

PNM 2017-2036 Integrated Resource Plan

JULY 27, 2016



Talk to us.



DISCLOSURE REGARDING FORWARD LOOKING STATEMENTS

The information provided in this presentation contains scenario planning assumptions to assist in the Integrated Resource Plan public process and should not be considered statements of the company's actual plans. Any assumptions and projections contained in the presentation are subject to a variety of risks, uncertainties and other factors, most of which are beyond the company's control, and many of which could have a significant impact on the company's ultimate conclusions and plans. For further discussion of these and other important factors, please refer to reports filed with the Securities and Exchange Commission. The reports are available online at www.pnmresources.com.

The information in this presentation is based on the best available information at the time of preparation. The company undertakes no obligation to update any forward-looking statement or statements to reflect events or circumstances that occur after the date on which such statement is made or to reflect the occurrence of unanticipated events, except to the extent the events or circumstances constitute material changes in the Integrated Resource Plan that are required to be reported to the New Mexico Public Regulation Commission (NMPRC) pursuant to Rule 17.7.4 New Mexico Administrative Code (NMAC).

AGENDA

RELIABILITY

Agenda

Morning

- Meeting Logistics
- Reliability of the Bulk Power System
- Reliability Services
- PNM's Specific Reliability Responsibilities
- How Reliability Fits Into IRP

Afternoon

- Emerging Technologies

SAFETY AND LOGISTICS

- Fire escape routes via stairways at east and west ends of hallway; please let us know if you require special handicap egress or special assistance
- We must obey any fire or emergency alarm; even drills/test alarms
- Restrooms – Women's room at west end; Men's room at east end
- PNM's WiFi
- Please be aware that there are outlets/network connections on the floor

SAFETY AND LOGISTICS CONTINUED

- Must sign-in with security desk each time you enter the building
- Must be escorted in and out of the building by a PNM employee
- Recycling is easy and encouraged
- Please note that meeting room is scheduled immediately following the IRP meeting

MEETING GROUND RULES

- IRP Public Advisory purpose is to solicit and receive public input
- Questions and comments are welcome
- Comments should be respectful of all participants
- Use name tents to indicate you have a comment or question
- Please silence your cell phone
- Reminder; today's presentation is not PNM's plan or a financial forecast, it is a discussion of PNM's planning process

RELIABILITY OF THE ELECTRIC GRID

IMPORTANCE OF RELIABILITY

Reliability is the result of delivering electricity to customers within acceptable measures of quantity and quality

Why is reliability important?

- Electricity is essential to our daily lives (public health, safety, commerce, etc.)
- PNM is required to comply with all NERC and WECC standards

