PNM 2020-2040
Integrated Resource Plan

August 25, 2020

Current Events, Commodities Forecast, Load Forecast, Modeling Updates, ELCC Study, Process and Scenario Updates

Agenda

- Welcome and Introductions
- Safety and Ground Rules
- Online Participation Instructions
- Current Events & Updates
- Commodities Forecast
- Energy Efficiency Bundles
- Load Forecast
- Effective Load Carrying Capability
- Candidate Resource Summary
- Scenarios Update

Nick Phillips
Director, Integrated Resource Planning

Mr. Phillips manages the PNM Resource Planning department and is responsible for developing PNM resource plans and the regulatory filings to support those resource plans.

Prior to joining PNM, Mr. Phillips was involved with numerous regulated and competitive electric service issues including resource planning, transmission planning, production cost analysis, electric price forecasting, load forecasting, class cost of service analysis, and rate design.

Mr. Phillips received the Degree of Master of Engineering in Electrical Engineering with a concentration in Electric Power and Energy Systems from Iowa State University of Science and Technology, and the Degree of Master of Science in Computational Finance and Risk Management from the University of Washington Seattle.

Meeting ground rules

01

- Questions and comments are welcome – One Person Speaks at a Time

02

- Reminder; today's presentation is not PNM's plan or a financial forecast, it is an illustration of the IRP process

03

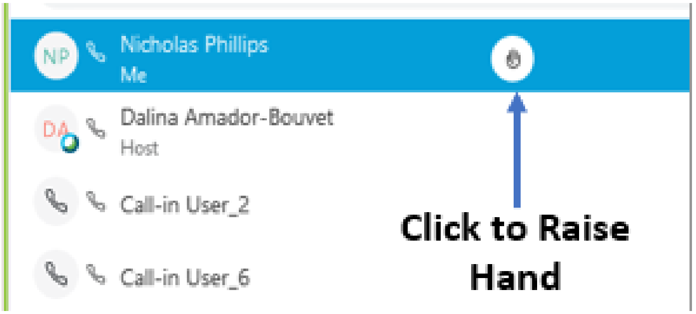
- Please wait for the microphone to raise your question or make your comment so we can ensure you are clearly heard and recorded. ***Only Q&A are transcribed for our filing package***.
- Questions and comments should be respectful of all participants

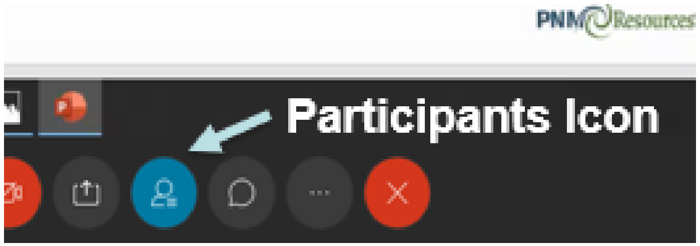
04

- These meetings are about the 2020 IRP, questions and comments should relate to this IRP. Any questions or comments related to other regulator proceedings should be directed towards the specific filing

Online Meeting Protocol

- All participants will be on mute upon entering the meeting, raise your hand to be unmuted or use the chat icon if you have a question.
- Participants asking questions are expected to identify themselves and the company they represent.
- All questions during this meeting will be public.





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).

Energy + Environmental Economics (E3) is assisting PNM for the IRP filing

- **Founded in 1989, E3 is a 70+ person leading energy consultancy with a unique 360-degree view of the industry built on the depth and breadth of their experts, projects, and clients**
- **E3's resource planning experts have led numerous analyses of how renewable energy and greenhouse gas policy goals could impact system operations, transmission, and energy markets**
  - Experience includes studies of deeply decarbonized and highly renewable power systems in California, Hawaii, the Pacific Northwest, the Desert Southwest, New York, New England, South Africa, and other regions

Arne Olson
Senior Partner

Nick Schlag
Director

Dr. Andrew DeBenedictis
Director

Current Events & Updates

Nick Phillips

Director of Integrated Resource Planning

Topics

1. San Juan Replacement Resources (PNM)
2. Palo Verde Leases (PNM)
3. Recent Peak Load Events (PNM)
4. California Blackouts (PNM)

San Juan Replacement Portfolio

San Juan Replacement Update

NMPRC Final Order in Case No 19-00195-UT Approved the “CCAE-1” Replacement Portfolio for Replacement of the San Juan Coal Plant

- 4 Solar-Battery Hybrid Projects
  - 300MW Solar – 150 MW Battery*
  - 50MW Solar – 20 MW Battery
  - 100MW Solar* – 30 MW Battery*
  - 200MW Solar* – 100 MW Battery*
- 24 MW Incremental Demand Response*
- 16 MW Incremental Energy Efficiency*
- Additional reliance on purchases/imports

*Requires additional approvals from PRC

San Juan Replacement Update

Additional Approvals:

- The Order required PNM to negotiate the necessary contracts to be filed with the PRC for review and approval within 60 days of the Final Order being issued.

- The Order also required PNM to file a proposal to develop and implement the 24 MW Demand Response (DR) program included in CCAE 1. The proposal will outline the contours of the DR program, the method of recovery of program costs, and the proceeding in which PNM will request Commission approval.

- PNM is in the process of negotiating the contracts and has issued a DSM RFP with bids due by September 14, 2020 to inform the 60- day filing.

Palo Verde Nuclear Generating Station Leases

Palo Verde Generating Station Leases

- PNM currently leases 114 MW of generating capacity from the Palo Verde nuclear generating station in AZ

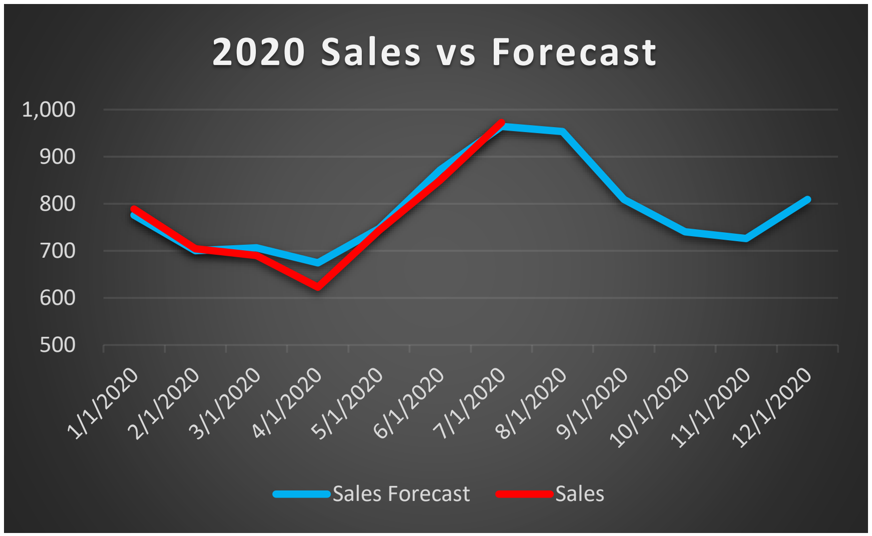
- PNM Also owns 288 MW of capacity at Palo Verde

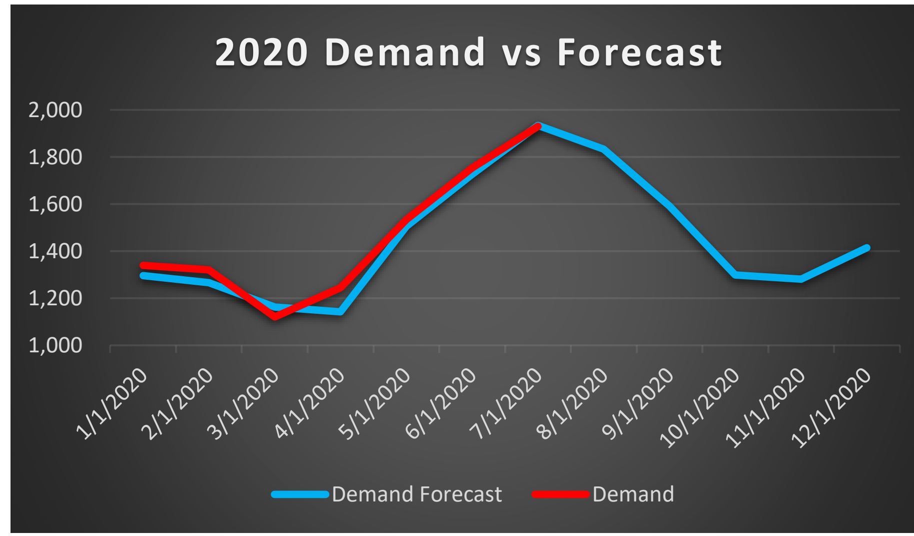
- On June 11, 2020 PNM provided notice to its lessors that it would not exercise an option to purchase the leased capacity when the leases expire.

- On June 25, 2020 PNM issued an all-source RFP to solicit proposals for resources with a Commercial Online Date by June 1, 2023.

PNM 2020 Loads

2020 PNM Load Summary





PNM realized a system peak on 7/10/2020 of 1,935 MW*

- Highest peak demand in 7 years
- On 7/11/2020 (a Saturday) the peak was 1,911 MW*
- Forecast is weather normalized

*data is still preliminary and are subject to minor changes during a reconciliation process

California Blackouts

2020 California Blackouts

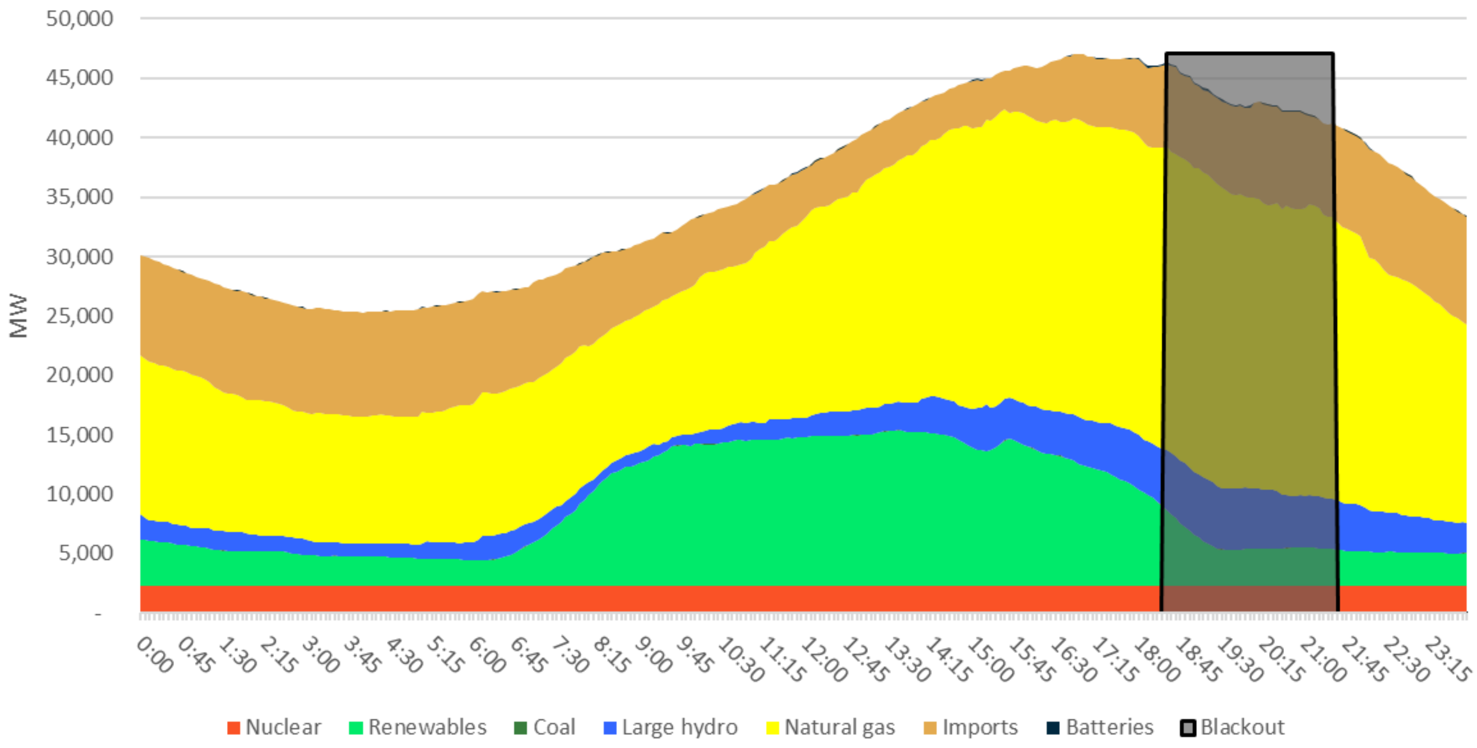
California took emergency action on August 14th and 15th shedding load due to a lack of supply for the first time since the 2001 Western Energy Crisis (Enron).

Rolling blackouts started on both days around 6:30 pm PT and lasted 2-3 hours.

Exact cause is still being studied, but preliminary data suggests a combination of generator outages, lower than expected renewable output, and lack of ability to purchase/import power from neighbors due to the widespread heatwave in the west were to blame.

2020 California Blackouts

Sources of Electricity in CAISO Friday August 14,2020
Rolling Blackouts begin at approx. 6:30 pm PT and end at 9:00pm PT



Source: CAISO

2020 California Blackouts

- CAISO has reported the problem was years in the making, multiple warnings were issued to regulators years in advance regarding summer net peak in 2020-2022 (4.7 GW short)
  - CPUC approved 3.3 GW for 2021

- Day-Ahead markets neared $1,000/MWh for 8/14/2020

- (8/14/2020) At 2:56 p.m. PT, a 475 MW Gas Generator tripped

- Additional reserves were called but there wasn't enough (9 GW of gas capacity retired in last 5 years)

- The only recourse left was to import power from neighboring states. Real-Time markets became illiquid; neighboring utilities would not sell to CAISO – they kept any extra supply in case they needed it as the heat wave intensified

2020 California Blackouts

What about the EIM?

- Self-Sufficiency requirement: In order to import power through the Energy Imbalance Market, which schedules deliveries across regions in real-time, CAISO BA had to pass what's called a flexible ramping sufficiency test -- a way of proving that it isn't overly dependent on imports to meet demand.

- The CAISO failed the ramping test at 15-minute intervals from 5:30 p.m. to 7 p.m. That reduced imports by about 446 megawatts during the peak demand hour

Source: Bloomberg

2020 California Blackouts

Blackouts again on Saturday 8/15/2020:

- Demand was lower than Friday
- Shortly after 5:00 p.m. PT a sudden change in weather caused a drop of approximately 1,000 MW in wind power
- An hour later a natural gas unit tripped
- Once again, unable to import in Real-Time market to cover the shortfall.

2020 California Blackouts

“There are several things at play,” said Stephen Berberich, president of the California Independent System Operator [CAISO], which runs the state grid.

“The first is we do have less capacity here in California. A number of units have been retired since the 2006 heat wave, and there’s also less resources across the West because many of the large units in the West have retired or are retiring, as people move off of coal.”

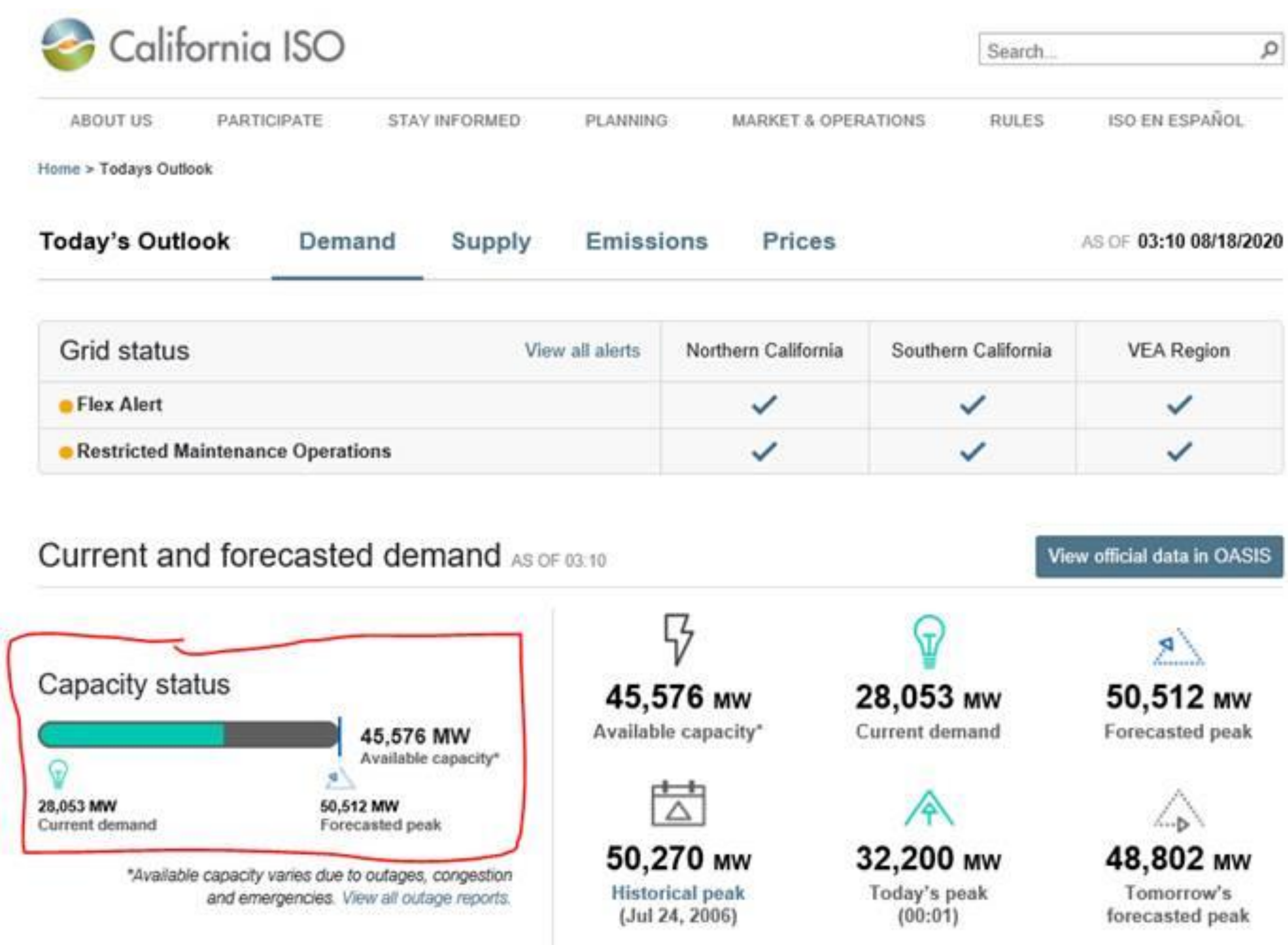
That means California has less ability to import electricity to cover surges in demand.

