEN Energy	Facility must have at least five (5) rooftop package HVAC units greater than 10-tons each with an overall facility average greater than 20-tons. This technology option is only available for Southern NV customers.
	OpenADR2.0 Gateway	Trial 2014 / Production 2015	This is a direct install program that targets medium commercial customers that already have a building energy management system that is capapble of controlling package rooftop HVAC units and/or lighting, but the building energy management system does not yet support demand response protocols. NVE will install and connect a gateway that allows NV Energy to issue demand response events. NVE will provide assistance in identifying and programming curtailment strategies.	Universal Devices	Facility must have an existing Building Energy Management System, lighting controls or other load controlling equipment that is capable of responding to two dry contact relay signals during a DR Event request. Provide outbound Internet access to OpenADR2.0 gateway device over port 443.
	DR Enabled Customers	Trial 2014 / Production 2015	This program is comprised of an incentive offer and does not require any technology installation. The program is for customers that already have a building energy management system that is OpenADR compatible, or compatible with participating in NVE demand response events. Customers are paid for paticipation with a higher level of incentives offered if the customer invests incentives in energy efficiency.	N/A	Facility must have an existing Building Energy Management System, networked thermostats, lighting controls or other load controlling equipment that is already OpenADR2.0 certified.
Industrial	Grid-Interactive Process Controls	Trial 2014 / 2015	This Market & Technology Trial is focused on demonstrating the capability for "Fast DR" which is essentially the management of certain types of loads to be able to provide ancillary services as a way to manage an increasing amount of renewable energy on the electric grid. The same end-use loads can be utilized for traditional emergency and economic demand response events as well. The Trial will target process loads at Industrial facilities.	Enbala	Ideal facilities will have process loads with some storage capability. Examples of this are cold storage facilities and waste water treatment facilities among others. The facilities must already be controlled via an automated management system (could be industrial process controls or a building management system).
Large Commercial & Industrial	Back-up Generation	Trial 2014 / Production 2015	This pilot is focused on demonstrating proof of concept of a demand response program design in which the incentive is that NVE will cover the cost of environmental regulation upgrades and assist with maintenance schedules in return for utilization of the backup generators for demand response events.	N/A	Customer has diesel or natural gas backup generators with quality switch gear and must be willing to allow upgrades to the generator to ensure compliance with RICE/NESHAP environmental regulations to allow emergency and economic usage of the generators for demand resposne events.

Residential sector recruitment channels:

- Internet and electronic marketing - corporate website and email;

- Print materials - direct mailers, postcards, door hangers, and paid advertisements in the Community Associations Institute and Nevada Chapter's HOA monthly magazine – totaling over 700,000 distributed pieces;

- Local trade associations, including the Southern Nevada Air Conditioning Refrigeration Services Contractor Association;

- Direct sales – five to eight full-time agents were used for a door-to-door campaign;

- Joint customer education and outreach efforts with other energy efficiency programs.

Commercial sector recruitment channels:

- the Company approached building managers through the customer relationships built by the Major Accounts representatives;

- engaged comprehensive third party commercial real estate information systems to identify and target promising industry sectors;