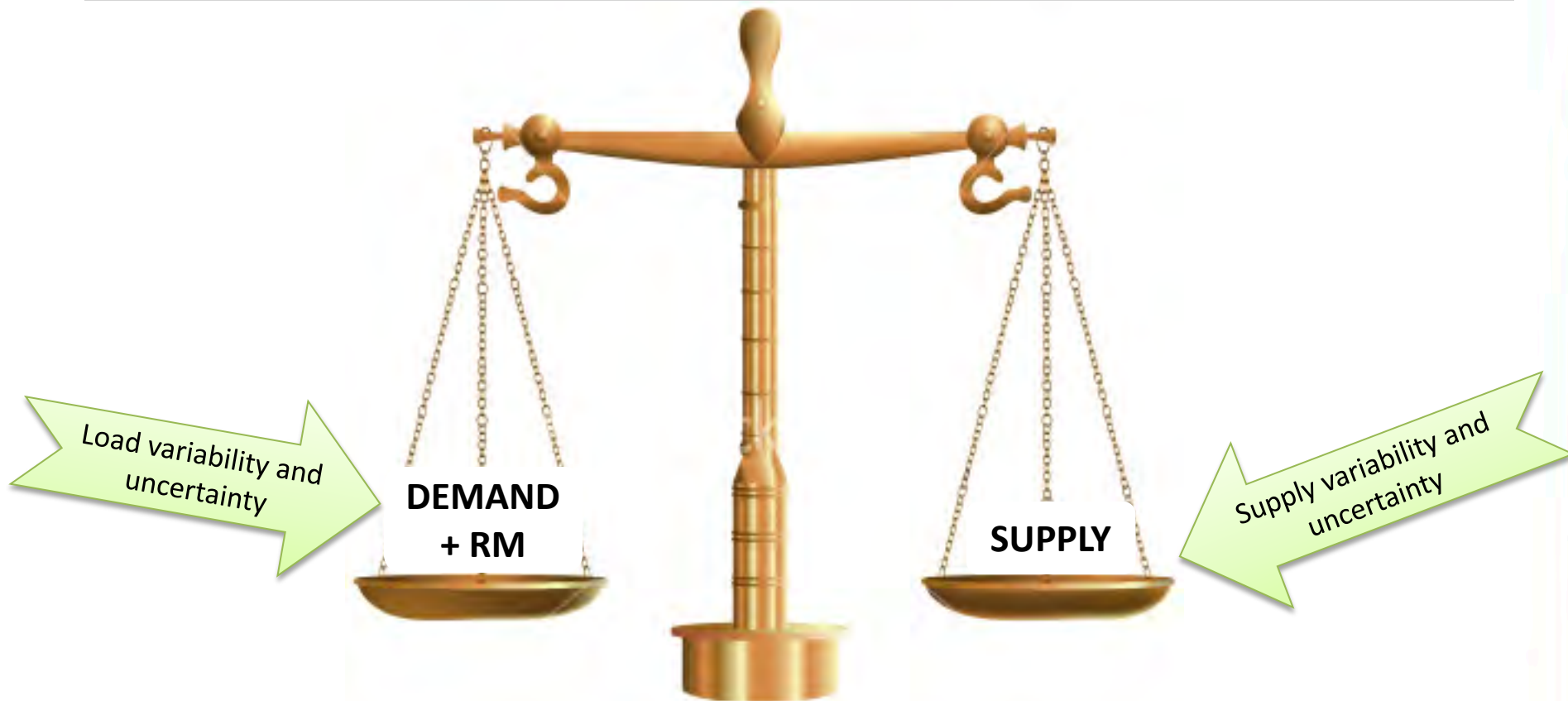
RELIABILITY SERVICES

THE BUILDING BLOCKS OF THE ELECTRIC GRID

- Reliability Services are what a utility like PNM utilizes to operate the grid and fulfill requirements.
- Reliability Services are building blocks normally provided by generation.
 - **Voltage Support Services:** Operating the system to maintain system voltages
 - Regulation
 - Disturbance control
 - Reactive power supply
 - **Frequency Support Services:** Operating the system to maintain balance
 - Load following
 - Frequency response