“So what we’re seeing is less capacity in California, but more importantly, less capacity across the rest of the region,” Mr. Berberich said.

Mr. Berberich said the state needs to look at how it backfills retired coal and natural-gas units, but stressed that “renewables have not caused this issue.”

“This is a resource issue, not a renewables issue, and I think we need to be more thoughtful about what the grid looks like now,” he said.

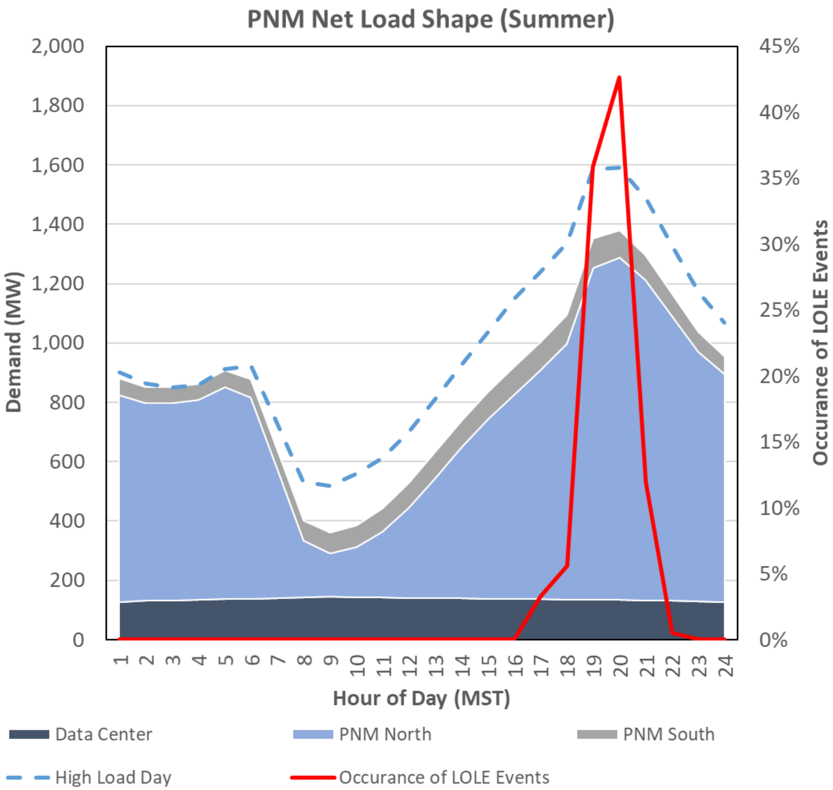
CAISO Reliance on Imports

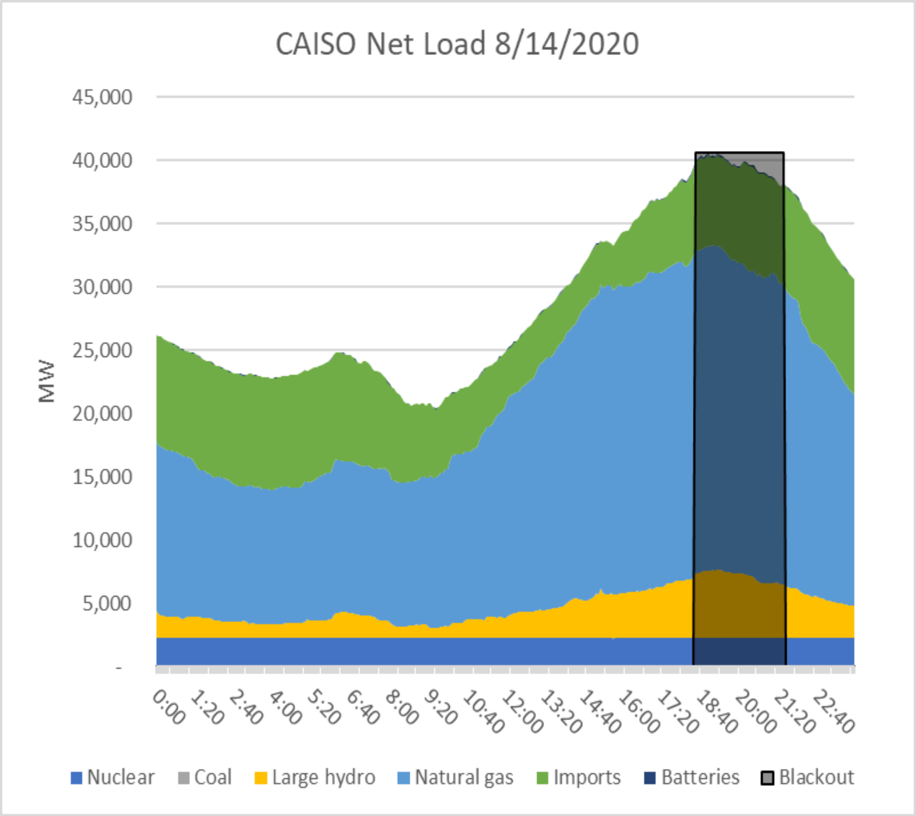


This shows that on 8/18/2020 the CAISO would require at least 11% of the expected peak load to be covered by short-term imports.

CAISO warned of potential for load shed but load was served without interruption.

2020 California Blackouts: What Can We Learn?

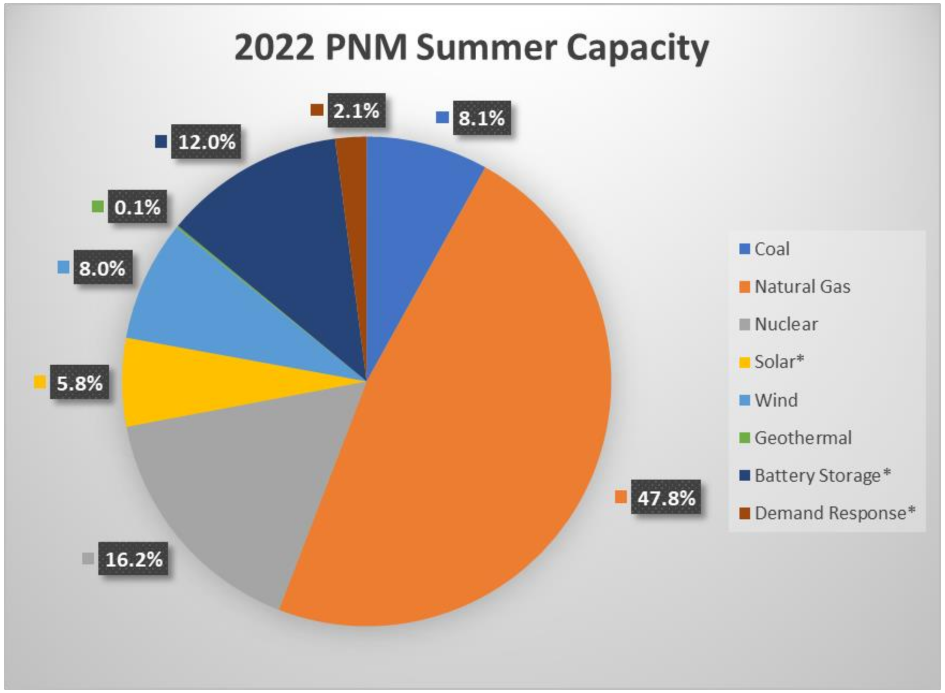


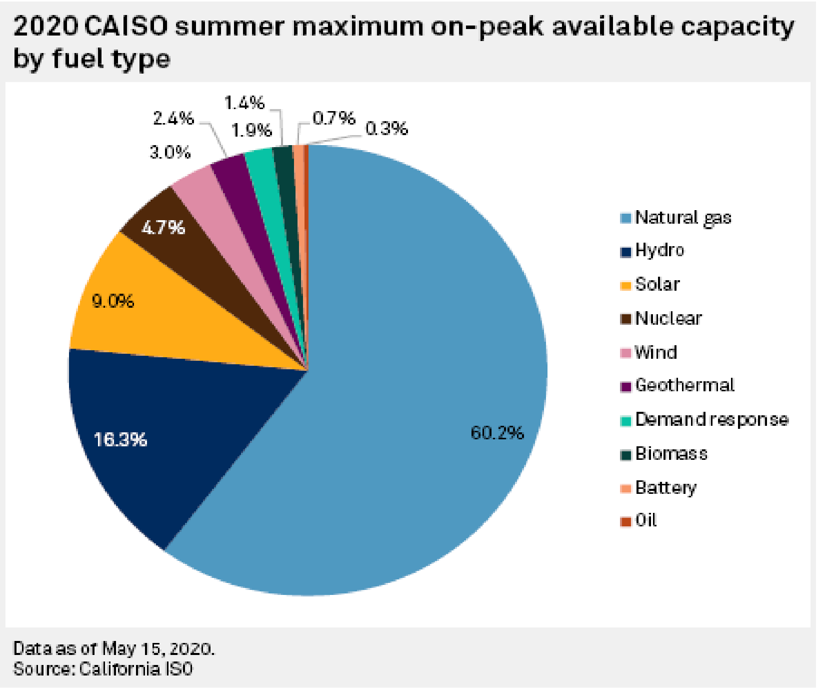


Net Peak Load becomes the highest risk – EV & Building electrification can lead to high net peaks in winter when solar production is reduced.

Note: PNM Figure represents 2023 expectation of LOLE risk – see ELCC section of this presentation

2020 California Blackouts: What Can We Learn?





Both CAISO and PNM still provide most capacity through non-renewable sources. During the transition to zero carbon, properly replacing fossil-fired generation with reliable capacity (i.e. sufficient effective load carrying capability) within the BA is critical to maintaining supply to ensure reliable service, especially when imports are limited.

2020 California Blackouts: What Can We Learn?

How does this effect PNM in the short-term?

- While the PNM system was tested, PNM was able to meet its customers demands
- The western bilateral markets were illiquid to purchase real-time power.

PNM could not rely on any assistance from spot market resources.

2020 California Blackouts: What Can We Learn?

How does this effect PNM in the long-term?

- As more fossil plants are retired and replaced with renewable resources and storage, the historic conditions of excess energy to be shared across the west will evaporate further.
- Reliability criterion will need to be re-examined to ensure reliable service.

2020 California Blackouts: Key Takeaways

1. This was not a renewables problem, but a resource adequacy problem.

2. PNM and New Mexico can learn from this event and prevent load shedding in New Mexico as it transitions to 80% Renewable and 100% Carbon Free by 2040

3. Proactive steps to provide sufficient resource adequacy (type and amount) as well as strengthening the transmission and distribution systems are required.

4. Ensuring reliability is a critical element of prudent planning.

IRP Inputs and Modeling Updates

IRP Improvements & Updates

While awaiting a Final Order in Case No 19-00195-UT, PNM continued to work on its IRP.

- Energy Efficiency Bundles
- Transmission Modeling
- Technology Review & Candidate Resources
- Existing Demand Response Resource Modeling

System Topology and Transmission

IRP Improvements & Updates

Topology with Market Modeling and Transmission Expansion is preliminary and still in testing stages

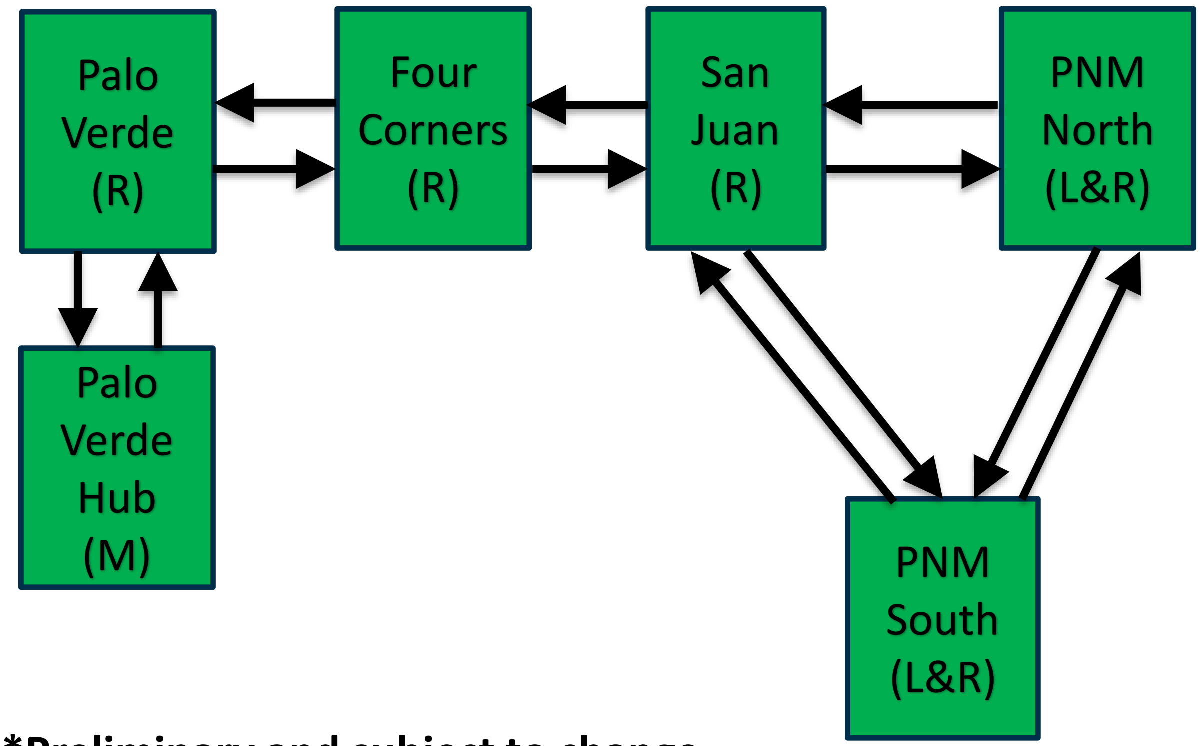
- The next few slides present the basic set up and idea.

- Transmission projects and resource zones based on the September 6, 2019 IRP presentation.

- Initial tests seem promising.

- PNM will provide an update on this progress at the next meeting on September 8th 2020.

PNM Topology

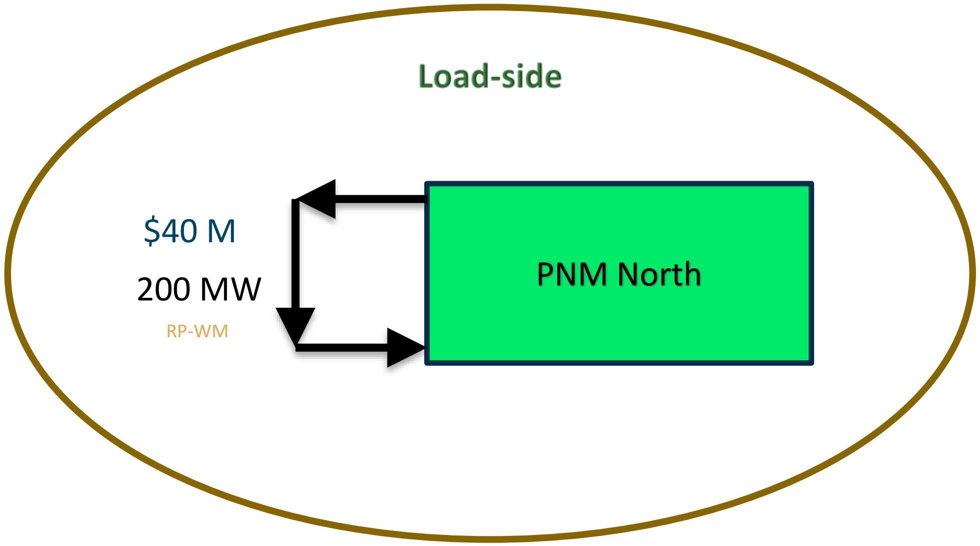


L : Loads
R : Resources
M : Energy Markets

***Preliminary and subject to change**

Transmission and Resource Zones

- Assumes PNM Needs to build
Rio Puerco-Pajarito $70M Upgrade
to allow any zone deliverability
- All costs in blue are incremental



***Preliminary and subject to change**

Transmission and Resource Zones

Resources not limited by geographies will be allowed in any zone

New Northern Resources

(Solar, PSH, CAES & GS)

Renewable resources in different zones will have geographically differentiated production profiles and costs

$100 M 600 MW
Ojo-Norton

New Western Resources

(Mainly Solar)

$170 M
600 MW
McKinley-RP

PNM North (L&R)

$360 M
800 MW
WS-Pajarito

New Eastern Resources

(Mainly Wind)

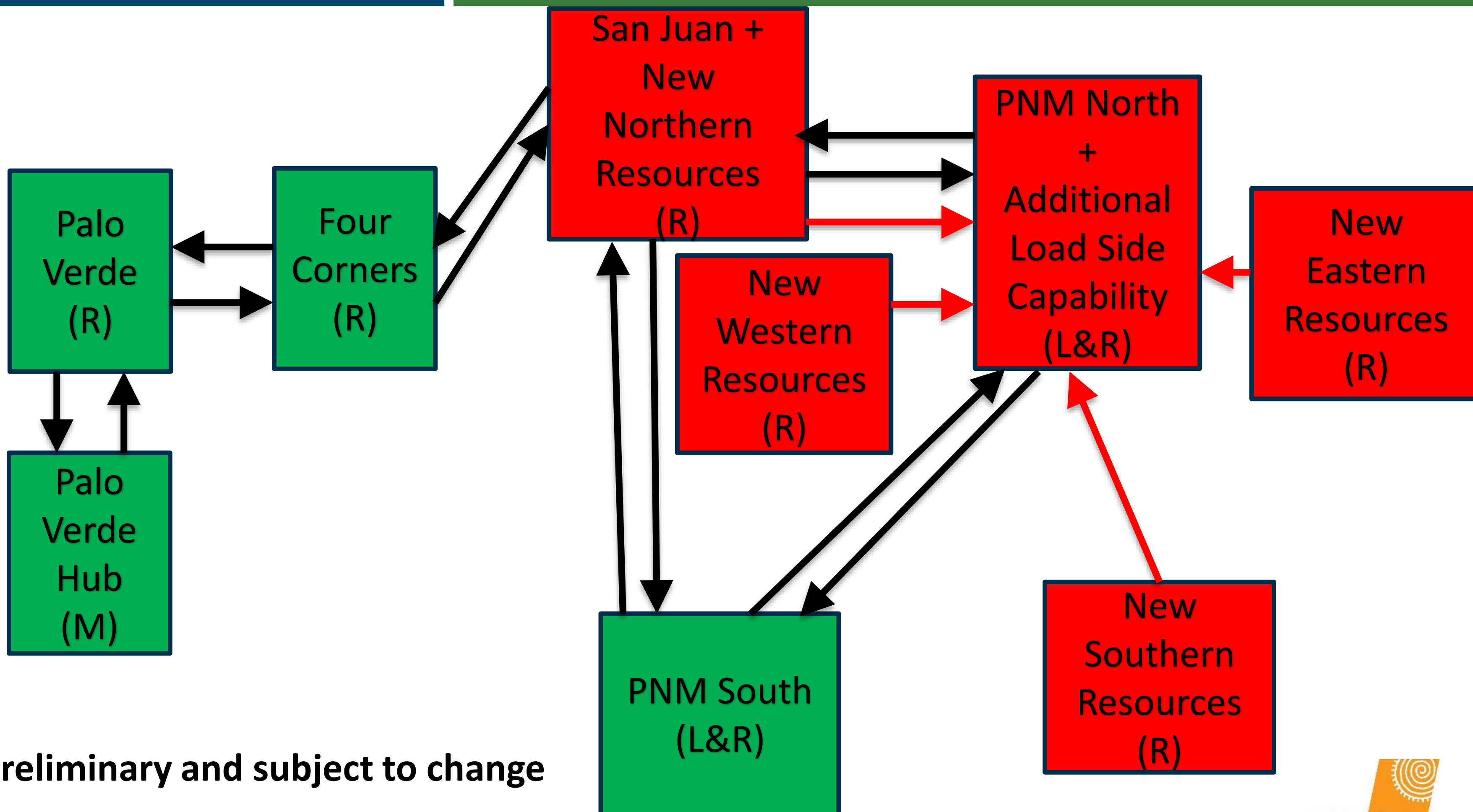
$25 M 100 MW
Belen-Person

New Southern Resources

(Mainly Solar)