- the Company participated in the United States Green Buildings Council's Demand Response Partnership Program which helped the Company identify and target commercial customers interested in obtaining LEED (Leadership in Energy and Environmental Design) certification for their building. Points can be earned toward LEED certification by participating in a demand response program.
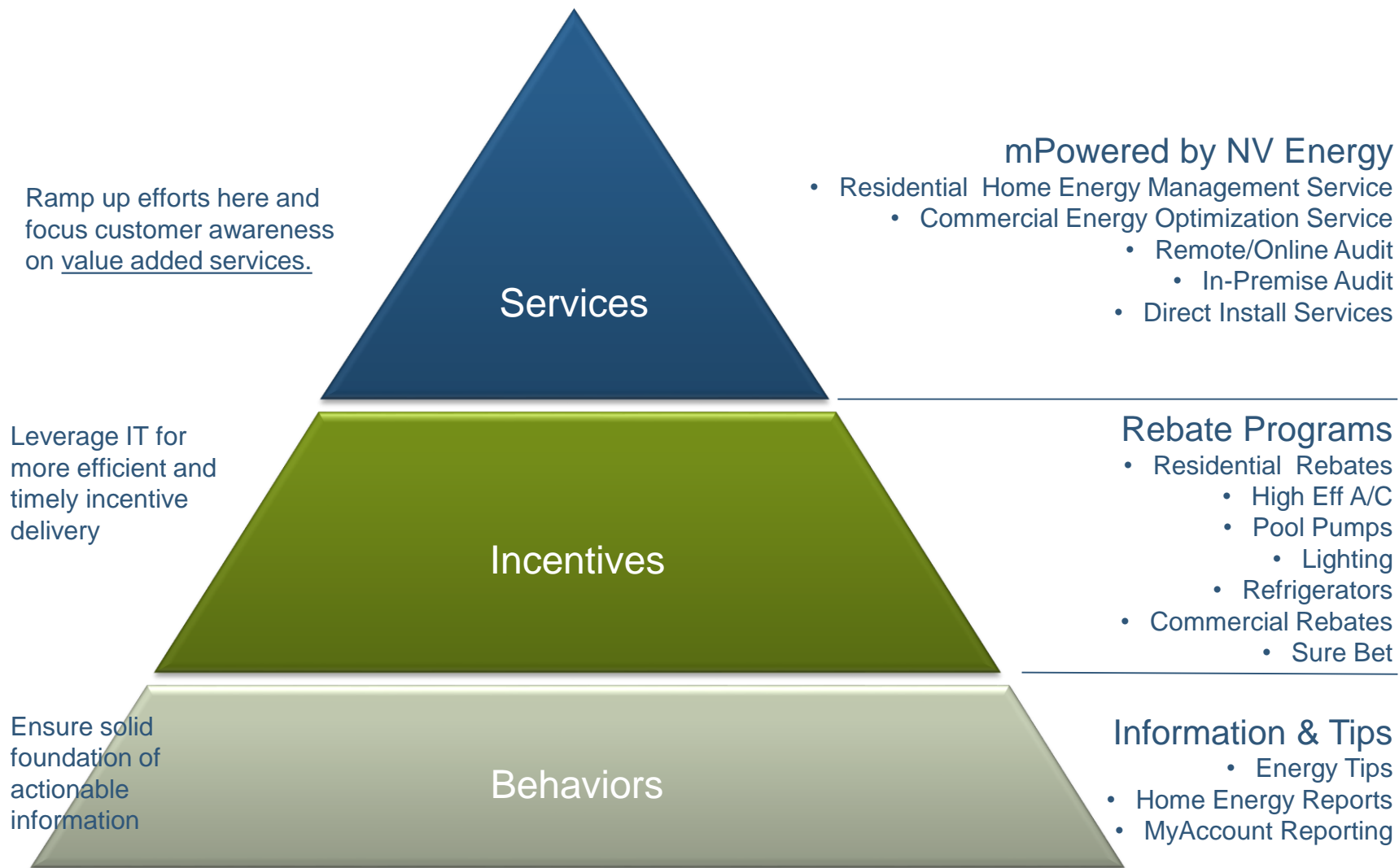
Organization

DR Operations & Engineering Domain

- Design and implement dispatch strategies
- Configure and maintain DRMS and LMS Systems
- Monitor and troubleshoot communication systems
- Main interface to RO, BA, Distribution Ops, Distribution Planning
- Manages Customer systems, Communications Systems, and Back Office Systems

Back Office Systems

Enterprise Service Bus (IBM Websphere)

- GIS
- Business Intelligence Microstrategy
- MDMS
- BANNER (Billing)
- SCADA
- DRAS Open AutoDR LBNL
- IA Server
- Optimization Tool
- DR Data Warehouse

Communications Systems

154.4 6 MHz 900 MHz 2.4 GHz

Communication Systems

Actual — Baseline

Network Monitoring

Security

Analytics Domain

Reporting

Metrics & KPIs

M&V Forecasting

Customer Segmentation

Front Office Domain

Project Management

Legal and Contracting

Marketing

Customer Service

Field Services Domain

Commercial Audits

Customized Commercial DR

Inventory

Quality Assurance

Installation, Maintenance & Training

Customer Systems

In Home Displays

Digital Programmable PCTs

Personal Computers

Smart Phones or PDAs

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The DSM organization has been realigned to improve NV Energy's capability to deliver higher levels of customer satisfaction and awareness by increasing the focus on direct delivery of Energy Services

Ramp up efforts here and focus customer awareness on value added services.

Services

mPowered by NV Energy
- Residential Home Energy Management Service
- Commercial Energy Optimization Service
- Remote/Online Audit
- In-Premise Audit
- Direct Install Services

Leverage IT for more efficient and timely incentive delivery

Incentives

Rebate Programs
- Residential Rebates
- High Eff A/C
- Pool Pumps
- Lighting
- Refrigerators
- Commercial Rebates
- Sure Bet

Ensure solid foundation of actionable information

Behaviors

Information & Tips
- Energy Tips
- Home Energy Reports
- MyAccount Reporting

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Two primary groups will work as a team to deliver integrated packages of services to customers including elements of energy efficiency, demand response, and distributed energy resources.

DSM Program Delivery

DSM Service Management

Front Office
(Customer Engagement)

Field Services

Analytics

Engineering

Back Office / Operations

Functional Specialization for improved service delivery.

Ensures consistency and quality across delivered services.

Develops and manages core service delivery infrastructure.

Resource center for project Managers.

Monitors & Reports.

Scope / Schedule / Budget
Responsible for ensuring project success.
Manages both internal and external resources.
Resource procurement and management of implementation contractors as required.
Major role in regulatory approval process.
Ensures cost effective projects.