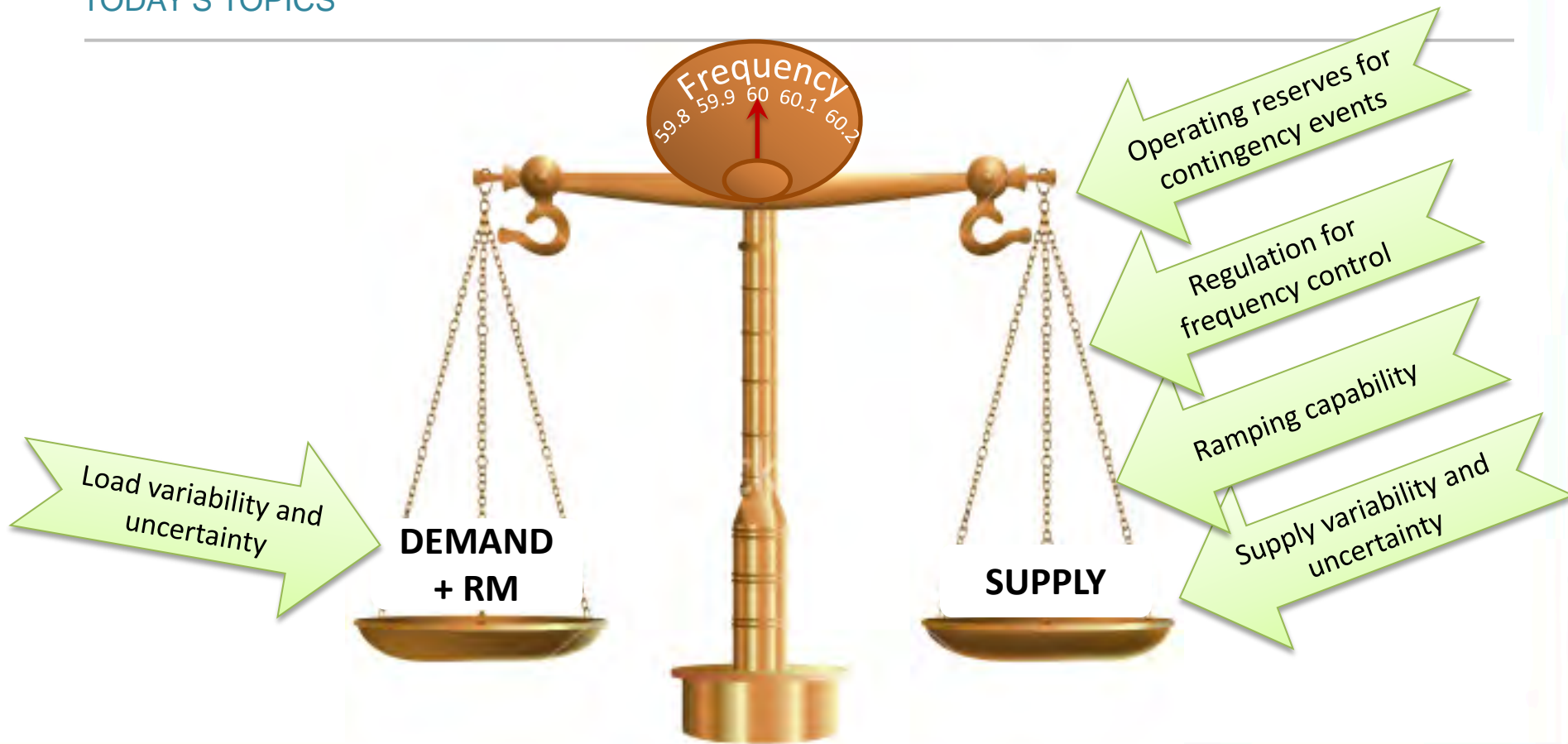
BALANCING LOAD AND GENERATION

TOPICS DISCUSSED IN 2008 IRP



BALANCING LOAD AND GENERATION

TODAY'S TOPICS



PLANNING RESERVE MARGIN

LOADS & RESOURCES TABLE – SUMMER PEAK

Line No.	Description	2018	2019	2020
(1)	Forecasted System Peak Demand	1,980	2,023	2,068
(2)	Forecasted Incremental Energy Efficiency	(48)	(60)	(73)
(3)	Forecasted Incremental Customer Sited PV	(11)	(13)	(12)
(4)	Net System Peak Demand (MW)	1,922	1,950	1,983
(5)	Four Corners	200	200	200
(6)	San Juan	497	497	497
(7)	Total Coal Resources (MW)	697	697	697
(8)	Palo Verde Unit 1 & Unit 2	268	268	268
(9)	Palo Verde Unit 3	134	134	134
(10)	Total Nuclear Resources (MW)	402	402	402
(11)	Reeves	154	154	154
(12)	Afton	230	230	230
(13)	Lordsburg	80	80	80
(14)	Luna	185	185	185
(15)	Rio Bravo	138	138	138
(16)	Valencia	145	145	145
(17)	La Luz	40	40	40
(18)	80 MW Plant	80	80	80
(19)	Total Natural Gas Resources (MW)	1,052	1,052	1,052
(20)	Total Demand Response Programs (MW, Net of losses)	52	52	52
(21)	Wind Purchase (NMWEC)	10	10	10
(22)	Wind Purchase (Red Mesa)	5	5	5
(23)	Prosperity Battery Demo	1	1	1
(24)	Utility Scale Solar PV	69	69	69
(25)	PNM Sky Blue - 1.5 MW Solar	1	1	1
(26)	Dale Burgett Geothermal Plant	4	4	4
(27)	Total Renewable Resources (MW)	90	90	89
(28)	Total System Resources (MW)	2,293	2,293	2,292
(29)	Reserve Margin (MW)	372	343	309
(30)	Reserve Margin (%)	19.3%	17.6%	15.6%