***Preliminary and subject to change**

PNM Topology Combined with Resource Zones



*Preliminary and subject to change

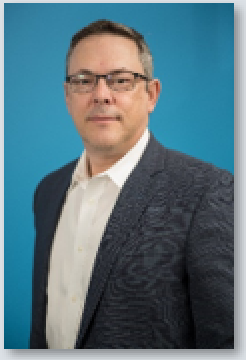
Red denotes potential choices for expansion of transmission

Commodities Forecast
PACE Global

Power Market Forecasts

Public Service Company of New Mexico
August 25, 2020

Background



Mr. Despard has 30+ years of power industry experience. He is a Consulting Director and Principal at Siemens Power Technologies International ("PTI"), which is Siemens Industry's economic and technical consulting division. In this role, Mr. Despard and his staff provide electric power clients with the following services:

- ✓ Integrated Planning - Optimization of generation, transmission and distribution
- ✓ Integrated Resource Planning ("IRP") - Meeting energy and capacity requirements
- ✓ Price Forecasting - Power (energy and capacity), fuels, REC's and carbon (CO_2)
- ✓ Asset Valuations - Storage and fossil-generating assets
- ✓ Transmission Congestion Analysis
- ✓ Portfolio Optimization and Risk Assessments
- ✓ Commodity Risk Management
- ✓ Commercial strategies

Career Highlights

Mr. Krall is a Consulting Manager at Siemens PTI, Energy Business Advisory unit. In this role Mr. Krall is primarily involved in the development of Siemens PTI's National Forecast Model and Energy Markets Modeling.

Mr. Krall's is an expert in U.S. wholesale electricity markets, and the analysis of those markets using advanced quantitative methods. Mr. Krall has substantial experience with short- and long-term electricity market forecasts. He has expertise in developing electricity market models using production cost tools, linear optimization, mixed-integer optimization, and other analytic methods. Mr. Krall is proficient in *AURORAxmp*, Python, SQL, GAMS, Fortran, PROMOD, among other programming languages and modeling tools.

Contents

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Introduction

- Siemens Energy Business Advisory developed commodity price forecasts for PNM's analysis and planning needs.
- Siemens used its comprehensive power market modeling tools to generate these forecasts under Baseline, High, and Low scenarios to reflect uncertainty of market conditions over the long-term planning horizon (2020-2040).

Scenario	High Level Description
Baseline	Reference view based on market forwards early and longer term by fundamentals accounting for expected policy
High	High expected energy pricing based on high natural gas and carbon pricing throughout the forecast period
Low	Low expected energy pricing based on low natural gas and carbon pricing throughout the forecast period

- This presentation summarizes the methodology, assumptions, and forecasts.

Tools and Methodology

Gas and Power Integrated Modeling Approach

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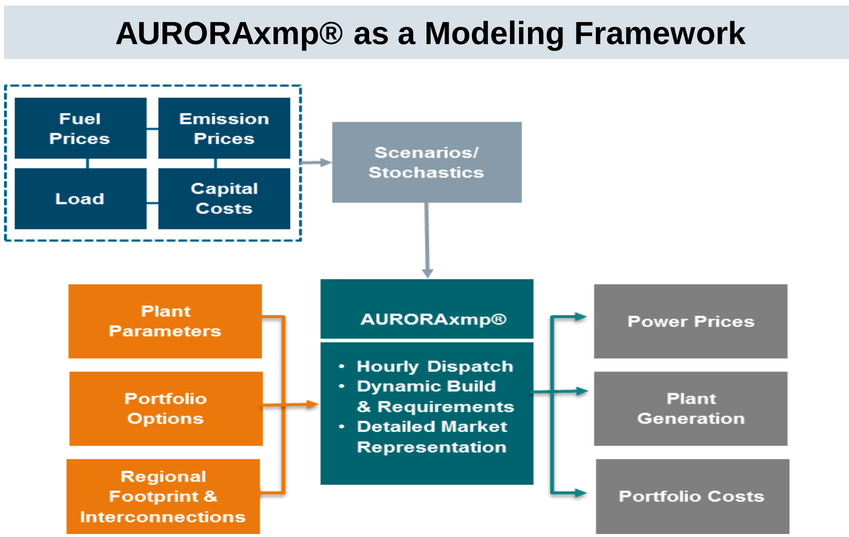

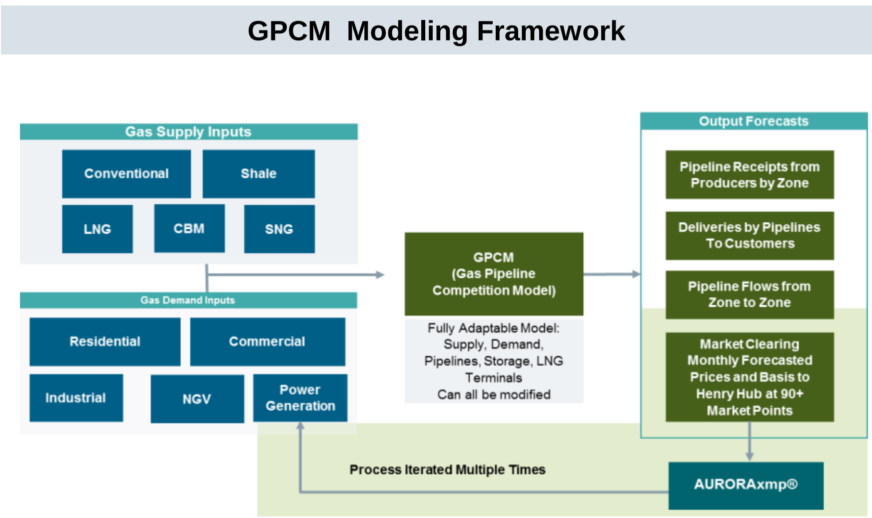

- Power modeling used AURORAxmp®, an hourly dispatch model, to simulate the economic dispatch of power plants within WECC power markets for the forecast horizon. AURORAxmp® assesses the economics of existing and future generation technologies for future builds and retirements in order to maintain minimum reserve margins and meet RPS and carbon free generation targets.
- Natural gas price inputs are produced using GPCM, a dynamic model that incorporates natural gas supply, demand, and infrastructure inputs to solve for expected prices and flows throughout North America.
- Iterations are performed between the two models to ensure gas prices and power sector natural gas demand is in balance.

Base Case

Overview of Base Case Assumptions

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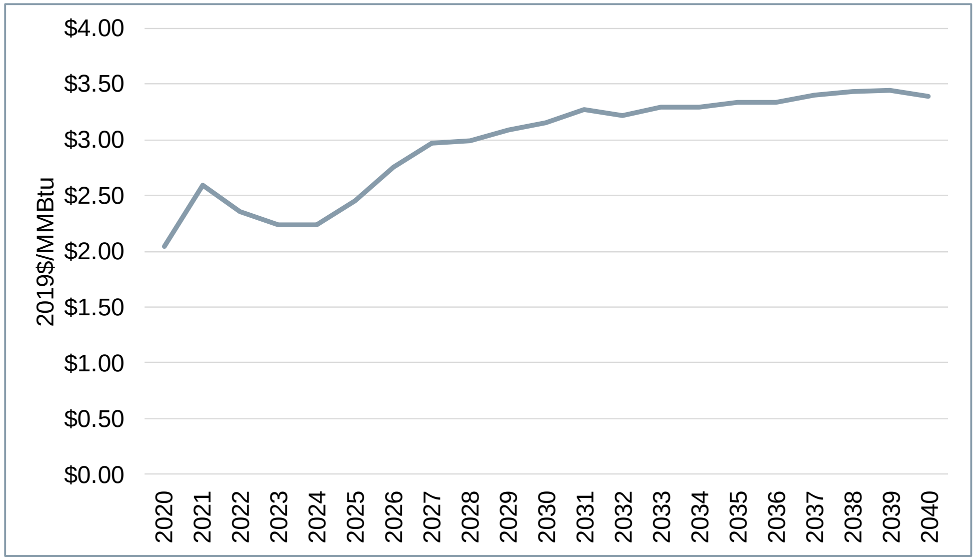
The Baseline Scenario

Key assumptions driving the Baseline scenario are:

- In the short-term, the Baseline assumes a business-as-usual perspective for all market drivers, consistent with market forwards and trends;
- Near-term power prices are projected to be low, driven by low natural gas prices and COVID-19 effects on demand;
- Natural gas prices increase somewhat from current low levels as demand rises faster than production in Winter 2020-21; and
- To reflect uncertainty around a future national carbon policy, Siemens assumes a U.S.-wide price on carbon starting in 2025 increasing through 2040.

Baseline Natural Gas Prices – Henry Hub

Baseline Henry Hub Natural Gas Price Forecast



*Base case prices were developed using OTC Global Holdings futures for Henry Hub as of May 2020

Near-Term – Reflects recent futures with an average price of ~$2.30/MMBtu through 2022. Markets will yo-yo to adapt to simultaneous supply and demand shocks.

Mid-Term (2025-30) – Gulf Coast prices are expected to rise as new demand (LNG exports, Mexico exports) continues to turn the region into a premium market.

Long-Term – Annual average prices (in real terms) expected to remain below $3.50/MMBtu, the price ceiling at which most conventional basins become economic.

Current Market Dynamics Impacting Southwest Gas Markets

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US Gas Market Drivers:

Overall, the US gas market in 2020 continues to adjust to several ongoing shocks and drivers:

- COVID-19, which is depressing demand, putting downward pressure on gas prices, and creating uncertainty in the future;
- Oil price crash, which has curtailed a significant level of associated gas production in the Permian Basin;
- Weak global LNG markets, which is further depressing demand and prices in the Gulf Coast and at the Henry Hub; and
- Expectations, which show in the Aug 2020 futures an increase in Winter 20/21 gas prices as demand rises faster than production can rise.

Permian Basin Drivers:

- 10 Bcf/d of pipeline takeaway projects are on hold until pricing fundamentals improve or they are delayed due to litigation;
- US associated gas production in 2020 is down 4 Bcf/d from last year's outlook and could decline another 4 Bcf/d by the end of this year;
- Total Permian Basin production is down 10% in Aug 2020 from the peak in Mar 20, just as the price of oil fell to $0 and below; and
- To the north, Rockies gas production is on a managed decline, boxed in by cheap production to the north (Canada), east (Marcellus), and south (Permian), but also declining as long-term anchor shipper contracts expire.

Waha Hub to Market - New Pipeline Projects:
Development Status as of August 2020

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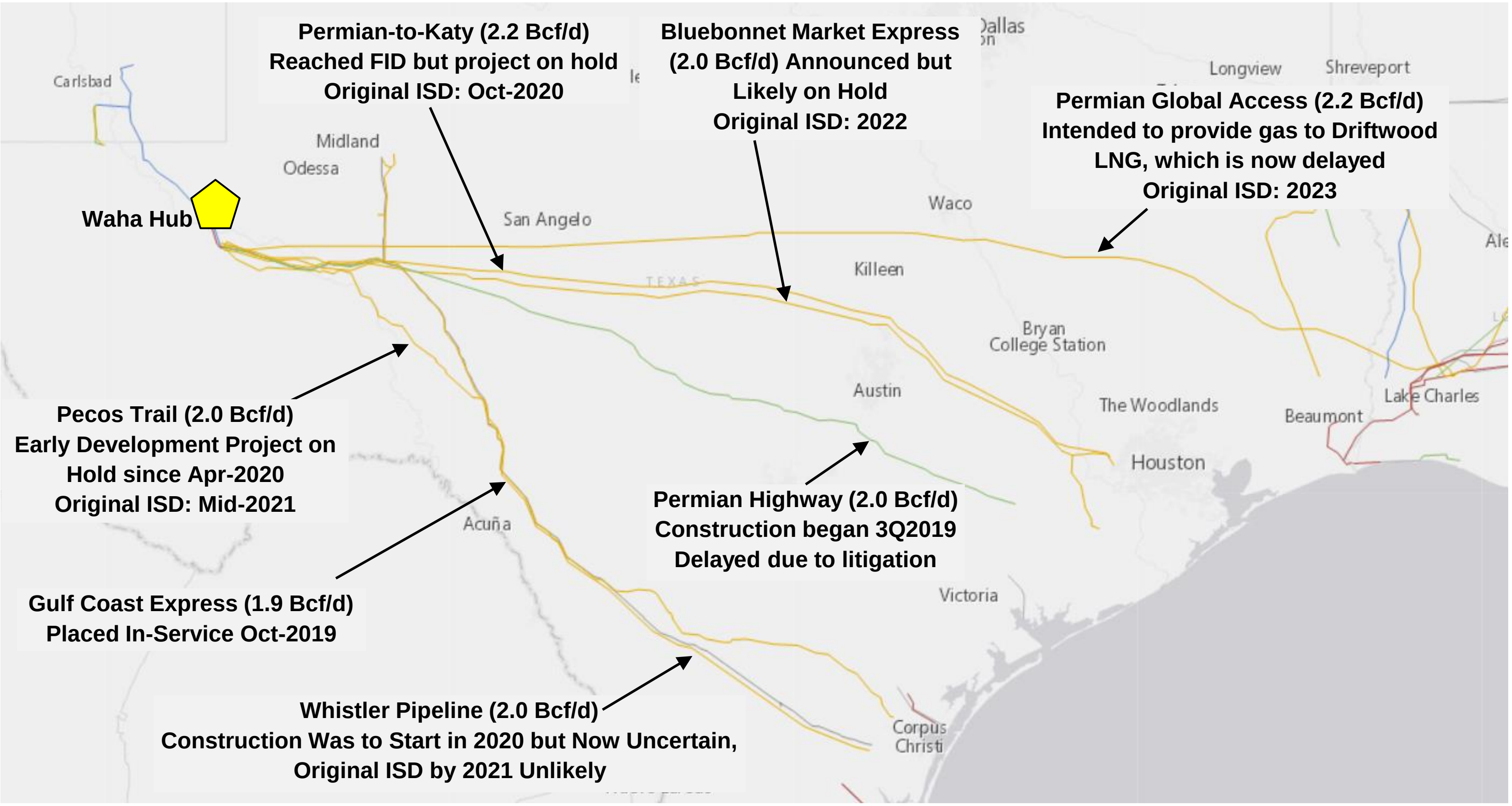
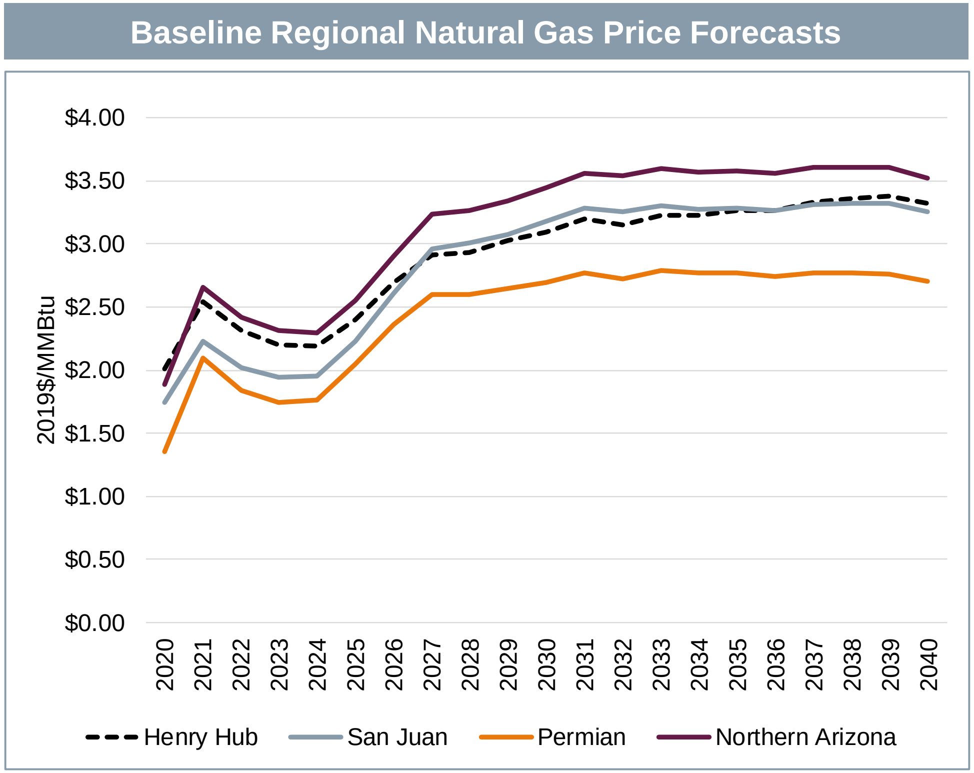


Baseline Natural Gas Prices – Key Southwest Hubs



Permian

Permian production has declined with the drop in oil prices, which curtailed associated gas production. But overall Permian production economics remain competitive even with low Henry Hub prices. Export capacity out of this region is now sufficient, with many pipeline projects on hold as developers await an improvement in economics. Permian (Waha Hub) pricing is expected to maintain a strongly negative basis to the Henry Hub over the planning horizon.

San Juan

This is a longstanding conventional production region in northwest New Mexico overlapping southern CO, but production has fallen significantly in recent years due to displacement from the Permian Basin. It is expected to remain a secondary source of gas for the Southwest, but a higher-cost source than the Permian.