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Operations

1.1 Engage Customer
  1.1.1 Recruit Customers
  1.1.2 Enroll Customer in Dynamic Pricing Trial
  1.1.3 Enroll Customer in Cool Share 2.0
1.2 Prepare Device Installation
  1.2.1 Maintain Home Area Network Device Inventory
  1.2.2 Prepare Devices for Field Installation Pick-up
  1.2.3 Prepare Install Technician Field Routes
  1.2.4 Reschedule Appointment while Install Technician is Enroute
1.3 Install and Provision DR Device
  1.3.1 Install Home Area Network Device
  1.3.3 Provision HAN over internet and connect to Meter over Zigbee
1.4 Communicate with Customer
  1.4.1 Handle Demand Response Customer Inquiry
1.5 Prevent or Resolved Device Malfunction, Remove Device
  1.5.1 Perform Device Troubleshooting
  1.5.2 Perform Remote Monitoring and Preventative Maintenance
  1.5.3 Conduct Quality Assurance Field Inspection
  1.5.4 Remove Home Area Network Devices
  1.5.5 Initiate and Track Return Materials Authorization
1.6 Curtail Load
  1.6.1 Configure Dispatch Strategy in DRMS
  1.6.2 Execute Dynamic Pricing Trial Event
  1.6.3 Execute Cool Share 2.0 Event
  1.6.7 Update Portal with Event Participation Details
  1.6.8 Portal functionality for customer DR management
  1.6.9 Execute Bench Test Event
1.7 Measure & Verify
  1.7.1 Analyze Load Drop in Near-real Time
  1.7.2 Conduct Post-event Analysis
  1.7.3 Develop Customer Billing Determinants for Cool Share
1.8 Change/Remove Customer from DR Program
  1.8.1 Change/ Remove Customer from Cool Share 2.0
1.9 Administer Application
  1.9.1 Set-up New DRMS User for DRBizNet and MetrixIDR
  1.9.2 Manage Application Database
  1.9.3 Purge Database
  1.9.4 Recover from Disaster
  1.9.5 Migrate Application Versions
  1.9.6 Migrate Customer Data
1.11 Security
  1.11.1 Security of HAN Device Communication
  1.11.2 Security of Messages between DRMS to Portlet
1.12 Program Management
  1.12.1 Program Management - Configure Programs

1.6.3 Execute Cool Share Event
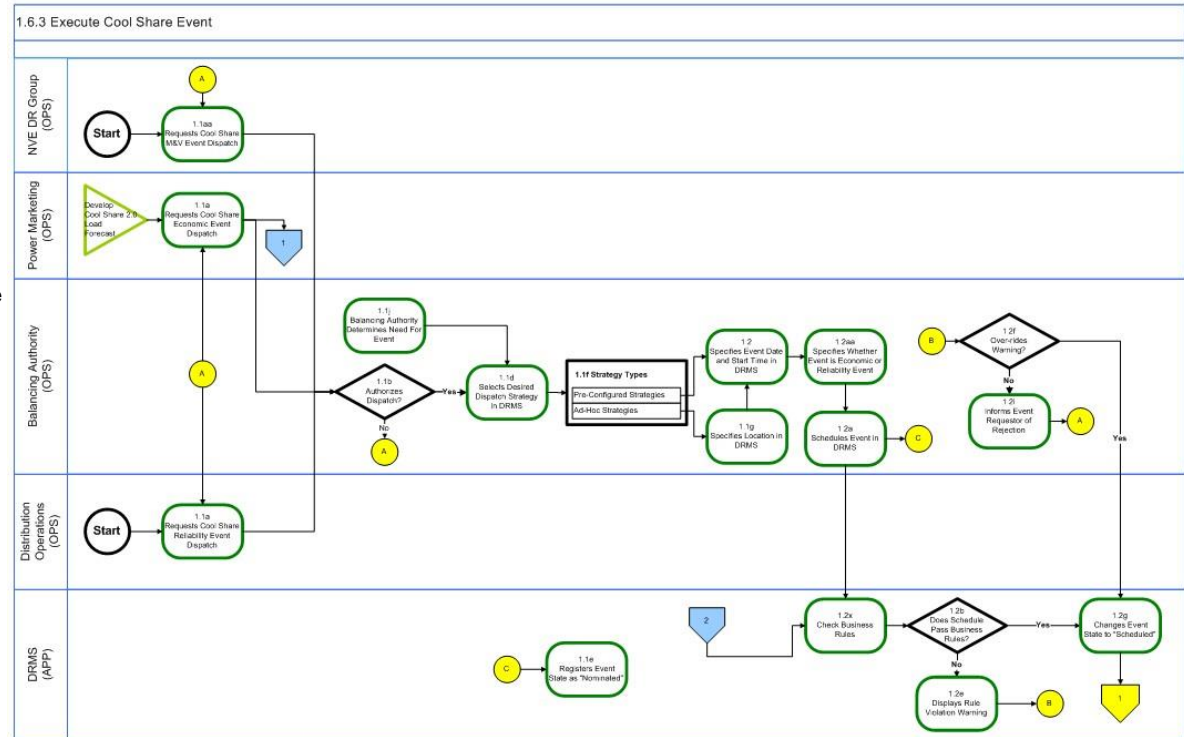
❖ **Resource Planning (long term planning)**

- Coordinate and develop DR portfolio considering load and resources forecasts
- Provide assistance in modeling the impact of DR events on future load forecasts
- Assist in the development of future resource scenarios to be run through production cost models