System operability is important and not reflected on the L&R table

- Must look at more than a single hour
- Variability is more of a probability question than an assignment of capacity
- Look at more than reserve margin that only covers the variability in loads and resources

How does the resource mix adequately provide the essential reliability services?

David Eubank

Director, Power Operations

PNM'S RELIABILITY RESPONSIBILITIES

KEEPING THE LIGHTS ON

- PNM maintains 24x7 operations to assure reliability for its customers and prevent adverse effects on neighboring systems
- PNM has the responsibility and authority to take whatever actions are needed to prevent or alleviate problems on our system.
- Actions within PNM's authority includes re-dispatch of generators, switching of facilities, adjust interchange, curtailment of energy schedules and, if conditions require, shedding load as a last resort.
- Virtually every aspect of PNM's real-time operations are regulated
 - Balancing performance, mitigation of generation and transmission disturbances, system operator training, procedure development and adherence to those procedures, emergency plans, etc.

PNM operates under the observation of regional reliability coordination centers

- one is in Loveland CO, the other is in Vancouver, WA

PNM'S SPECIFIC RELIABILITY RESPONSIBILITIES

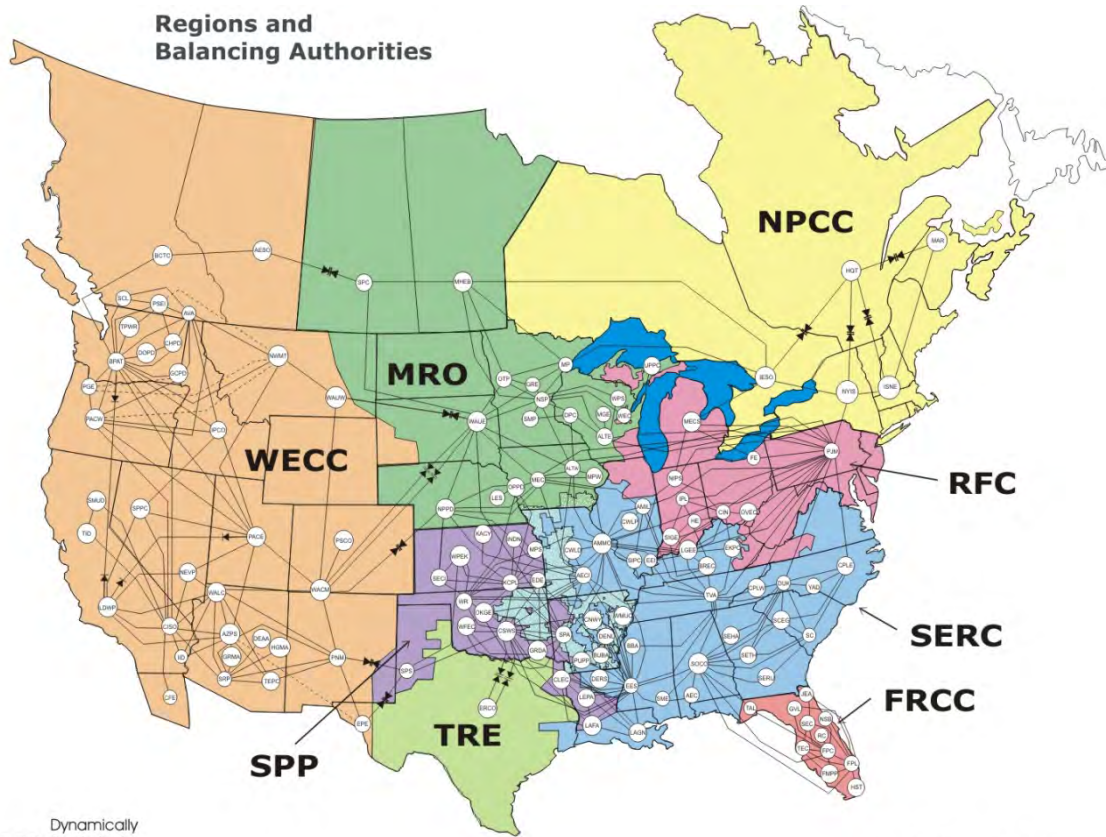
POWER OPERATIONS

Insure transmission grid reliability in real-time via:

- Balancing Operations:
 - Assure that the supply of power and the demand for power within the PNM system remains in balance to maintain 60hz power – PNM has this responsibility within its operating footprint and shares grid balancing responsibility with about 37 other operating entities in the western interconnection
- Transmission Operations:
 - Monitor power flow on transmission elements (lines and transformers) and if necessary, make adjustments primarily through generation dispatch
 - Control the voltage profile on the transmission system -
 - Facility restoration in response to forced outages – weather, animal contact
 - Manage planned outages for maintenance and construction activity

BALANCING LOAD AND GENERATION

BALANCING OPERATIONS



There are three interconnections in the continental United States

Western Interconnection

Eastern Interconnection

Texas, or TRE Interconnection

PNM operates at the southeast corner of the Western Interconnection

--- Dynamically Controlled Generation

As of August 1, 2007

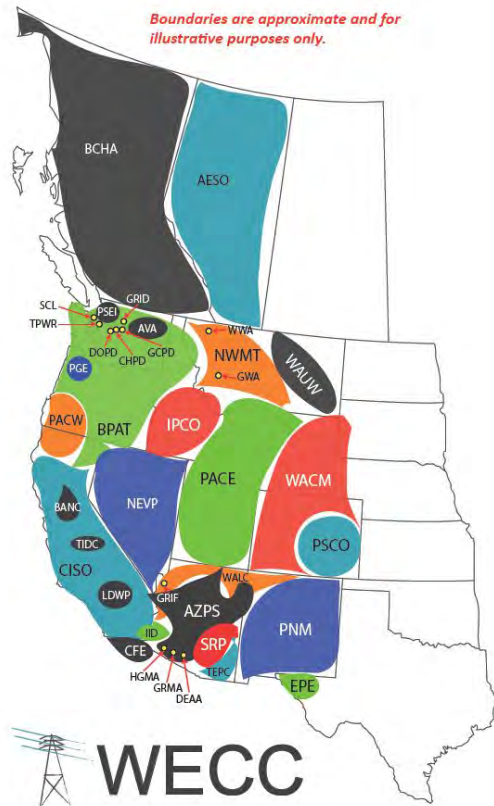


Talk to us.



BALANCING LOAD AND GENERATION

BALANCING OPERATIONS – BALANCING AREA IN THE WEST



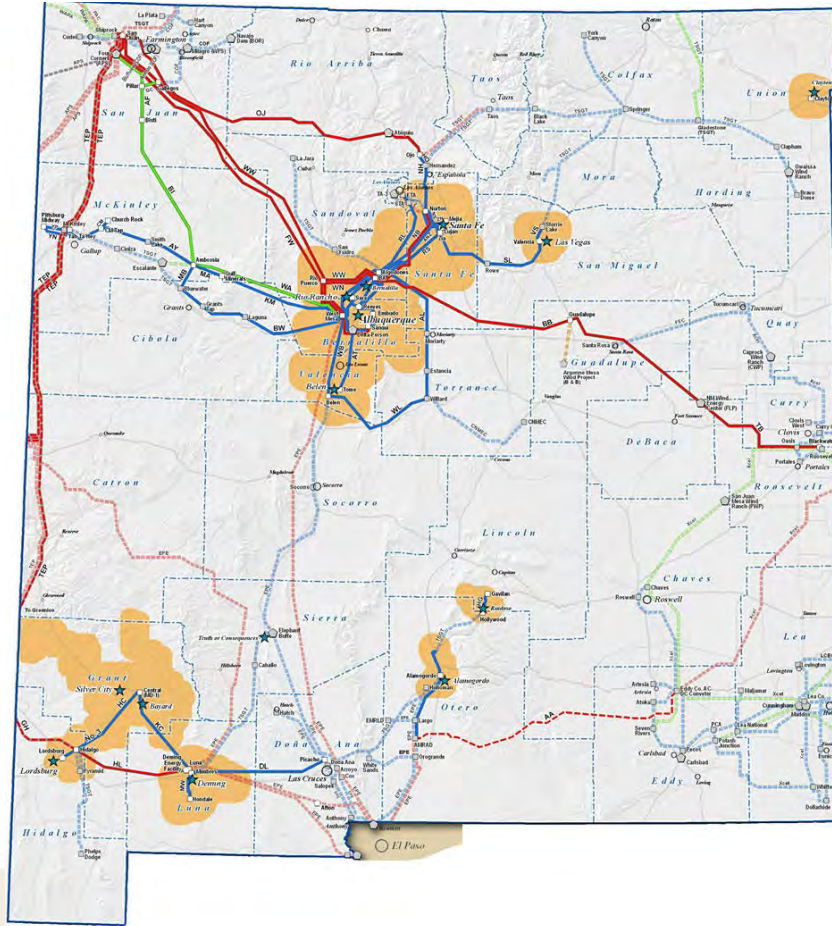
Performance is measured by “area control error”