Northern Arizona

This region shows an early negative basis to Henry Hub in 2020, but the longer term price outlook begins to exceed the Henry Hub due to strong demand in Arizona, Southern California, and increasingly from exports to Mexico.

Baseline Carbon Prices – California and U.S.

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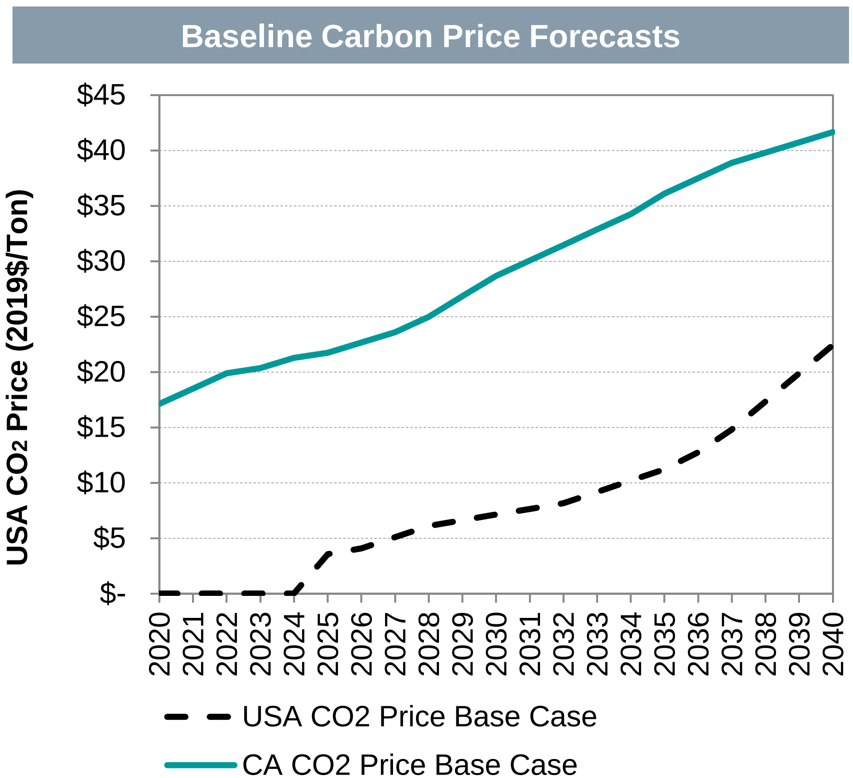


Note: California carbon allowance pricing is presented here in terms of short tons for comparison purposes, but is traded as units of metric tonnes.

U.S.

- **Near Term** – No national carbon price
- **Mid-Term** – national price on carbon starting in 2025 representing expectation of additional measures
- **Long-Term** – CO_2 pricing increases reflecting expectation of eventual restrictions

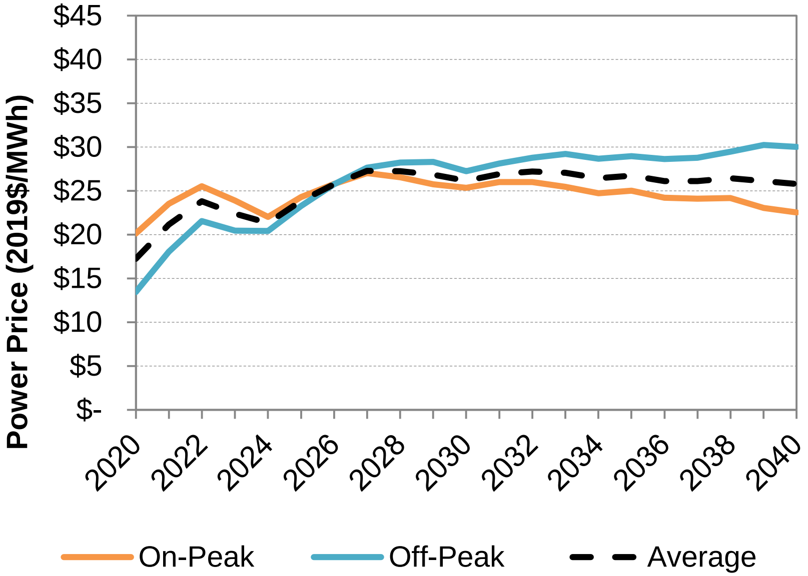
California

- **Near-to-Mid Term** – Prices are expected to increase due to emission reduction targets
- **Long-Term** – Assumes that the program is extended beyond 2030 to meet long-term emission reduction goals

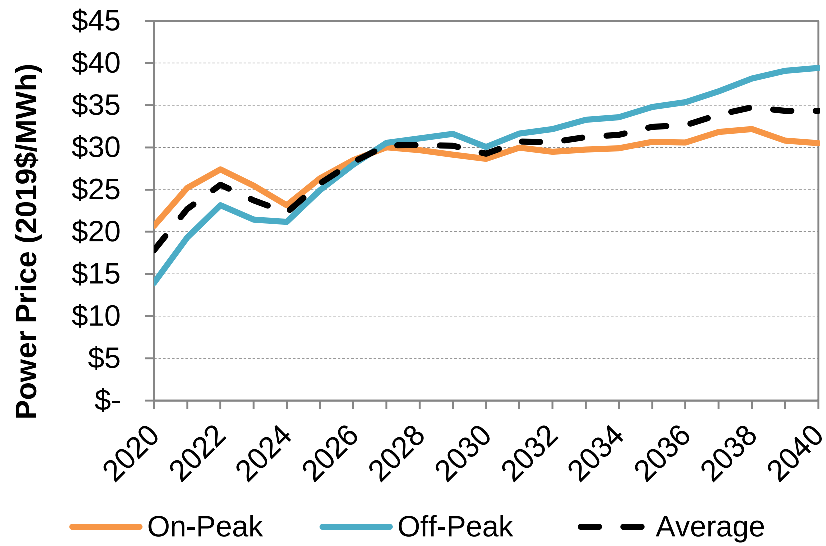
Baseline Zonal Power Prices – Annual

- **Near Term** – Low power prices reflecting low natural gas prices and COVID-19 effects on electricity demand.
- **Mid-Term** – On-peak energy prices decline driven by increase in solar capacity, reducing prices in many hours of the peak period.
- **Long-Term** – On-peak prices fall below average prices, driven by increased solar.

Four Corners Annual Pricing



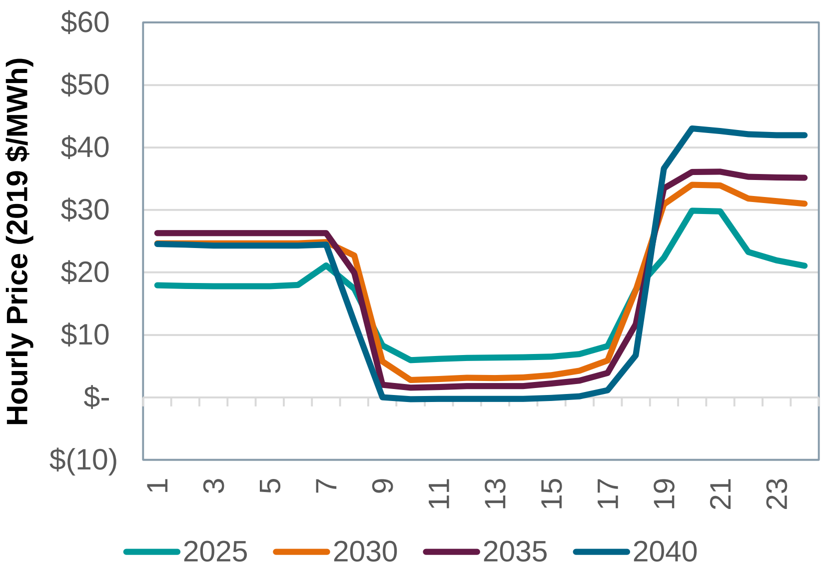
Palo Verde Annual Pricing



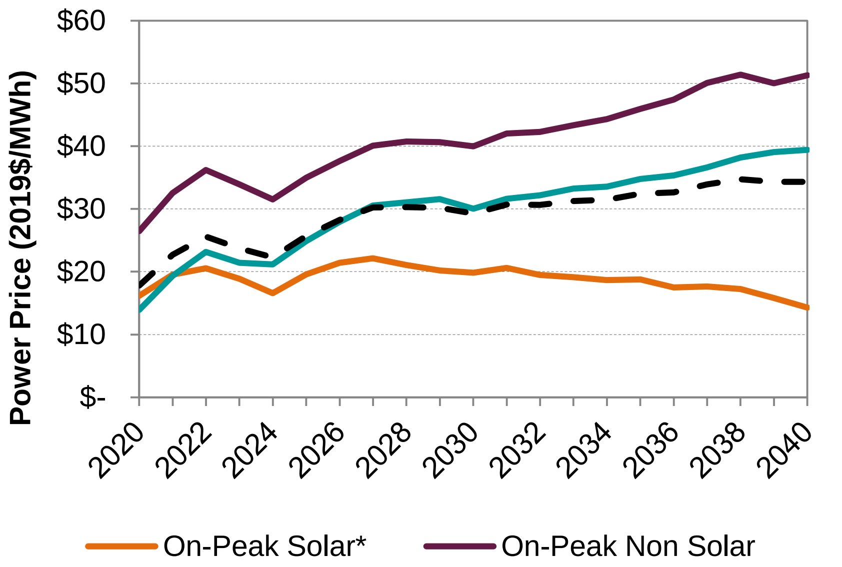
Increased Solar Penetration and the "Duck Curve"

- With growth in solar generation expected to exceed electricity demand growth, duck curve effects are projected to increase.
- Peak solar hours, from 8 A.M. to 5 P.M., will experience price drop while the balance of peak power hours are expected to see higher prices.
- This trend is projected to increase over the forecast horizon, creating incentives for storage resources that can arbitrage price differences.

Palo Verde Average Hourly Pricing (April)



Palo Verde Annual Pricing w/ On-Peak Solar



*On-peak solar defined as the hours of 8 A.M. to 5 P.M.

Base Case Pricing and Market Fundamentals Summary

- Under the Base Case, new builds in the region are largely solar, wind, fast ramping gas units and battery storage. Battery storage capacity additions help to manage increasing amounts of non-dispatchable renewable resources in the region;
- Palo Verde is priced at a premium to Four Corners throughout the forecast horizon; and
- On-peak prices are driven lower by renewables additions, particularly solar, and fall below average prices by the late 2020s.

High and Low Cases

Natural Gas Price Scenarios – Henry Hub

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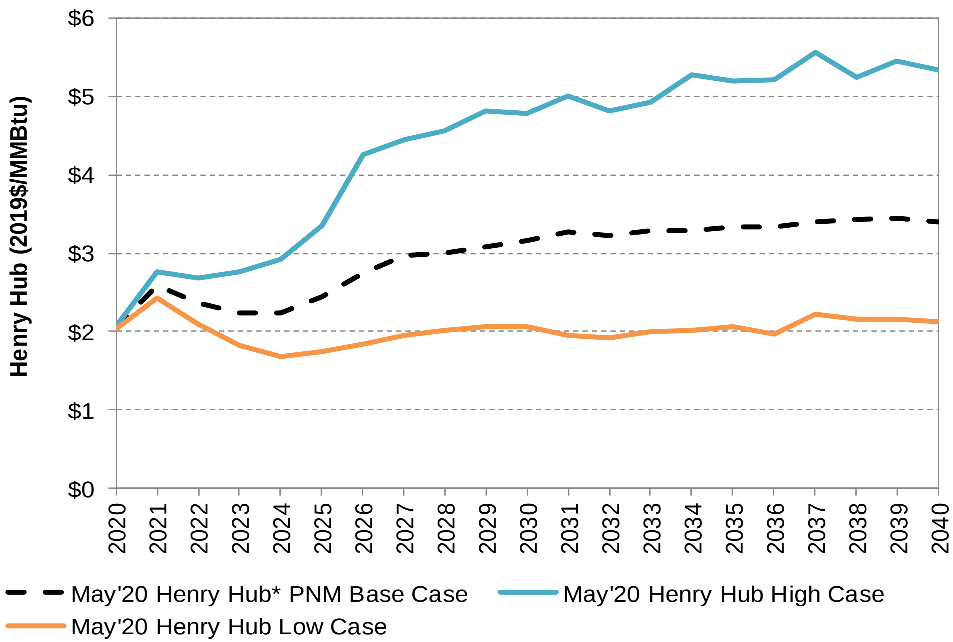
HH Natural Gas Price Forecast Scenarios



Henry Hub Low and High Cases

Low Case – The Low Case reflects a sensitivity case with increased amounts of low-cost gas resources and relatively lower demand.

High Case – The High Case reflects a sensitivity case with restricted production, and higher demand.

Carbon Price Scenarios

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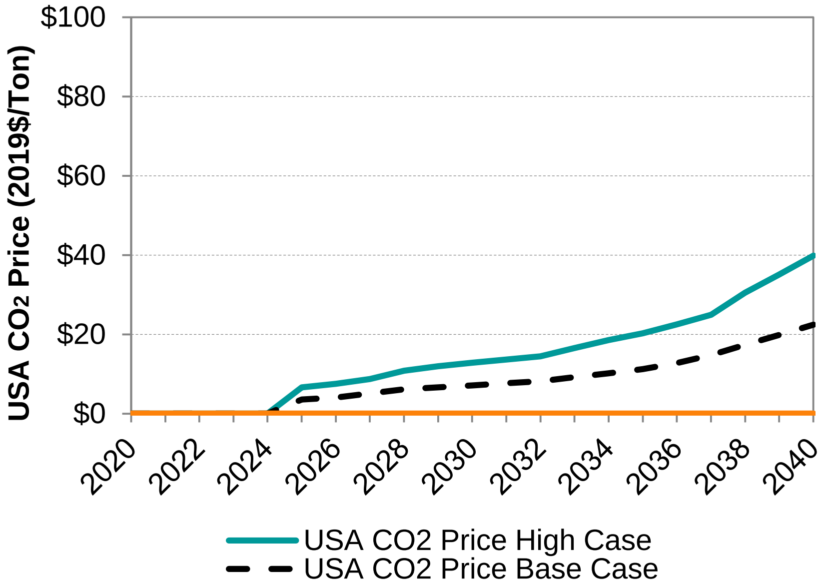
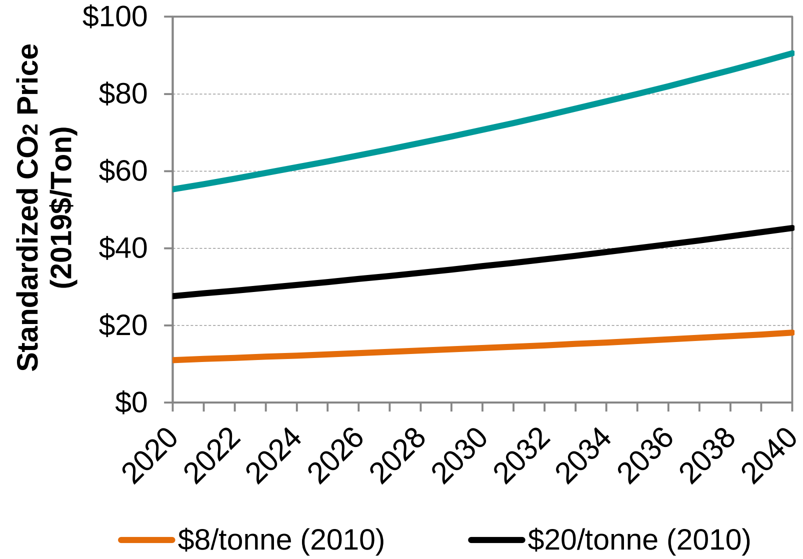
- Range of carbon prices reflects uncertain outlook for carbon policy and resulting pricing in western states. The High Case nears $40/ton by the end of the forecast horizon while the Low Case remains at $0 in all years.

U.S. Carbon Price Scenarios



IRP Rule Standardized CO_2 Prices

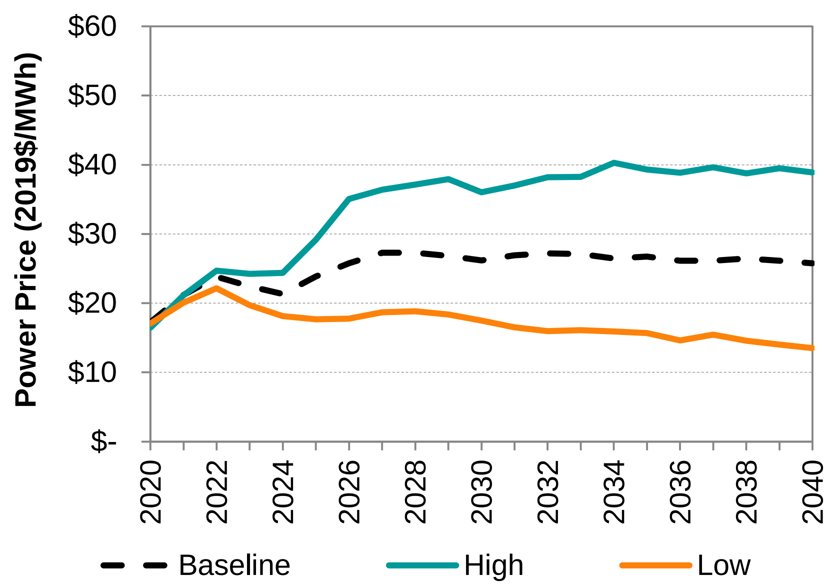


Notes: Standardized prices assumed to escalate at 2.5% per year beginning from 2010. In this figure, standardized prices are converted to $/short ton for comparison purposes.

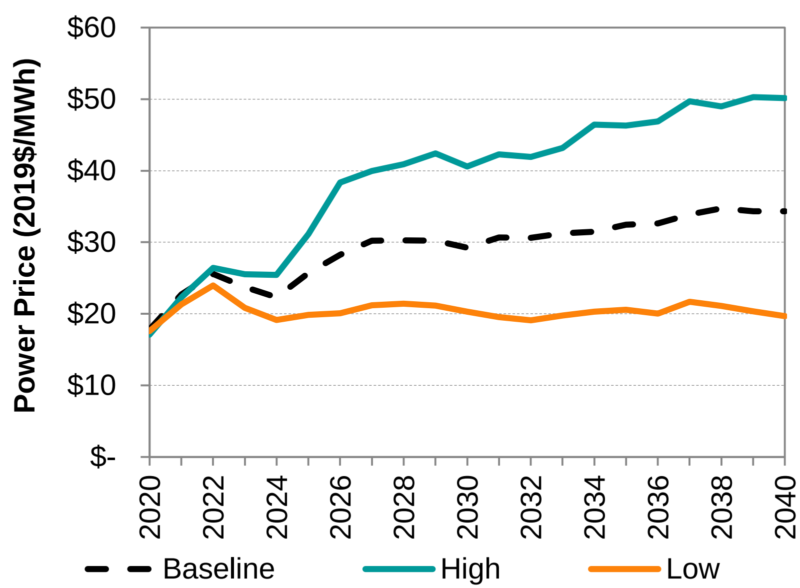
Zonal Power Price Scenarios – Four Corners and Palo Verde

- Higher energy pricing in the High Case is driven by higher natural gas prices throughout the forecast, and higher CO_2 prices later in the horizon.
- Lower energy pricing in the Low Case is driven largely by lower natural gas prices in that scenario, as well as the absence of a long-term CO_2 price.