❖ **Resource Optimization (short term planning)**

- Develop economic dispatch algorithm
- Provide assurance of dependable load reduction
- Provide forecasting of load reduction (day-ahead, hour-ahead)

❖ **Balancing Authority**

- Provide dispatch capability, training, and support
- Ensure DRMS is always up to date and configured for load control dispatch plans and schedules, i.e. balancing operator needs to know when load control system can be queued up for non-spinning reserve
- Enusre DRMS load reduction forecasts are accurate

❖ **Distribution Planning/Mapping**

- Coordinate load control device addressing/mapping
- Coordinate strategic grouping of load aggregation points

❖ **T&D Operations**

- Provide load reduction forecasting by load aggregation points
- Coordinate strategic operation of load control for system reliability reasons
- Implement procedures for executing dispatch of load control system for reliability reasons

❖ **Information Technology**

- Coordinate hardware/software installation and maintenance, server maintenance
- Plan, design, implement business intelligence and data warehouse architectures, and business user query, reporting, and analysis tools
- Develop, build enterprise systems integrations via Service Oriented Architecture

❖ **Metering**

- Coordinate on locations of pilot AMI meters and load control devices
- Coordinate on methods for collecting interval data from pilot AMI meters

❖ **Load Profile Group**

- Coordinate on locations of load profile meters and load control devices

❖ **Telecommunications**

- Coordinate communications testing
- Coordinate repairs/testing of remote site controller and RF transmitter
- Coordinate on backhaul communications systems for AMI interval data

❖ **Procurement and Legal**
- Ensure compliance with Corporate Standards
- Review vendor and customer facing agreements
- Ensure multi-party review of program and vendor risk management

❖ **Major Accounts**
- Coordinate all contact with Major (Key) Accounts
- Ensure appropriate training on DR program portfolio

❖ **Customer Service**
- Coordinate call handling, customer technical support, customer sign-ups, etc.
- Coordinate cross marketing of customer service programs (e.g. online bill pay, equal payment plan, MyAccount online energy information)

❖ **Corporate Communications**
- Coordinate program recruitment, messaging, and branding
- Coordinate web-site development and maintenance

❖ **Energy Efficiency**
- Coordinate everything
- Work in progress…

Infrastructure

Enterprise Systems Integrated to DRMS

- MDMS
- RNI
- BANNER
- PI / SCADA
- GenTrader
- TESLA
- Active Directory/ Exchange Server

Enterprise Service Bus (SOA Layer)

Load Management Systems

Demand Response Management System

(DRMS)

DMZ

- Open ADR Server
- Generic Device Manager
- Customer Portals

NVE Owned or Third Party Communications

Premise Based Devices

- Carrier Thermostats
- EcoFactor Thermostats
- Comverge Switches
- Canon/Cooper Thermostats
- Canon/Cooper Switches

Customers

DRMS Release Overview & Integrations

9/30/2011	12/16/2012	3/31/2013 – 9/8/2014
R1	**R2**	**R3**

STRATEGIC OBJECTIVES		
Enable CS 2.0 Device Control via Broadband	Forecasting Settlement / M&V Additional Program Support Additional Device Management	Event Optimization Additional Program Support

FUNCTIONAL SUMMARY		
•Enrollment •Work Management •Event Execution •Dispatch Strategy Mgt •Device Management •1st HAN Device (C4) •Near Real Event Tracking (PI) •Notification via E-mail •Event & Program Reporting	•Settlement (OLM-AS Support) •Forecasting •Automated Measurement & Verification •CS 1.0 Program Support •C&I Program Support •NDPT / Recruitment & Enrollment •OpenADR •Online Enrollment and Scheduling •Additional Reports	•NDPT / CPP Event Execution •Optimization •Program Enhancements •IS-2 Program Support •Generic HAN Device Manager •Customer Self Provisioning •Additional Web Portal Features •Additional Reporting

INTEGRATION LIST		
•DR_INT 1 (Banner) •DR_INT2 (Banner) •DR_INT27 (Active Directory) •DR_INT28 (PI) •DR_INT29 (Exchange Server) •DR_INT15-24 & 30 (C4 Advantage)	•DR_INT 5 (MDMS Int Data) •ASD_INT 7 (Banner/MDMS) •DR_INT 7-14 (Portal) •DRMS Integrations to support OpenADR server in DMZ •SPPC - Banner, PI, Portal •DR_INT 14 Weather Data •DR_INT 11 Pricing Data	•DRMS to RNI •DRMS to MDMS /CPP Events •DRMS to Tesla (Load Forecast) •DRMS to PCI/GenTrader (Unit Commitment) •DRMS to Notification Engines •Additional Banner (Billing Determinants) •DRMS to EE Datastore •IVR Lookup