All schedules for power and all flows of power into and out of the PNM system are continuously monitored, recorded and verified on an hourly basis with neighboring utilities

Balancing performance is governed by NERC reliability standards

TRANSMISSION OPERATIONS

POWER FLOW AND VOLTAGE CONTROL ON THE TRANSMISSION SYSTEM

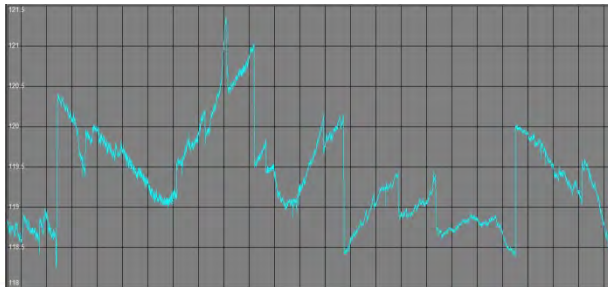
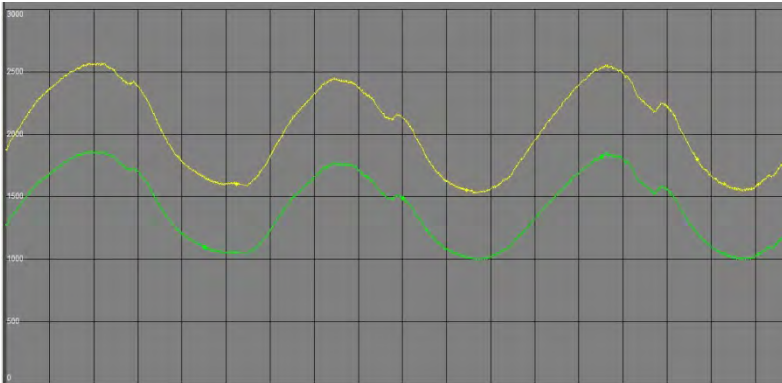


- PNM operates 115kV, 230kV and 345kV transmission facilities
- All facility power flows are monitored
- Bulk power imports into northern NM are also monitored and managed to remain within reliable limits
- Operators receive notification via alarms of high loading levels

TRANSMISSION OPERATIONS

SYSTEM VOLTAGE REGULATION

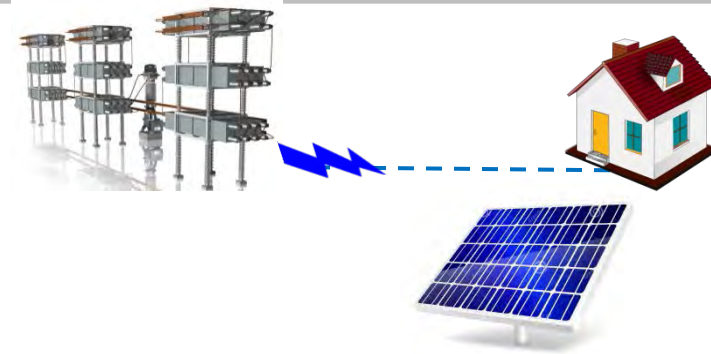
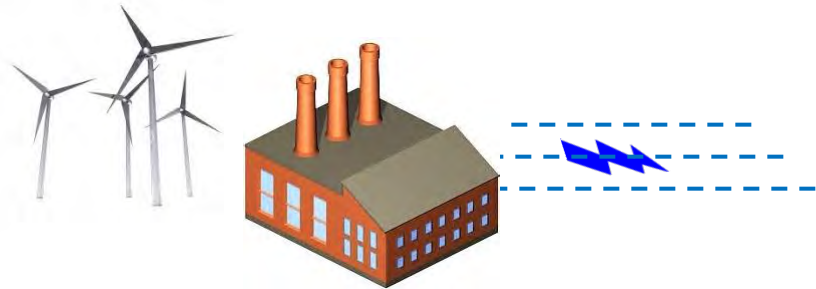
- PNM manages the system to ensure that operating voltages are properly maintained throughout its service territory



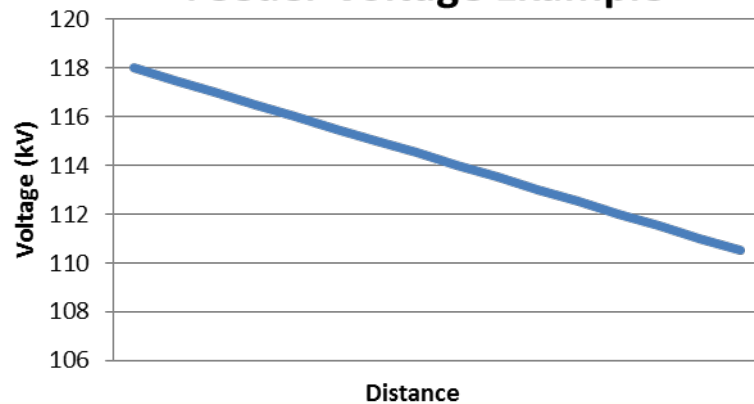
- Why do we need to maintain voltage?
 - Keeping voltages at correct operating levels allows for electricity to be delivered in a reliable manner – protect PNM and customer equipment
 - Public Regulation Commission Rules
- How do we maintain voltage on our system?
 - Generator output voltage schedules
 - Operating transformer load-tap changers (LTC), voltage regulators, capacitor/reactor banks and static VAR compensators (SVC)