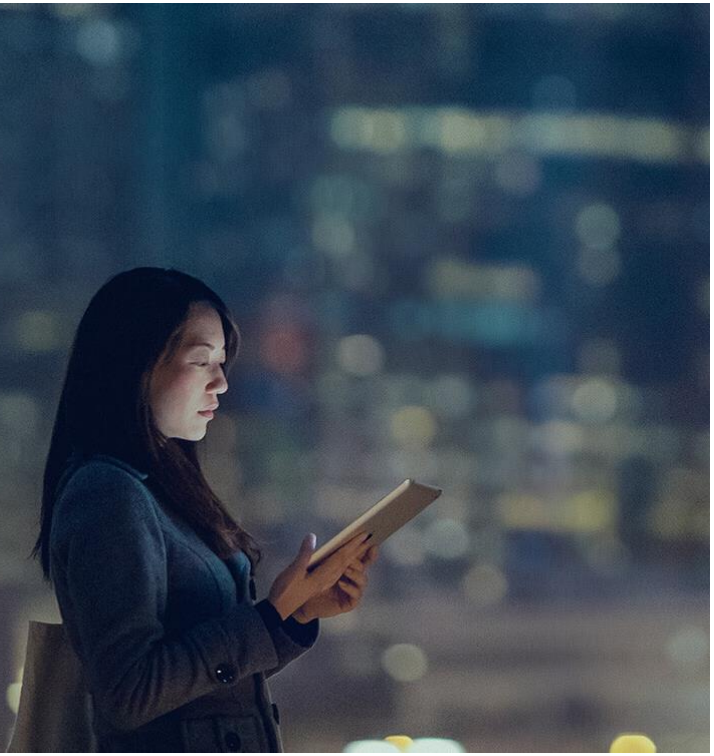
Four Corners



Palo Verde



Contact



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Energy Efficiency Bundles

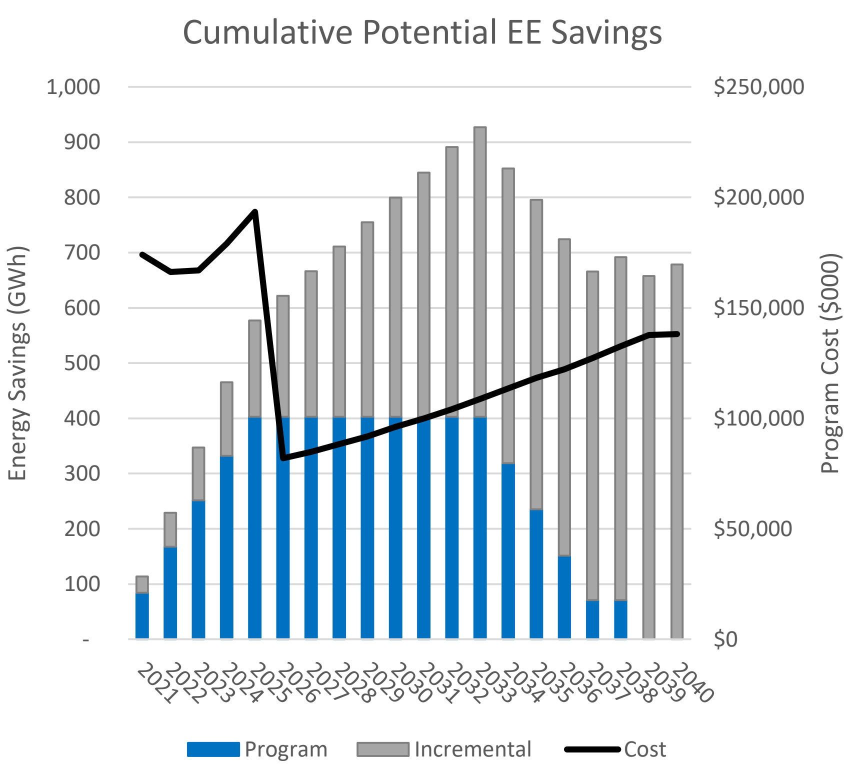
Energy Efficiency Bundles

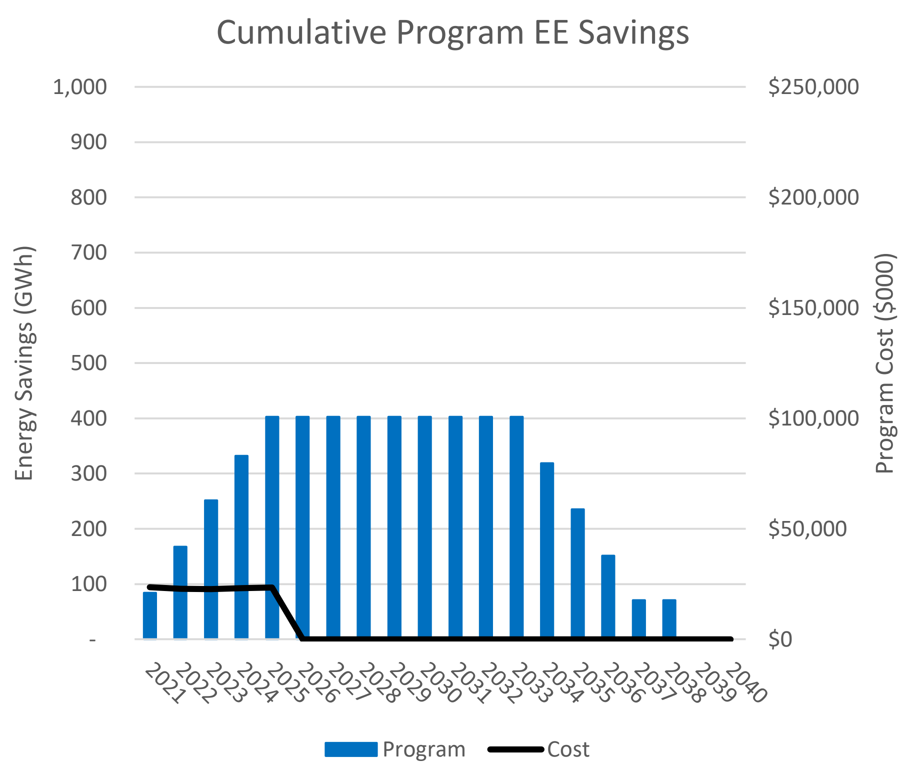
- Allows Energy Efficiency to be considered equivalently against supply side resources. This is the first step towards moving incremental energy efficiency to the supply side. PNM will continue to evaluate and refine this approach in future IRPs.

- Statutory requirements to meet the EUEA from 2021-2025 will be included in all simulations. Will also help to analyze 16MW included SJGS replacement portfolio (CCAE-1).

- Incremental Energy Efficiency beyond statutory requirements will be added to portfolio based on cost-effectiveness rather than assuming extensions of statutory requirements.

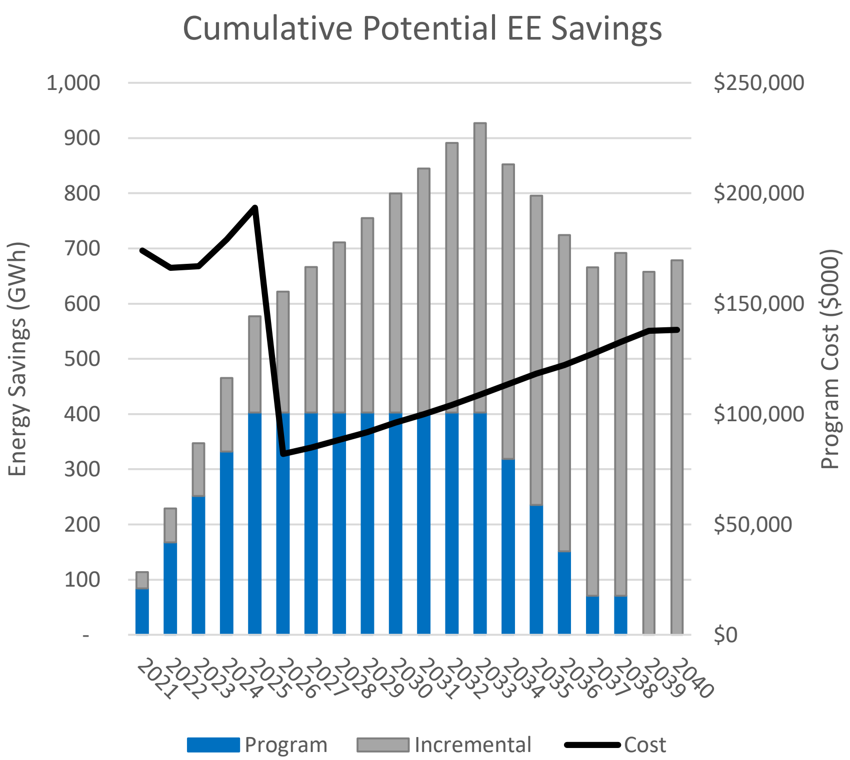
Energy Efficiency Bundles

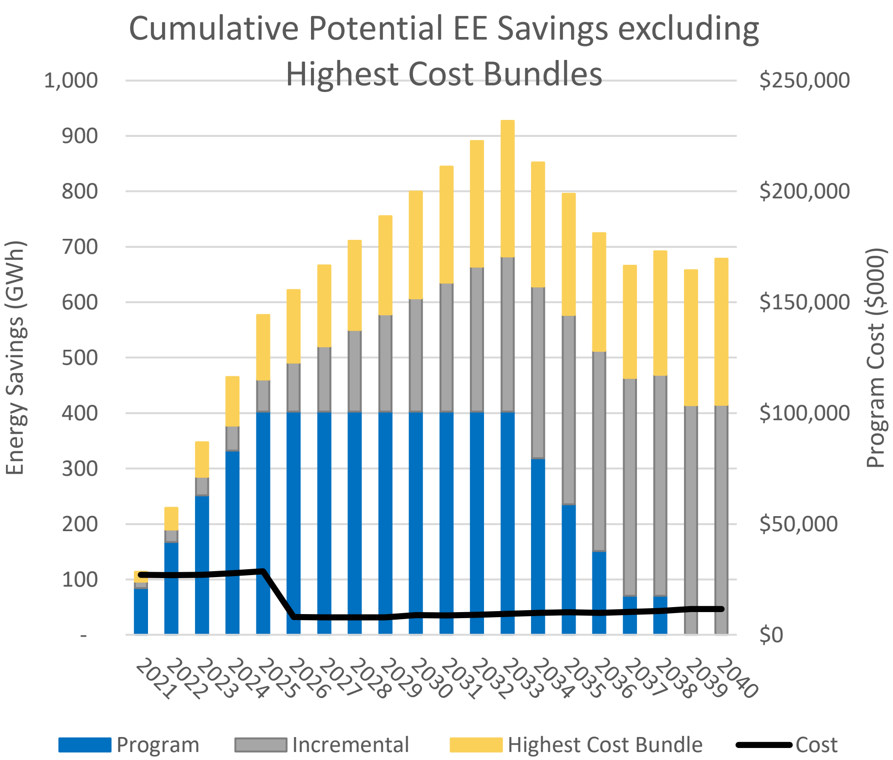




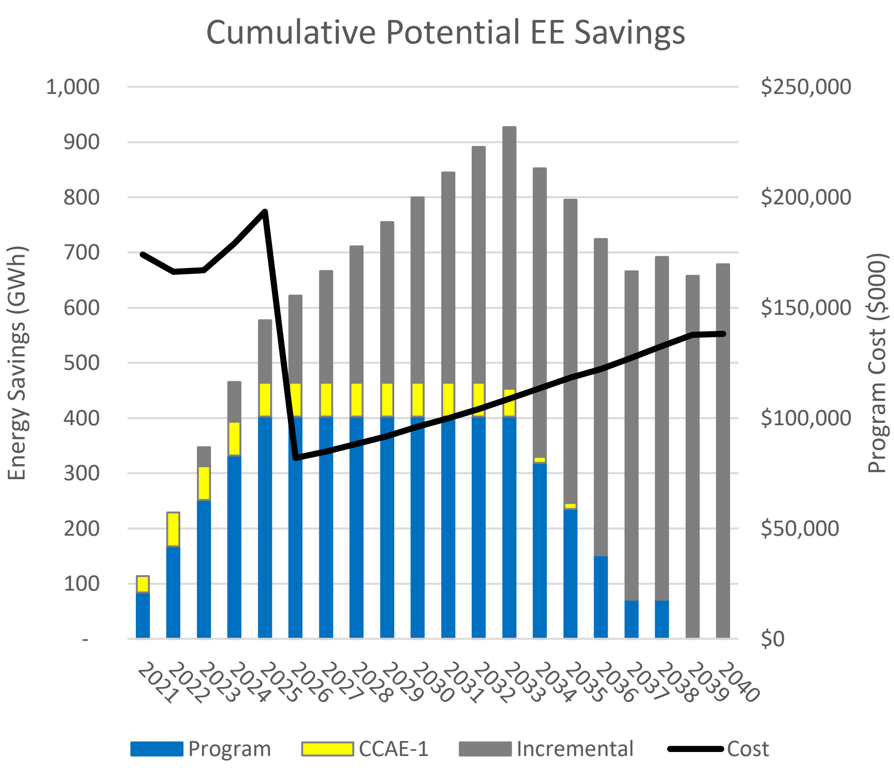
The difference between the two plots (the grey bars) becomes a dynamic economic choice rather than performing a separate forecast that is input statically

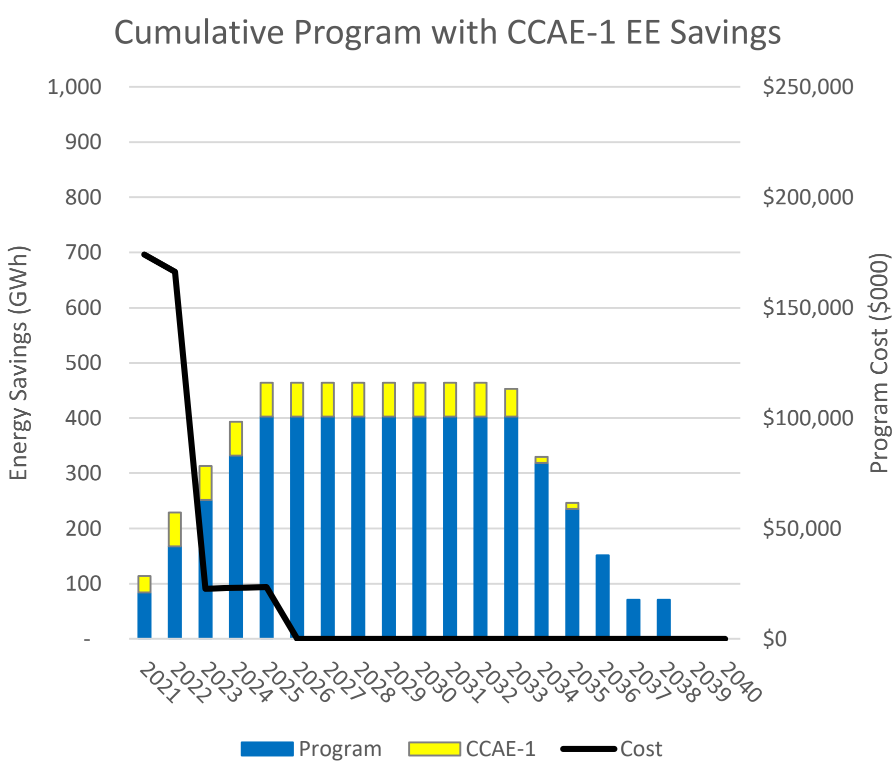
Energy Efficiency Bundles





Energy Efficiency Bundles





The difference between the two plots (the grey bars) becomes a dynamic economic choice rather than performing a separate forecast that is input statically

Energy Efficiency Bundle Development
Applied Energy Group

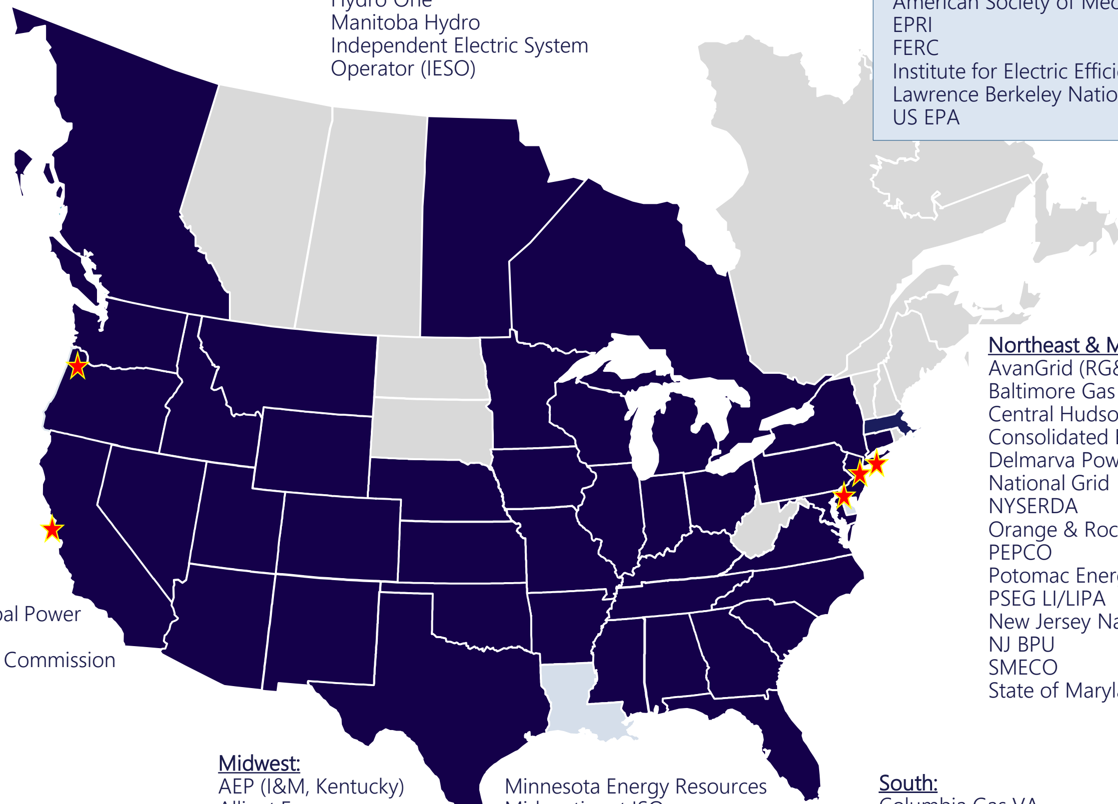
AEG
Applied Energy Group



PNM IRP ENERGY EFFICIENCY RESOURCE BUNDLING

August 25, 2020

CONSULTING CLIENTS AND PRIMARY OFFICE LOCATIONS



Northwest & Mountain:
Avista Energy
Bonneville Power Admin. (BPA)
Black Hills Energy
Cascade Natural Gas
Chelan PUD
City of Fort Collins
Colorado Electric
Cowlitz PUD
Energy Trust of OR
Idaho Power
Inland P&L
Northwest EE Alliance
Northwest Power & Conservation Council
Oregon Trail Electric Co-op
PacifiCorp
Pacific Gas & Electric
PNGC
Portland General Electric
Seattle City Light
Snohomish PUD
Tacoma Power