DRMS Functions

Release 1   Release 2   Release 3

Customer / Program Management
•Tracks customer device associations
•Tracks customer program enrollments
o   Cool Share 2.0
o   Cool Share 1.0
o   C&I
o   NDPT
o   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:
o   Substation
o   D-bank/Feeder
o   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:
o   Avoided Capacity
o   Economic Dispatch/Cost Minimization
o   Manage renewable resource volatility
o   Facilitate distribution operations

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

Reporting
Event Reports:
o   Internal – Participation, Load Shed, etc.
o   External (Customer) – Participation, Rebate, etc.
•Vendor Information
•Remote Maintenance (Device States)
• Customer Information
o   CS 2.0
o   CS1.0, NDTP, C&I
o   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

Optimization Goals

DRMS Embedded Objective Functions
- Maximize Avoided Capacity
- Targeted Load Reduction

GenTrader (Unit Commitment) Functions
- Minimize Energy Supply Cost considering Supply-Side and Dispatchable Demand-Side Resources

Optimization Processes
- Stage 1 – serve load shape products to Unit Commitment software
- Stage 2 – create load shape in response to iterative requests from Unit Commitment software

T&D Planning and Operations
- Feeder/substation application of system level optimization techniques
- Additional targeted marketing efforts

Option 1: Simultaneous
2 hour control of the entire Demand Response system at the same time starting at 4pm PST

8/26/2010 - Option 1

Option 3: 3-Phased Control
3 hour control of the Demand Response system split into 3 phases. The 1st phase starts at 3:30pm PST.

8/26/2010 - Option 3

Option 8: Simultaneous
1 hour control of the entire Demand Response system at the same time starting at 4pm PST

8/26/2010 - Option 8

DR System Load Impact Optimizer

NVEnergy   NAVIGANT CONSULTING   Model Details
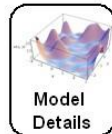
Input
- Participation
- Technology
- Event Impacts
- Other Input

Optimization Solution

Load Forecasts

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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
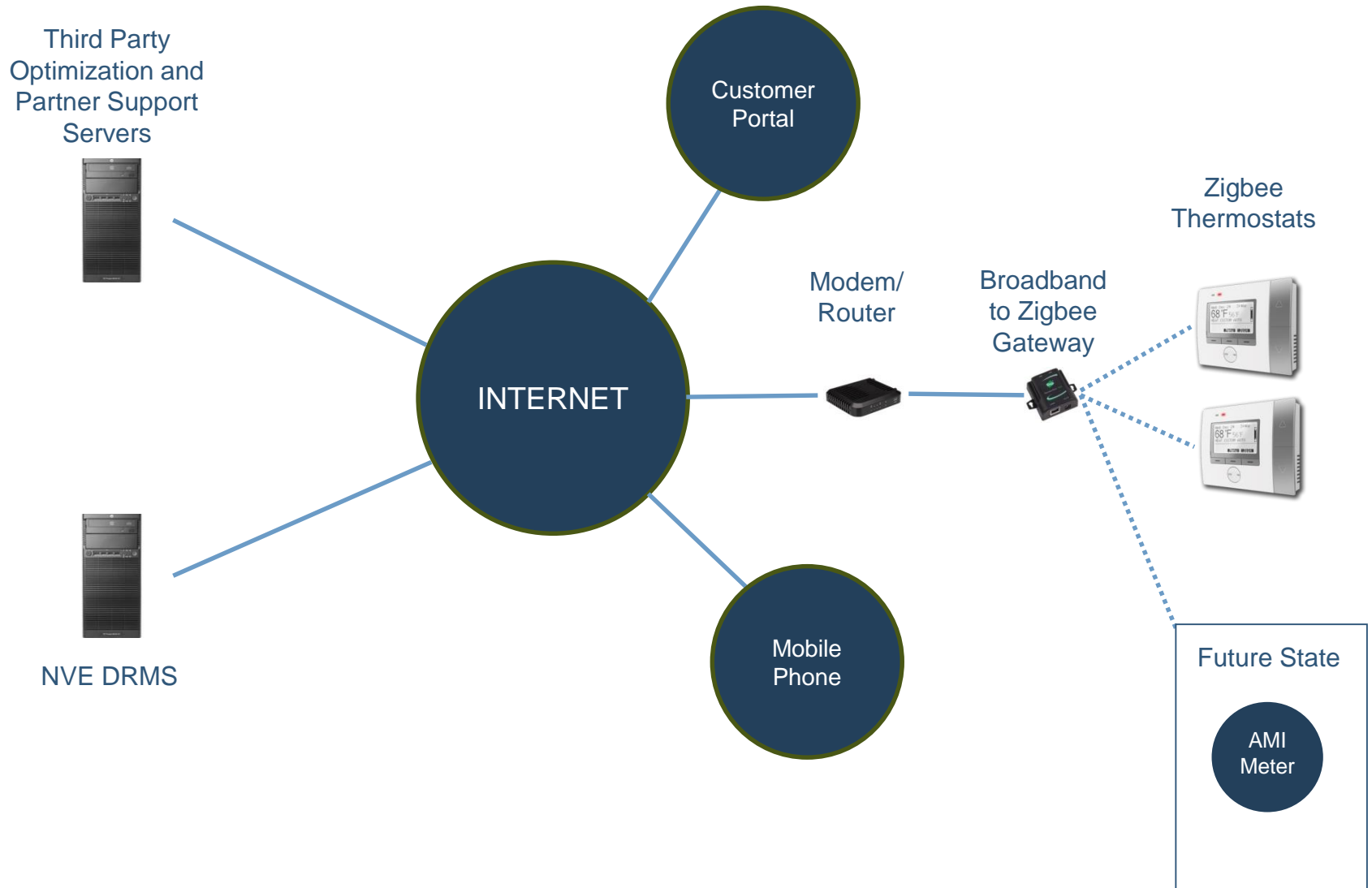
Energy Efficiency Optimization