SYSTEM OPERATIONS

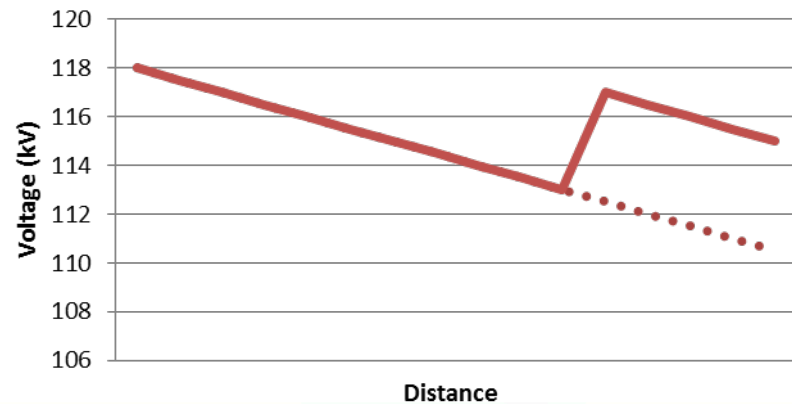
SYSTEM VOLTAGE REGULATION – DISTRIBUTION



Feeder Voltage Example



Reactive Support Example



OTHER RELIABILITY SUPPORT

COMPUTING SYSTEMS, OPERATING PROCEDURES, AND COMMUNICATIONS NETWORK

- PNM has IT staff support for its Energy Management System server systems and engineering staff support for its EMS/GMS¹ applications
- Extensive procedures to address:
 - Black Start and System restoration
 - Load Curtailments
 - Backup control center operation
- Extensive communications system
 - Fiber optic loops within the Albuquerque metro area
 - Microwave system to reach over long distances

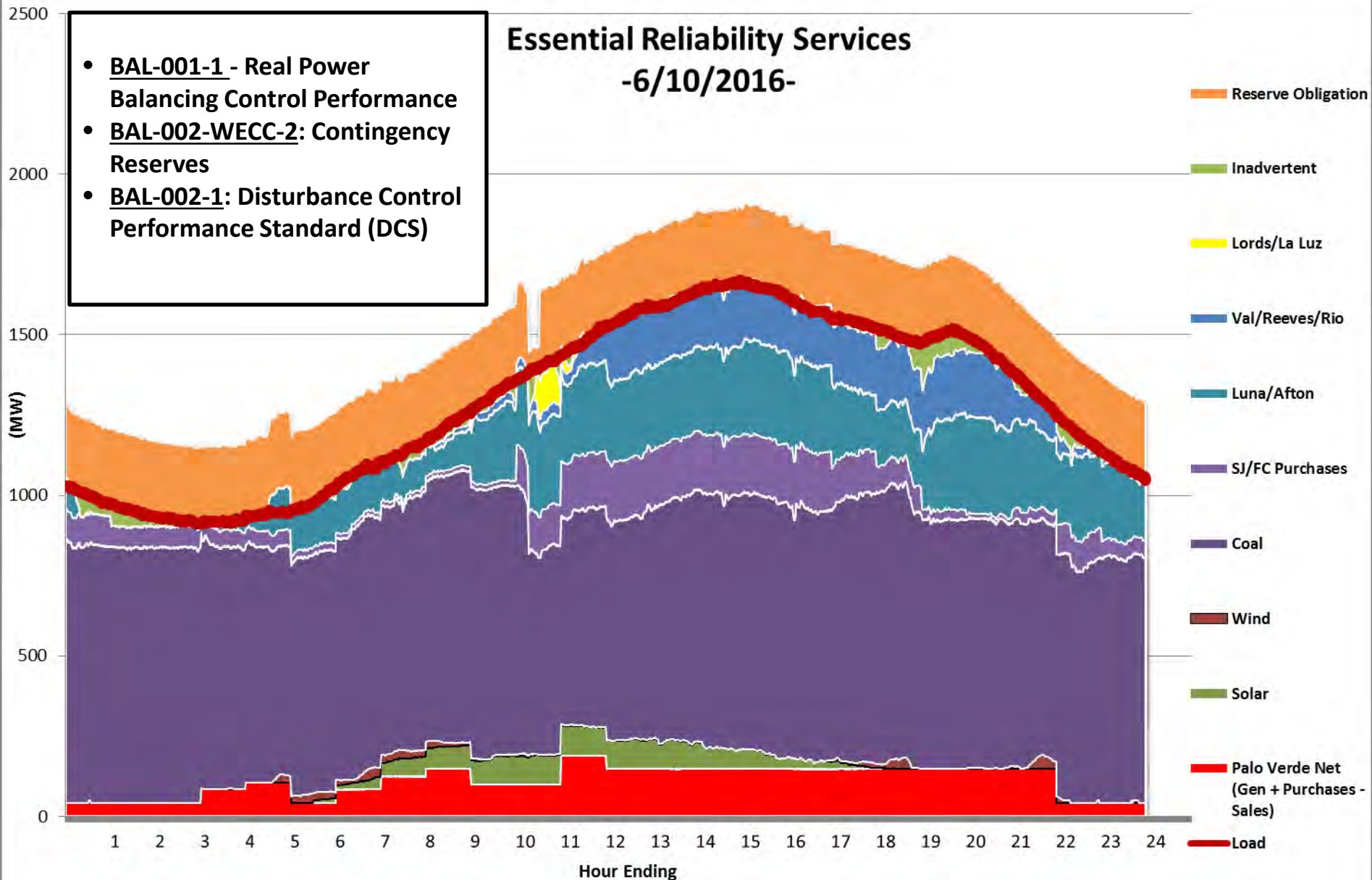
¹ EMS/GMS – Energy Management System/Generation Management System