Canada:
BC Hydro
Hydro One
Manitoba Hydro
Independent Electric System Operator (IESO)

National:
American Society of Mechanical Engineers (ASME)
EPRI
FERC
Institute for Electric Efficiency (IEE)
Lawrence Berkeley National Lab (LBNL)
US EPA

Southwest:
Alameda Municipal Power
Burbank W&P
California Energy Commission
HECO
LADWP
NV Energy
PNM
PG&E
SCE
SDG&E
SMUD
State of NM
State of HI
Tucson Electric Power
Xcel/SPS

Midwest:
AEP (I&M, Kentucky)
Alliant Energy
Ameren Missouri
Ameren Illinois
Black Hills Energy
Citizens Energy
Empire District Electric
First Energy
Indianapolis P&L
KCP&L
Minnesota Energy Resources
Midcontinent ISO
NIPSCO
Omaha Public Power District
Peoples Gas/North Shore Gas
Spire
State of Michigan
Sunflower Electric Power
Vectren (IN & OH)
Wisconsin PSC

Northeast & Mid Atlantic:
AvanGrid (RG&E & NYSEG)
Baltimore Gas & Electric
Central Hudson Electric & Gas
Consolidated Edison of NY
Delmarva Power
National Grid
NYSERDA
Orange & Rockland
PEPCO
Potomac Energy
PSEG LI/LIPA
New Jersey Natural Gas
NJ BPU
SMECO
State of Maryland

South:
Columbia Gas VA
Duke Energy
LG&E/KU
Oklahoma Gas & Electric (OK and AR)
South Mississippi Electric Power Association
Southern Company (Services and utilities)
TVA

★ AEG offices

AEG EXPERIENCE IN ENERGY EFFICIENCY AND INTEGRATED RESOURCE PLANNING SUPPORT

Eli Morris
Senior Director

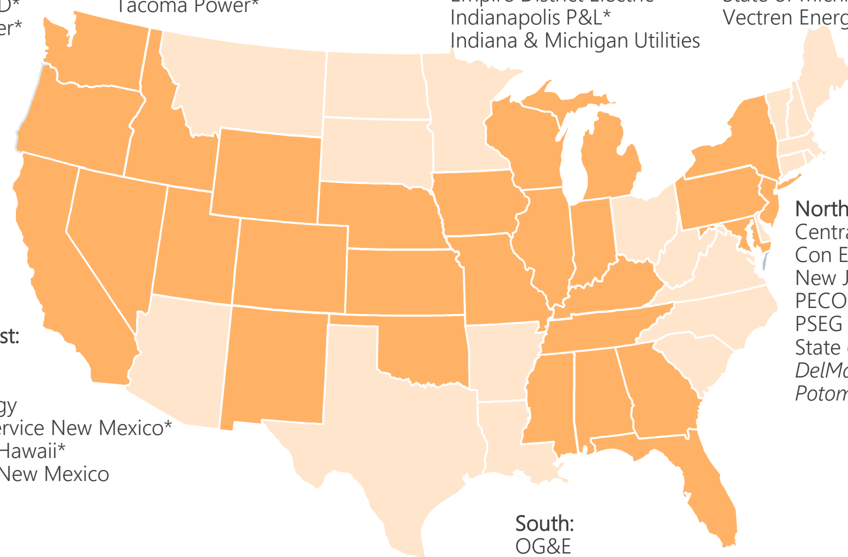
- 15+ years supporting utility energy efficiency and integrated resource planning
- Joined AEG in 2019
- Previously led Customer Solutions planning for PacifiCorp

Kelly Marrin
Managing Director

- Leads AEG's Research and Analytics practice area
- 15 + years supporting utility forecasting, potential assessment, and EM&V
- Worked with PNM since 2008

Northwest & Mountain:
Avista Energy*
BPA*
Cascade Natural Gas
Chelan PUD
Cheyenne LFP
Colorado Electric*
Cowlitz PUD*
Idaho Power*
Inland P&L*
Oregon Trail EC
PacifiCorp*
PNGC
PGE*
Seattle City Light*
Tacoma Power*

Midwest:
Ameren Illinois*
Ameren Missouri*
Citizens Energy
Empire District Electric*
Indianapolis P&L*
Indiana & Michigan Utilities
Kansas City Power & Light
NIPSCO*
Omaha Public Power District*
State of Michigan
Vectren Energy*



Southwest:
HECO
LADWP
NV Energy
Public Service New Mexico*
State of Hawaii*
State of New Mexico
Xcel/SPS

Northeast & Mid Atlantic:
Central Hudson G&E*
Con Edison of NY*
New Jersey BPU
PECO Energy
PSEG Long Island
State of Maryland (*BG&E, DelMarva, PEPCO, Potomac Edison, SMECO*)

South:
OG&E
Kentucky Power
Southern Company (*APC, GPC, Gulf Power, MPC)*
TVA

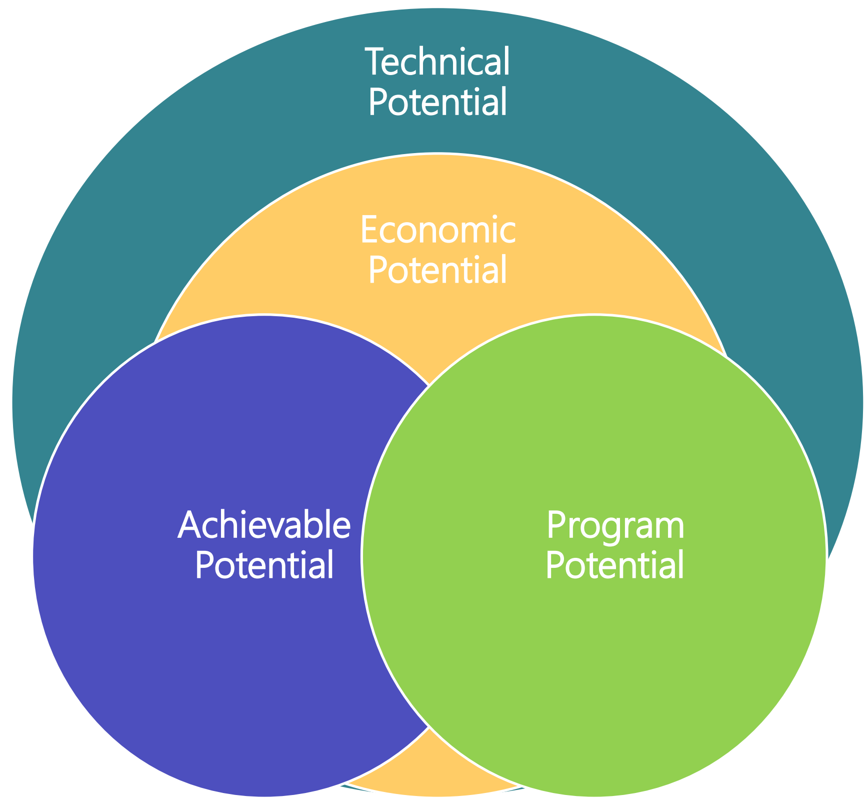
Regional & National:
Midcontinent ISO*
EEI/IEE*
EPRI
FERC

* Two or more studies

ESTIMATING ENERGY EFFICIENCY POTENTIAL

Primary Types of Potential:

- **Technical Potential**: assumes customers adopt all feasible measures, regardless of cost.
- **Economic Potential**: Assumes customers adopt all feasible and cost-effective measures.
- **Achievable Potential**: Applies expected customer adoption rates to Economic Potential to account for market barriers and customers' willingness to participate.
- **Program Potential**: Refines achievable potential based on specific program parameters. In PNM's case, Program Potential is defined as the level of savings to achieve HB 291 savings goals.



MODELING ENERGY EFFICIENCY POTENTIAL WITHIN AN IRP

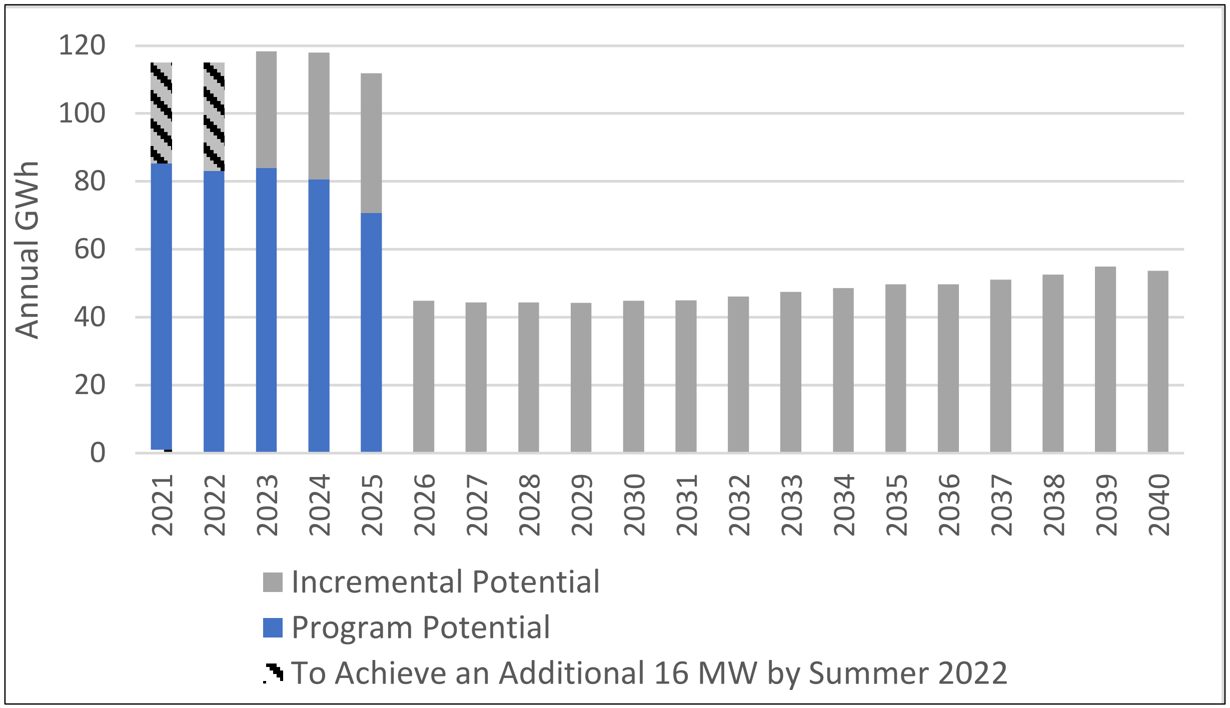
- AEG conducted an energy efficiency potential study to identify the opportunities in PNM's service territory through 2040.
- Energy efficiency measures can be considered on par with supply-side resources based on their availability, hourly impacts, cost, and life.
- Program potential is the best representation of energy efficiency's likely effect on loads and resource needs, however:
  - HB 291 savings targets only run through 2025
  - The Program Potential is already screened for cost-effectiveness, so does not allow the IRP to consider higher cost energy efficiency measures based on changing resource needs
- To enable modeling energy efficiency as a resource within the IRP, AEG developed hourly supply curves representing program potential and additional opportunities not deemed cost-effective within the potential study

AEG SUPPLY CURVE BUNDLING METHODOLOGY

Step 1: Calculate "achievable technical" potential, incorporating achievability rates, but not cost-effectiveness screening.

Step 2. Identify measure-level incremental potential beyond statutory goals

- 2021 – 2025: $\text{Incremental Potential} = \text{Achievable Technical} - \text{Program Potenital}$
- 2026 – 2040: $\text{Incremental Potential} = \text{Achievable Technical}$



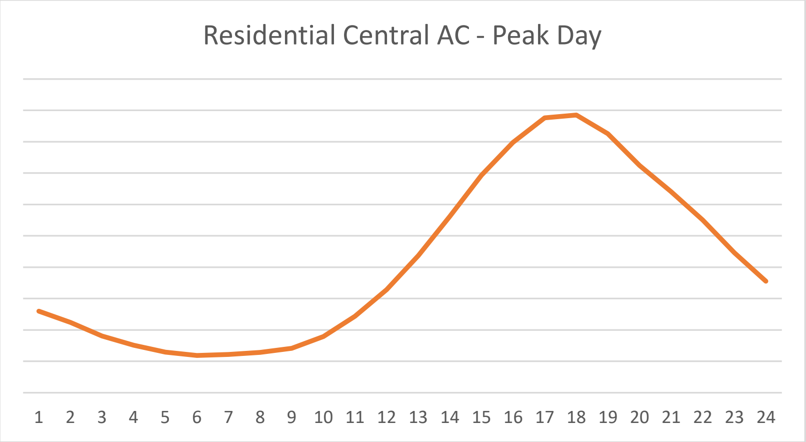
AEG SUPPLY CURVE BUNDLING METHODOLOGY (CONTINUED)

Step 3. Define bundles based on levelized cost of conserved energy.
Levelized costs are in 2016$

Step 4. Match energy efficiency measures to resource bundles and calibrated load shapes.

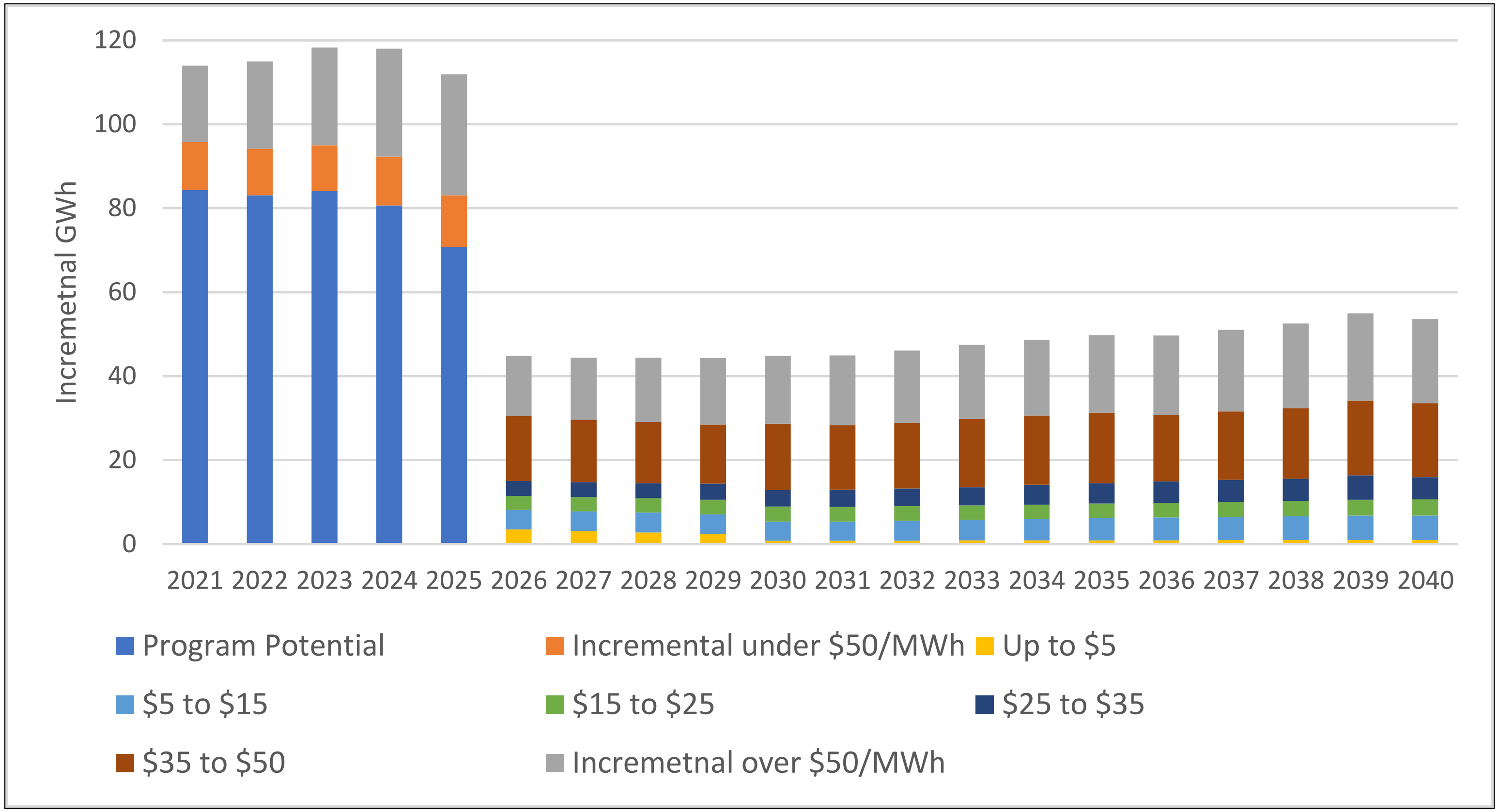
- AEG assigned each measure in the potential study to a bundle in each year based on
  - a) whether it was included in the program potential, and
  - b) its levelized cost.
- Each measure was similarly matched to a calibrated load shape by building type and end use.