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
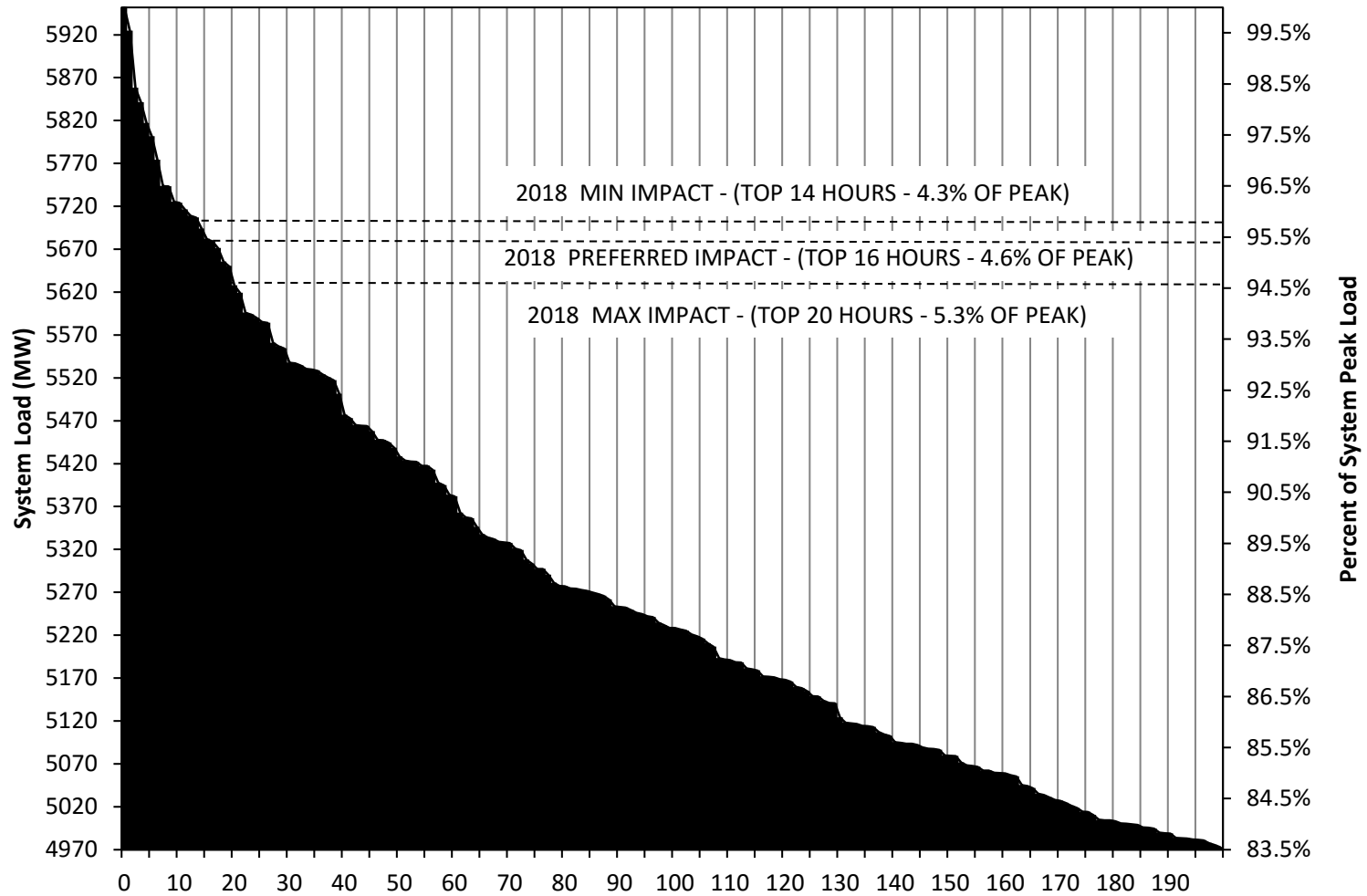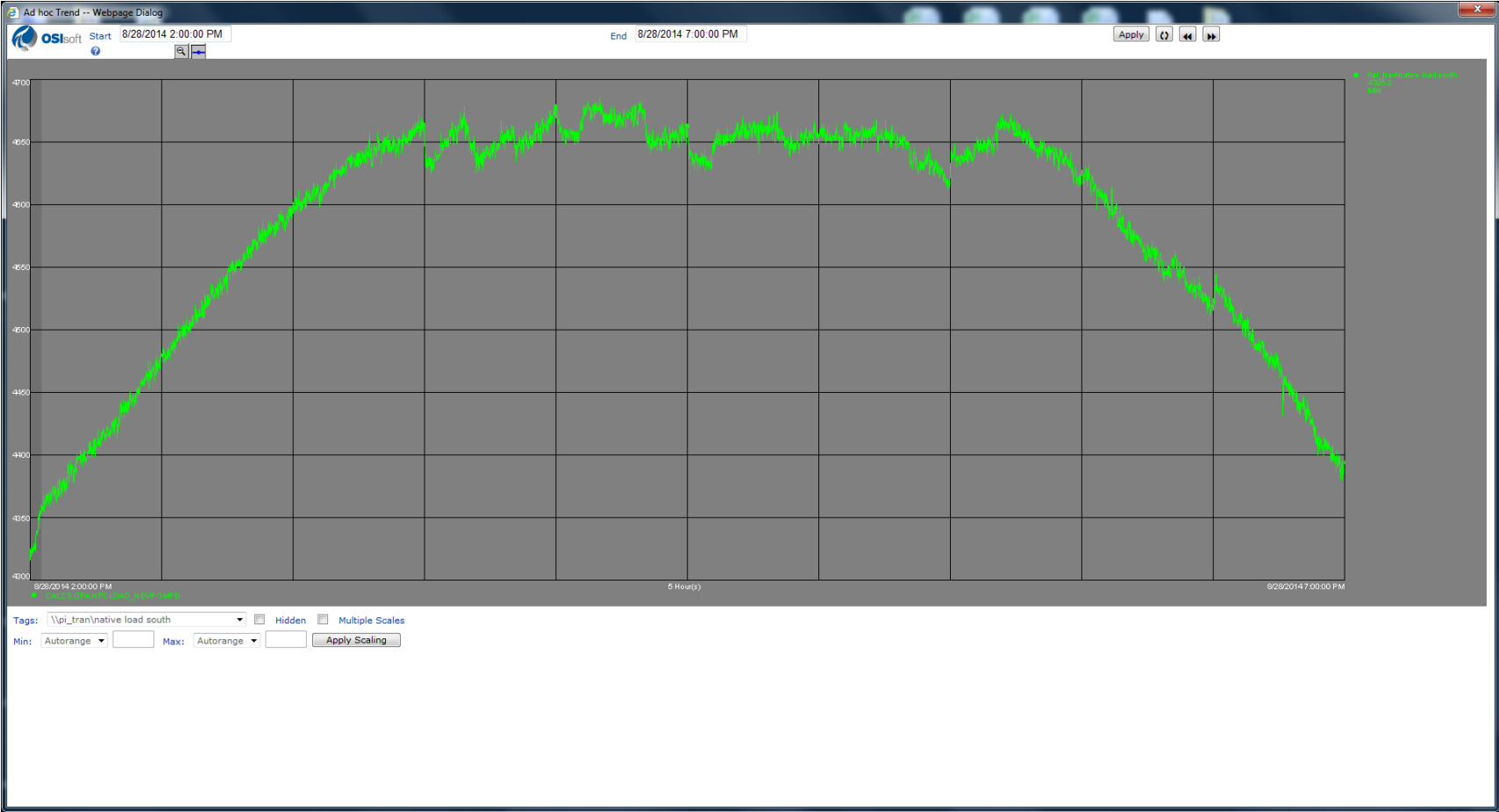
Value