David Miller

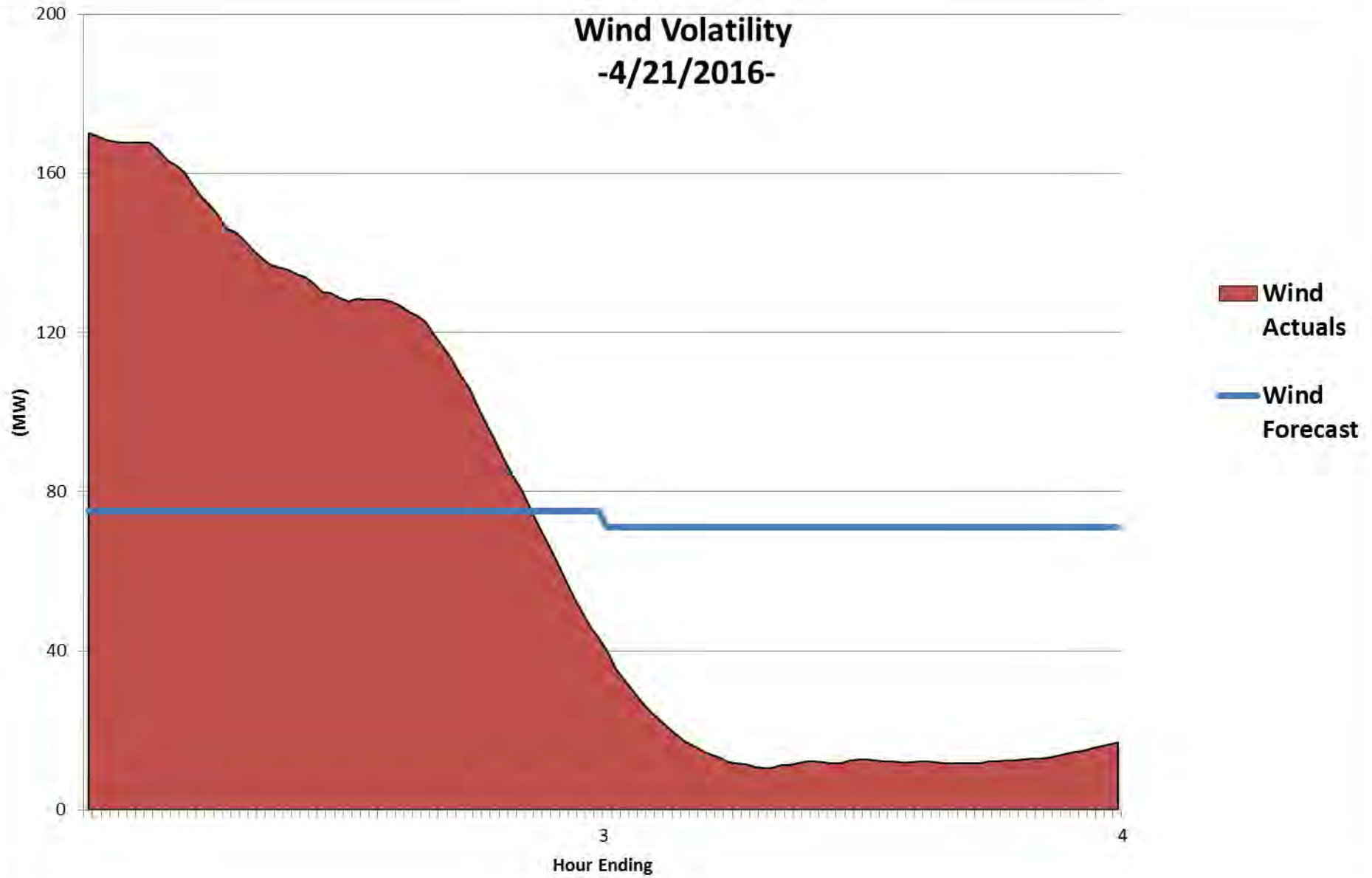
Director, Wholesale Power Marketing

Essential Reliability Services -6/10/2016-

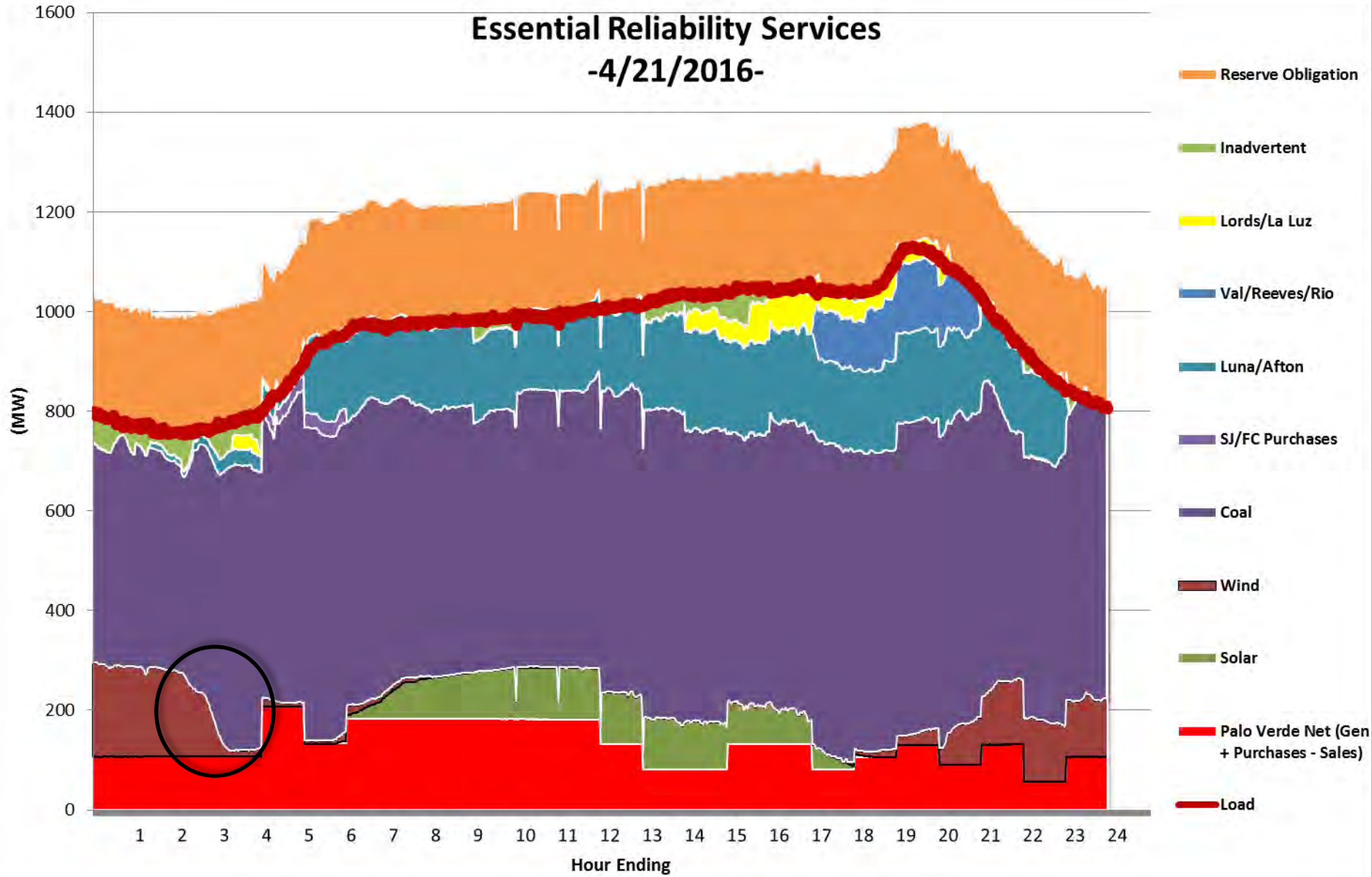
- BAL-001-1 - Real Power Balancing Control Performance
- BAL-002-WECC-2: Contingency Reserves
- BAL-002-1: Disturbance Control Performance Standard (DCS)



Wind Volatility -4/21/2016-



Essential Reliability Services -4/21/2016-



Pat O'Connell

Director, Planning & Resources

HOW RELIABILITY FITS INTO IRP

RESOURCE MIX IMPACTS

- Planning and operations modeling must consider the increasing challenges of providing reliability on the system with an evolving grid.
 - Generating unit retirements;
 - The addition of wind, solar, geothermal, gas-fired plants; and
 - Increasing energy efficiency
- PNM considers the impacts of all these changes and plans a portfolio that maintains reliability over the foreseeable futures.

HOW RELIABILITY FITS INTO IRP

RELIABILITY SERVICES AND PORTFOLIO PLANNING

- PNM will consider how changes to the resource mix will affect reliability during the planning process
- PNM will evaluate scenarios/portfolios against the cost and implications on reliability. Portfolios considered must provide adequate reliability.

ADDITIONAL RESOURCES

WHERE TO GO TO FIND MORE INFORMATION

- **Essential Reliability Services Task Force Measures Framework Report ; NERC**, November 2015.
<http://www.nerc.com/comm/Other/essntlrbltysrvcstskfrcDL/ERSTF%20Framework%20Report%20-%20Final.pdf>
- **Resource Adequacy Requirements: Reliability and Economic Implications**; February 10, 2014; K. Carden, N. Wintermantel, J. Pfeifenberger (Brattle), K. Spees (Brattle), FERC Report (2014)
<http://www.astrape.com/publications/>

MAKE SURE WE HAVE UP TO DATE CONTACT INFORMATION FOR YOU

www.pnm.com/irp for documents

irp@pnm.com for e-mails

Register your email on sign-in sheets for alerts of upcoming meetings and notices that we have posted new information to the website.

Meetings Schedule:

Thursday, August 11, 2016, 10 am – 3 pm

Thursday, Sept. 1, 2016, 10 am – 3 pm

Thank you