Statutory Period 2021-2025	Post-Statutory Period 2026-2040
Program Potential	n/a
Up to $50/MWh[1]	Up to $5/MWh
	$5/MWh to $15/MWh
	$15/MWh to $25/MWh
	$25/MWh to $35/MWh
	$35/MWh to $50/MWh
Over $50/MWh	Over $50/MWh



AEG SUPPLY CURVE BUNDLING METHODOLOGY (CONTINUED)

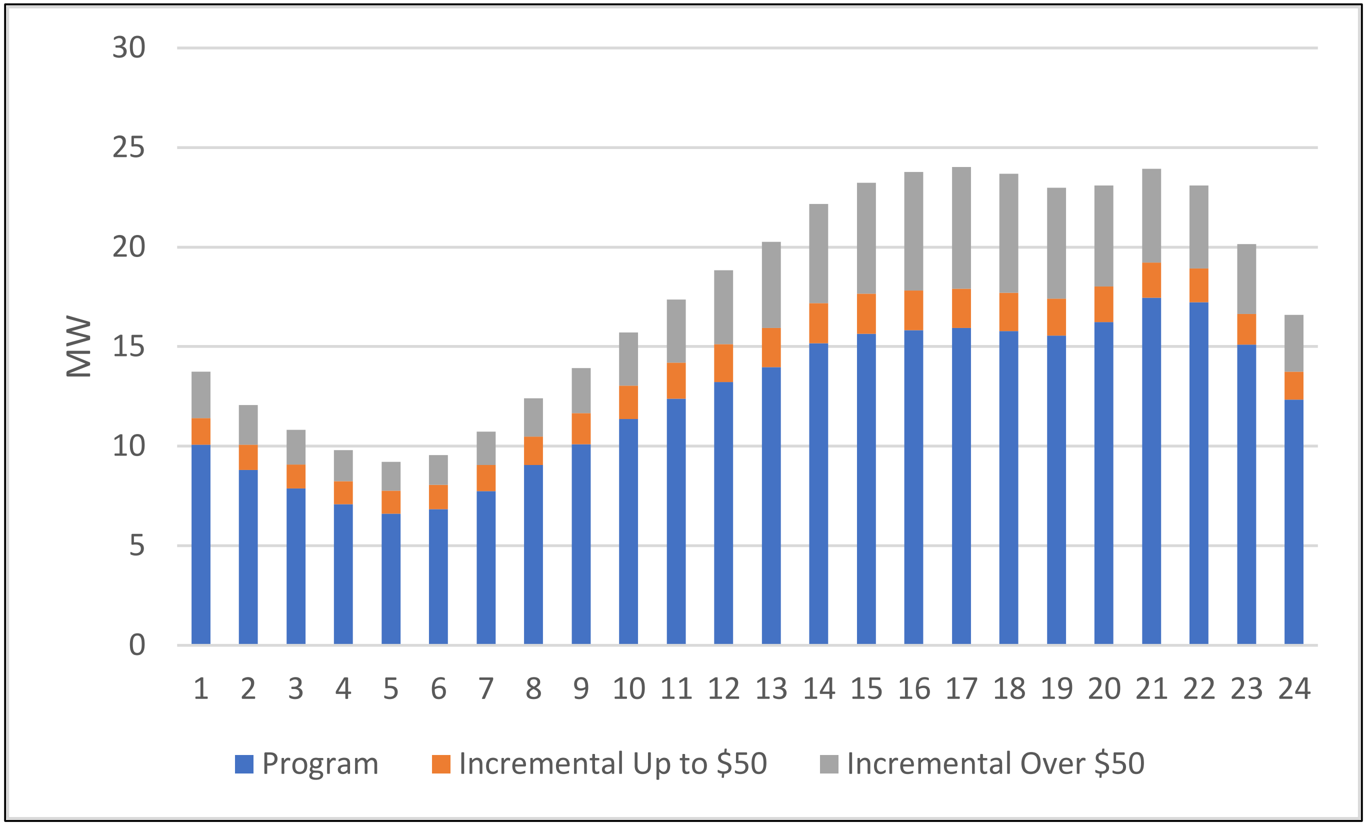
Step 5. Calculate annual incremental energy savings and weighted average cost and measure life for each bundle based on included measures.



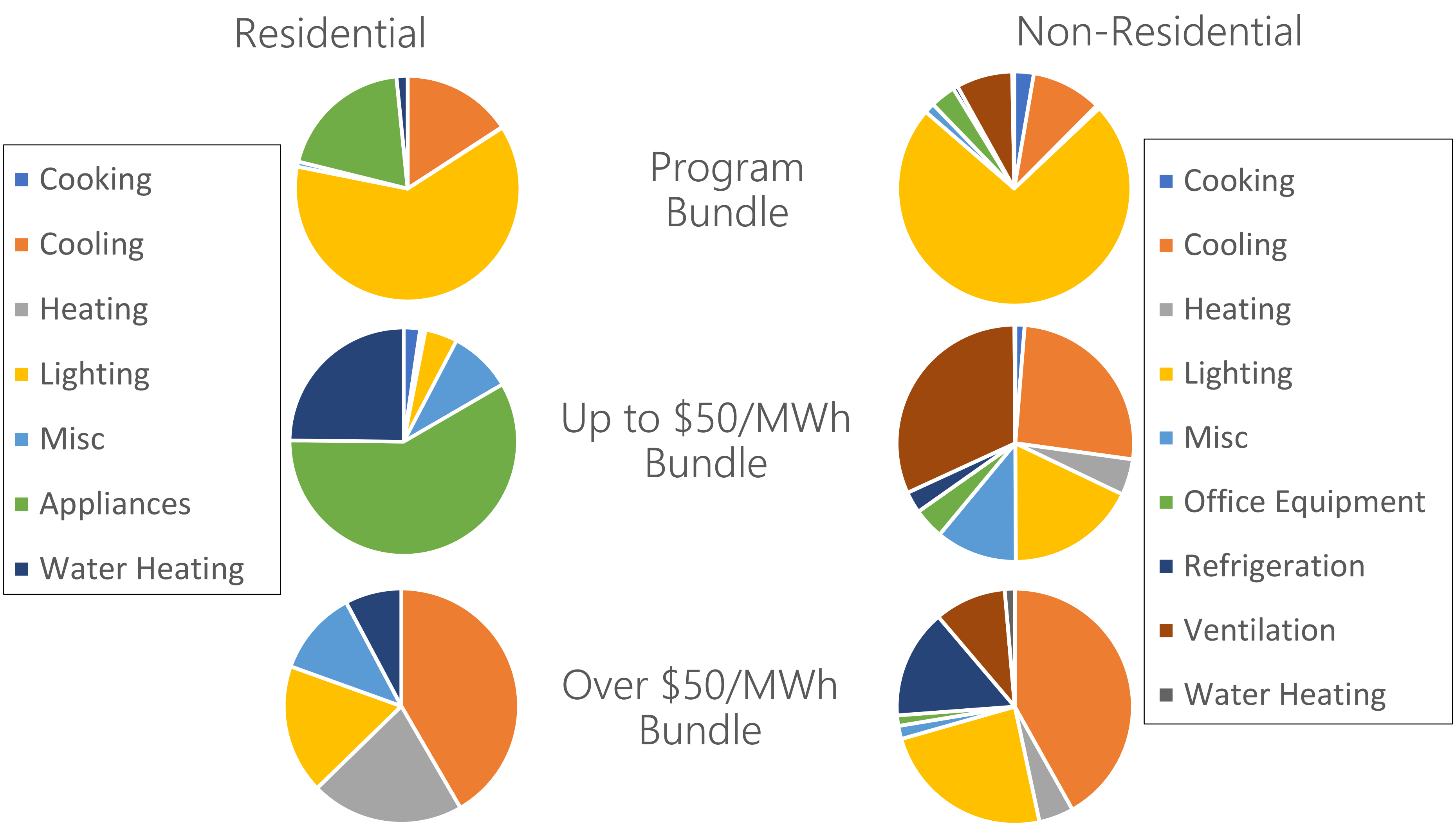
AEG SUPPLY CURVE BUNDLING METHODOLOGY (CONTINUED)

Step 6. Develop hourly impacts for each bundle by spreading measure-level impacts over calibrated end use load shapes

Example – 2021 Bundle Impacts – Peak Day



EXAMPLE BUNDLE COMPOSITION - 2021



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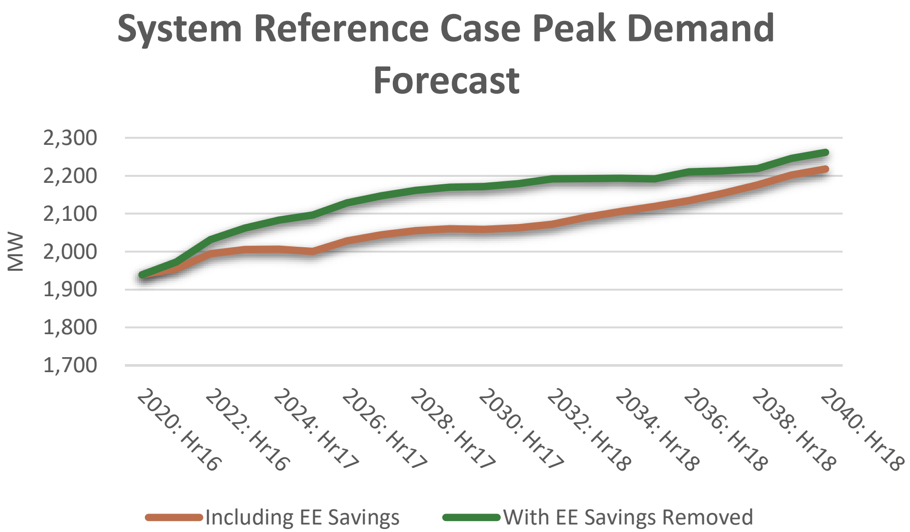
Kelly Marrin, Managing Director
kmarrin@appliedenergygroup.com

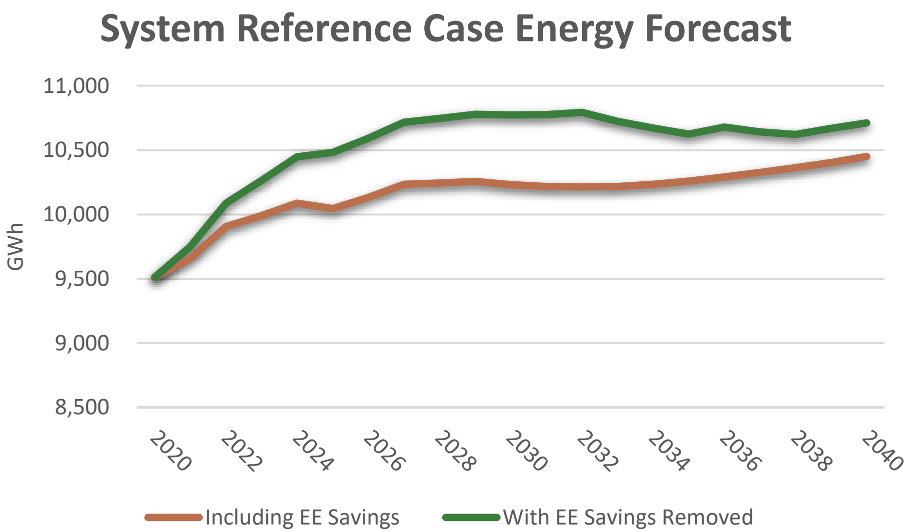
Load Forecast Intro

Load Forecast Intro

- The Load forecast scenarios and model inputs will be different than in past IRPs
- By moving energy efficiency to the supply side, load inputs will not include energy efficiency savings
- The load forecast methodology is different than in past IRPs and allow for a wider breadth in the ability to create specialized load forecast scenarios based on individual components.
- Some components, such as data center/potential large economic development ("ED") loads are forecasted separately and will be added to the futures/scenarios developed by ITRON

Load Forecast Intro





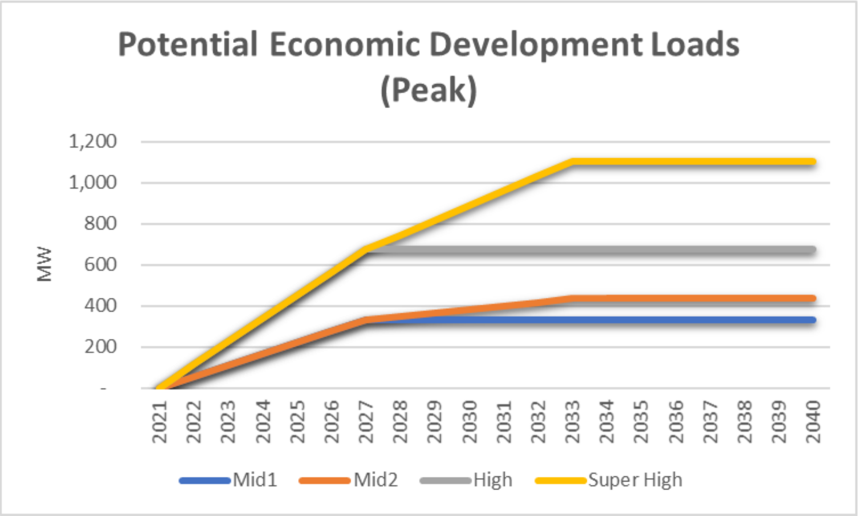
Reference case forecast including existing data center loads, excluding economic development loads

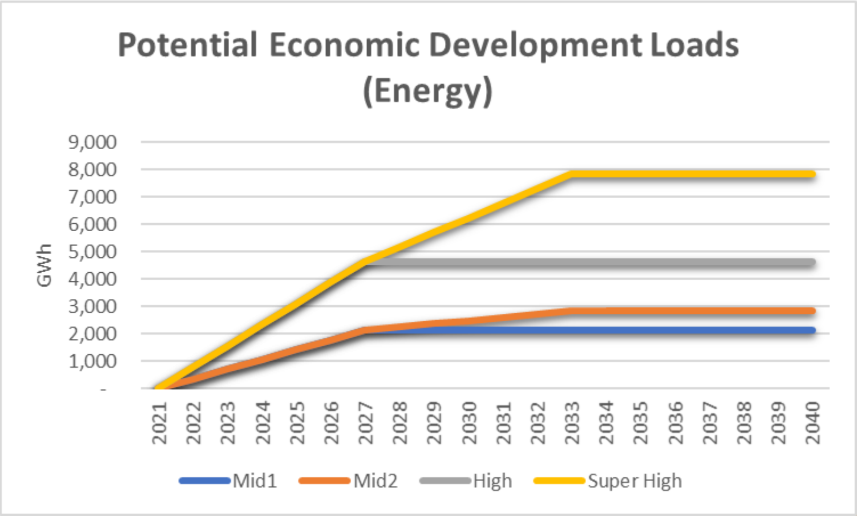
To add in potential economic development loads such as new data center(s), manufacturing load(s), etc. as a sensitivity to the reference case, the load addition would be added to both lines (energy efficiency bundles reflect residential and commercial programs).

Load Forecast Intro

New Mexico and PNM Service Territory has a number of inquiries regarding large economic development projects/loads.

The timing and magnitude of these loads, if they materialize would require additional resources to serve these loads.





*Low ED Forecast not shown
** ED Forecasts preliminary and subject to change

Load Forecast Development & Scenarios
ITRON

PNM Integrated Resource Plan Forecast Scenarios

Stuart McMenamin
David Simons
Itron, Inc.

August 25, 2020

Itron Background

Itron enables utilities and cities to safely, securely and reliably deliver critical infrastructure solutions at scale, all around the globe.

Dr. J. Stuart McMenamin directs Itron's Forecasting and Load Research division. He has over 40 years of experience in the energy forecasting field and is a nationally recognized expert in statistical and end-use forecasting for electric utilities.

David Simons is a Consultant in the Itron Forecasting division. He has been with Itron for 7 years and works with utilities around the world on short-term and long-term forecasting solutions.

Agenda

- » Economic Data and Forecasts
- » Weather Data and Normal Weather
- » Behind the Meter PV Data and Forecasts
- » Electric Vehicle Forecast
- » Other Scenario Inputs
- » Energy Modeling and Forecasts
  - Customer growth forecast
  - Statistically Adjusted End Use (SAE) Method
  - Use per customer models
  - Energy and peak forecast summary
- » Hourly System Load and Peak Demand Forecasts
  - Bottom-up load shape and peak demand forecast
- » Forecast Scenarios

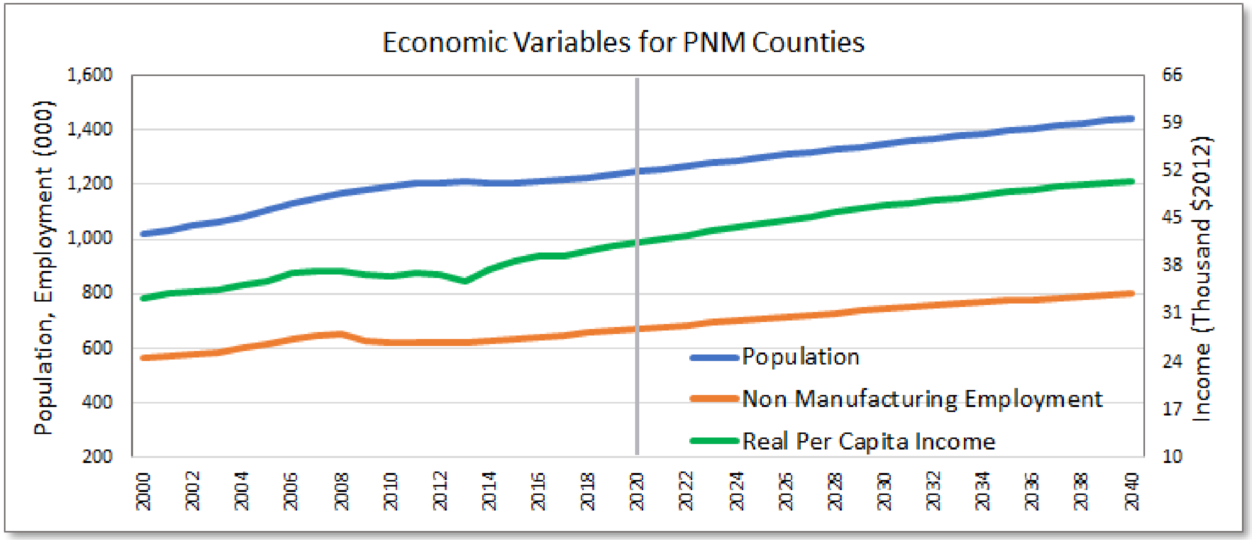
Economic Data and Forecasts

Economic Data and Forecast

- » Forecast provided by Woods and Poole
- » Annual history from 1950
- » Annual forecast to 2050
- » State and County level data
- » Used data for PNM counties:
  - North: Bernalillo, San Miguel, Sandoval
    Santa Fe, Union, Valencia
  - South: Grant, Hidalgo, Luna, Otero
- » Annual data converted to monthly using centered moving averages
- » Forecast from 2019 has not been adjusted for COVID impacts

Summary of Key Economic Variables

Year	Levels			Year Range	Growth Rates		
	Population	Non Mfg Employment	Real Income Per Capita		Population	Non Mfg Employment	Real Income Per Capita
2000	1,022	566.6	33,396				
2010	1,196	621.2	36,514	00 to 10	1.58%	0.92%	0.90%
2020	1,248	671.4	41,507	10 to 20	0.43%	0.78%	1.29%
2030	1,349	743.4	46,889	20 to 30	0.78%	1.02%	1.23%
2040	1,444	800.7	50,605	30 to 40	0.68%	0.74%	0.77%