Major Drivers of Company Value

- Avoided Cost Valuation (Standard Practice Tests)

- Operating Reserve

- Insurance Value

  - Avoid "low probability/ high consequence" events

  - Dispatch to avoid high market prices under high low situations

- Distribution Operations

- Arbitrage and Hedging Opportunities

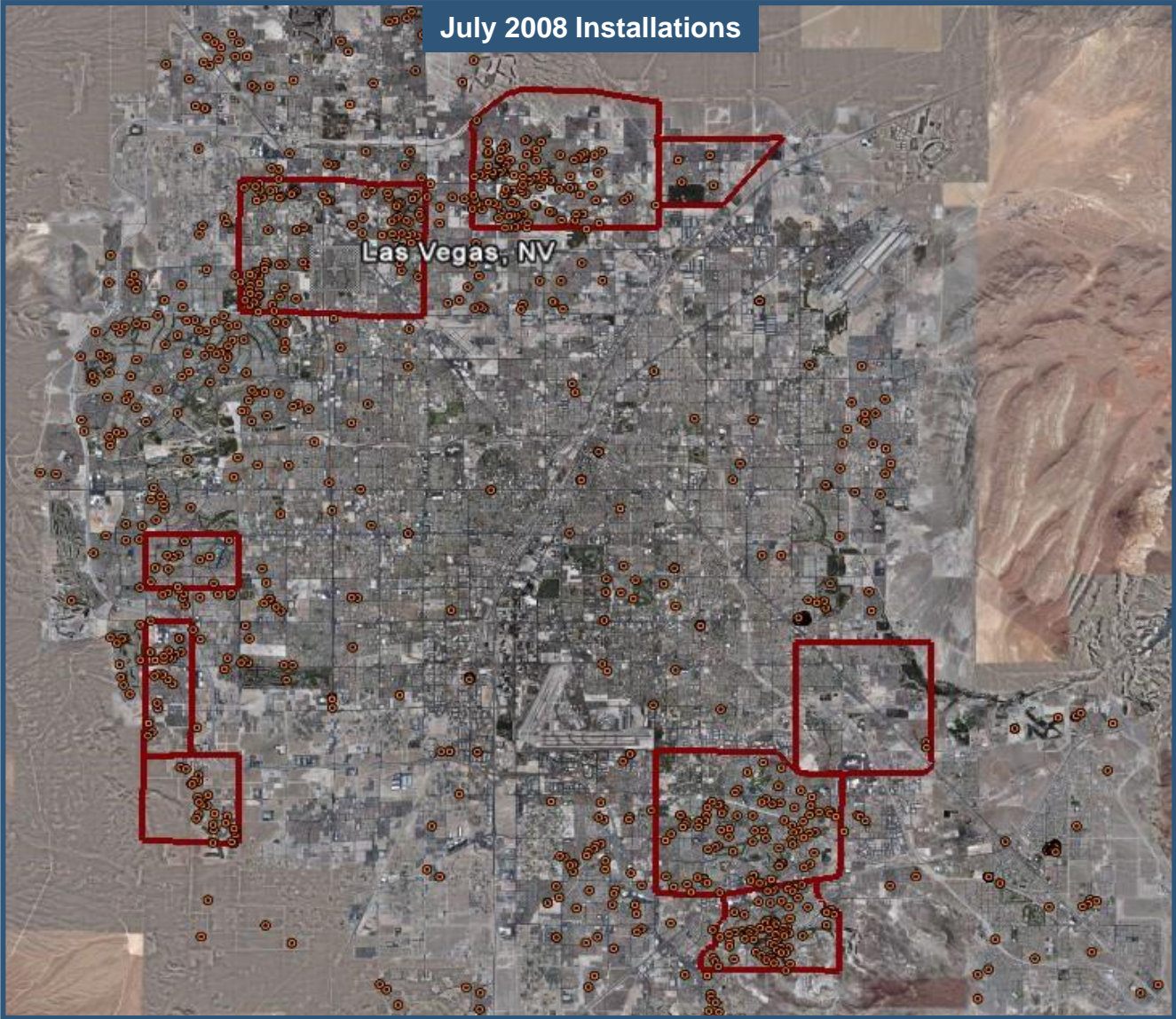- Generation Dispatch Optimization

- Portfolio Risk Reduction

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NV Energy (South) Load Duration Curve - 2018

2018 MIN IMPACT - (TOP 14 HOURS - 4.3% OF PEAK)

2018 PREFERRED IMPACT - (TOP 16 HOURS - 4.6% OF PEAK)

2018 MAX IMPACT - (TOP 20 HOURS - 5.3% OF PEAK)

Avoided Energy

July 2008 Installations

NV Energy DR & DER Priorities
- Integrated Energy Efficiency & Demand Response for Higher Value Customer Programs
- Networked Platforms vs. Discrete Devices for Data Rich Applications & Upgrade Capabilities
- Rapid Communications with Resources to Facilitate Flexible Operations
- Focus on Enabling Technology with Premise Specific Logic
- Provide Significant Technology Investment Opportunities
- Automated DR – automated business processes and "AutoDR"

Integrated Portfolio Approach
- Compatible & Complementary Programs and Rate Offerings
- Programs promotes time differentiated rates and many infrastructure components are compatible with the delivery of advanced rates

Forecasting
- Advanced and automated forecasting is required as more decision making is pushed to the customer/premise level
- More granular forecasts are required for customer groups/participants for programs to achieve higher level of benefits (distribution operations, renewable generation buffer, ancillary services)

Optimization
- Enables supply side equivalency in resource allocation determinations
- Enables more efficient utilization of demand-side resources thereby reducing customer impact
- Enables greater and more flexible utilization of demand side resources to address grid conditions

Tangible Benefits Realization
- Operating Reserve
- Insurance Value
- Portfolio Risk Reduction
- Load shaping to improve efficiency of generation dispatch
- Identify arbitrage and hedge strategies

Research Questions / DR Lab Tour