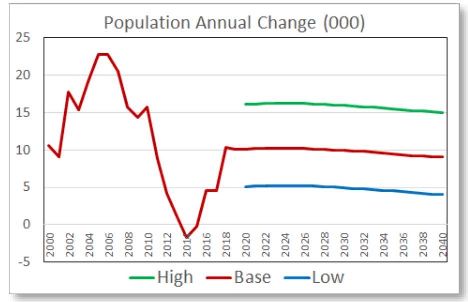


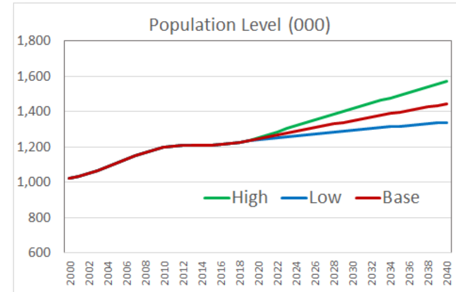
Economic Scenarios

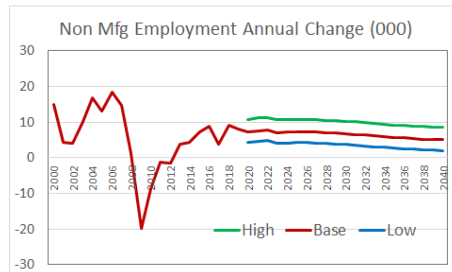
» Population Annual Gains
- High Case: 15,800
- Base Case: 9,800
- Low Case: 4,800

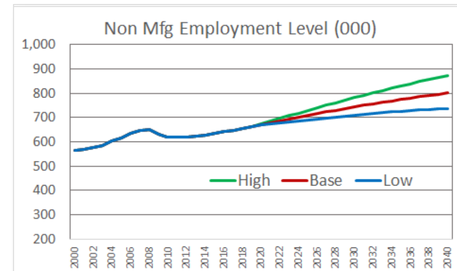
» Non Mfg. Employment Annual Gains
- High Case: 10,000
- Base Case: 6,500
- Low Case: 3,500

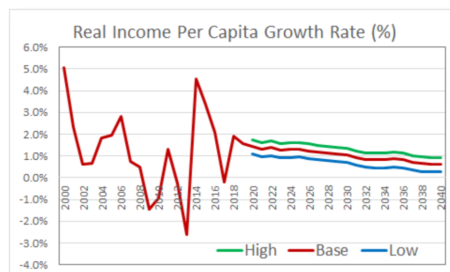
» Real Per Capita Income Growth
- High Case: 1.3%
- Base Case: 1.0%
- Low Case: 0.6%

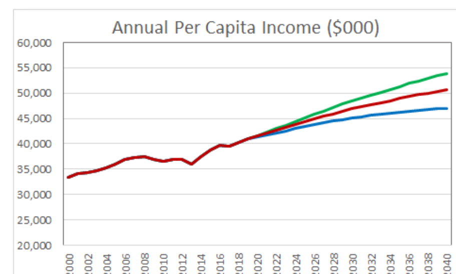












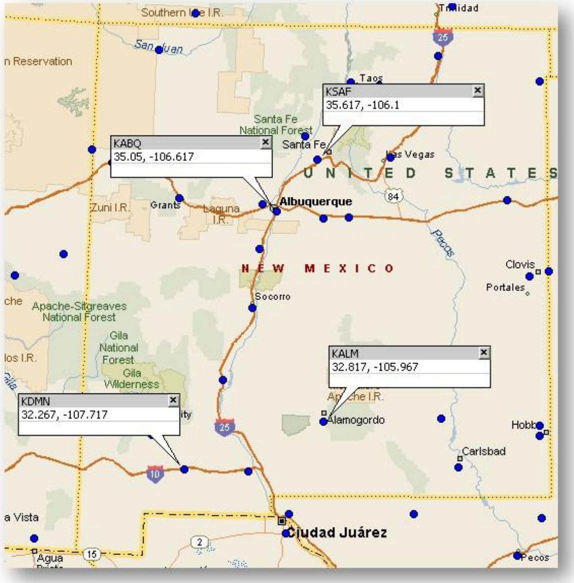
Weather Data and Normal Weather

Weather Data and Normal Scenario

» Hourly weather data from AccuWeather
- Temperature – Used to compute Degree Days
- Global horizontal irradiation (GHI) – Used for solar generation

» 4 Stations
- North: Albuquerque (KABQ), Santa Fe (KSAF)
- South: Deming (KDMN), Alamogordo (KALM)

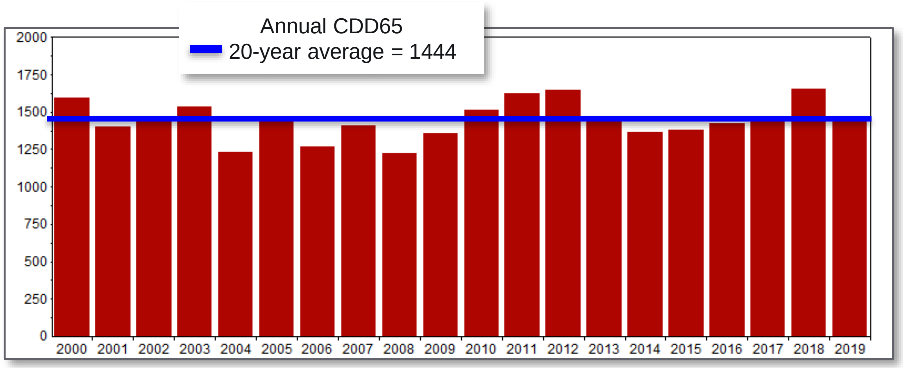
» Station weights for weather variables
- Based on billed sales 2015 to 2018
- Heating Degree weights based on winter sales
- Cooling Degree weights based on summer sales
- Solar GHI weights based on annual sales

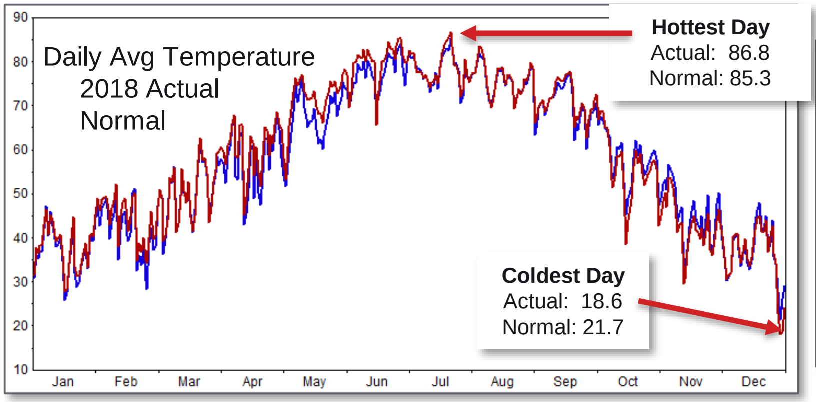


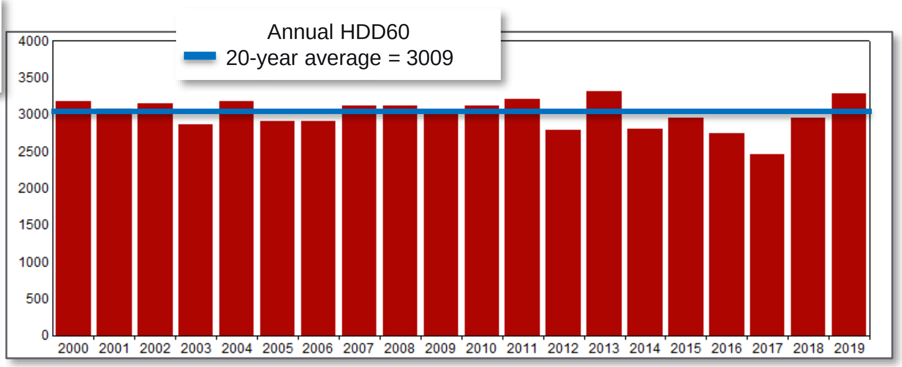
Station	Heating Degrees	Cooling Degrees	Solar GHI
KABQ	75.0%	77.8%	76.3%
KALM	3.0%	3.2%	3.1%
KDMN	9.0%	8.4%	8.9%
KSAF	13.0%	10.5%	11.7%

Normal Weather Calculation

» Normal Weather: 20-year basis
- Compute daily average temperature
- Compute daily CD (base 55, 60, 65, 70, 75)
- Compute daily HD (base 60, 55, 40, 45)
- Average by Date for energy forecast
- Rank and Average for load shape forecast
- Monthly HDD, CDD computed from daily







Weather Response Analysis

» Load Research data provide hourly and daily use estimates for a statistical sample

» Daily use shows the response to daily weather

» Response of load to weather is non linear

» Load research data used to calculate HD and CD weights
  - Daily regression models
  - Y is daily sales per customer
  - X variables are daily CD and HD values
  - Calculate weights for low, medium, and high-powered degrees

Residential Weights

Spline	Wgt
HD60	0.285
HD55	0.422
HD45	0.293
CD60	0.188
CD65	0.286
CD70	0.526

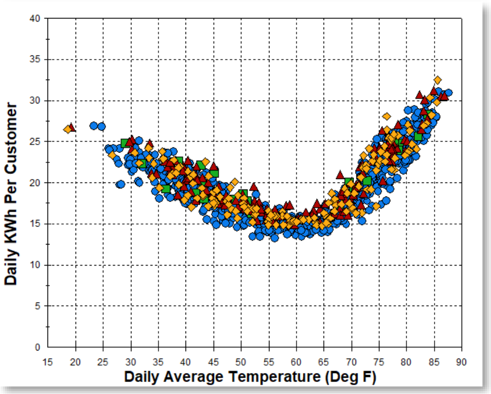
Small Power Weights

Spline	Wgt
HD55	0.572
HD45	0.428
CD55	0.237
CD65	0.629
CD75	0.134

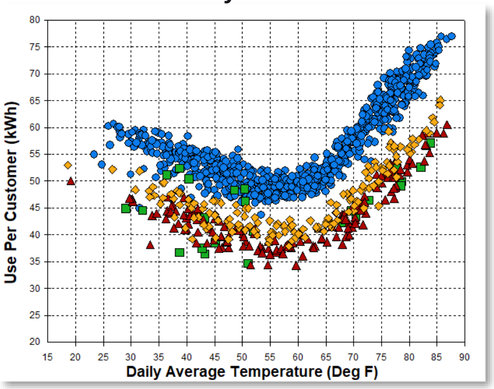
General Power Weights

Spline	Wgt
HD55	0.307
HD45	0.693
CD55	0.448
CD65	0.552

Residential Daily Sales Per Customer



Small Power Daily Sales Per Customer



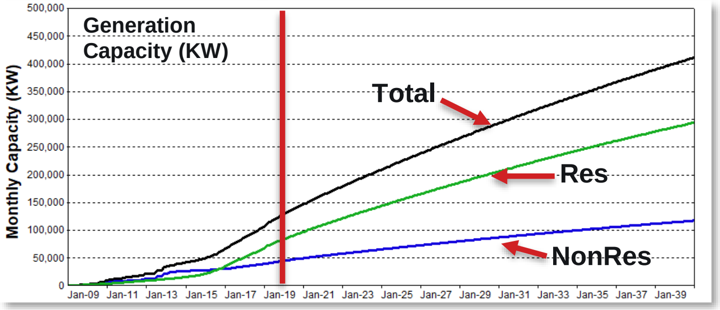
Behind the Meter PV Data and Forecasts

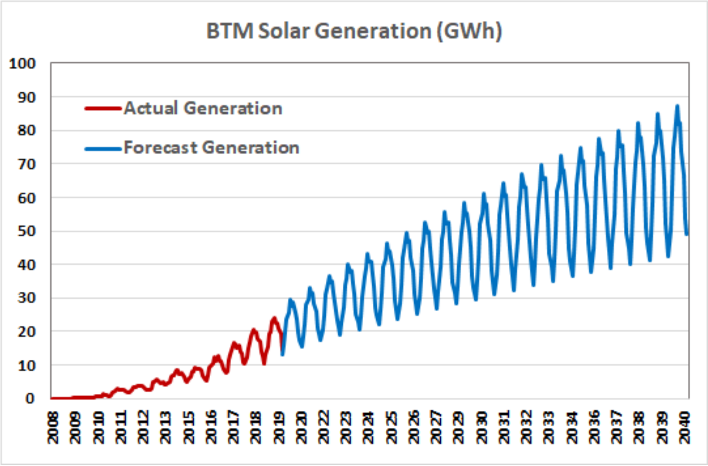
BTM Solar Capacity and Generation Data

» Solar Capacity Data
- Generation capacity data for new system
- Aggregated to monthly (Res & NonRes)
- Forecasted through 2040

» Solar Generation Data
- All solar customers have generation output meters
- Data are gathered monthly on a billing-cycle basis
- Totals are calculated by billing month and rate class

» Solar Model
- Y = Daily average KWh output per KW capacity
- X = Daily average GHI Sum
- Daily forecast allocated to hours based on hourly GHI
- Forecasts of MWh generated
  - GWh = Capacity (MW) * KWhPerKW / 1000

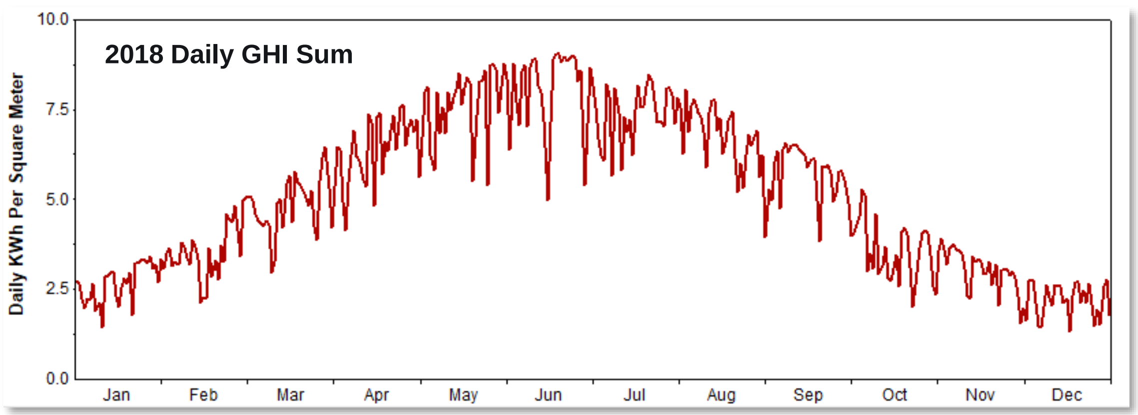


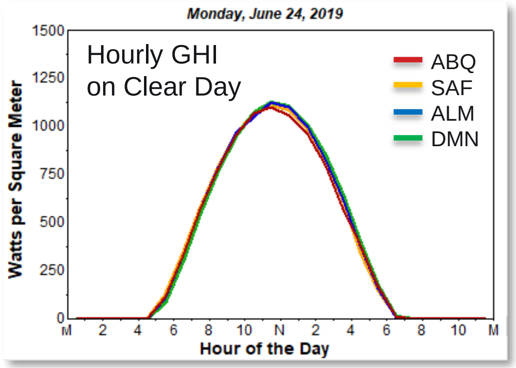


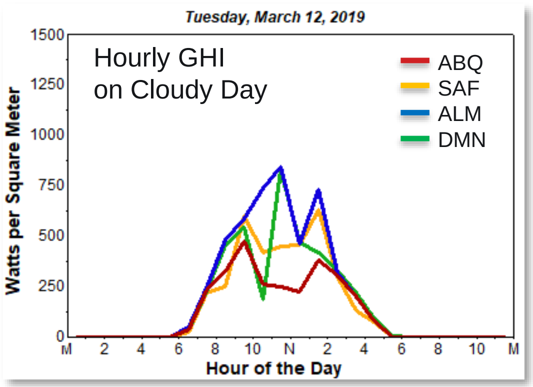
Behind the Meter Solar – GHI Data

» Global Horizontal Irradiation (GHI) from Accuweather
- Hourly GHI data for four weather stations
- Daily sums and monthly sums used in modeling

» 2018 pattern used for monthly & hourly forecasting
- 2018 Annual GHI within .3% of 20-year average
- Rotated to days based on daily temperature pattern







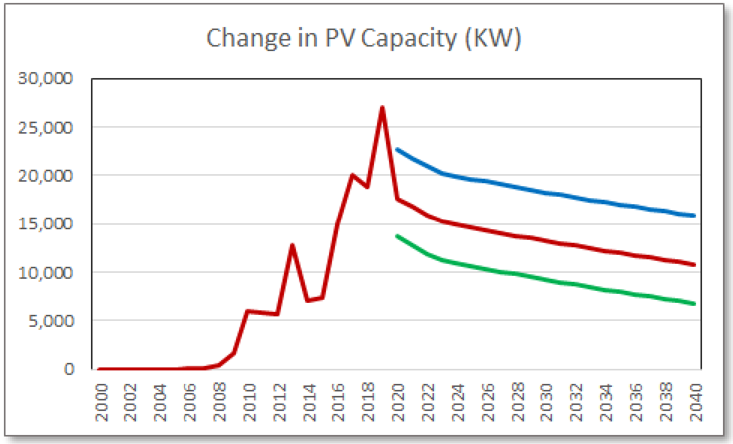
PV Scenarios

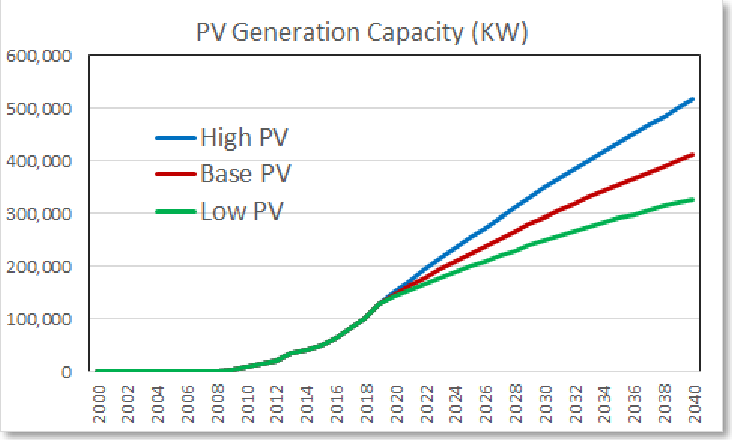
» Base Forecast provided by PNM Customer Operations Department

» Annual PV Capacity Additions 2021 to 2040
- High PV: 18.3 MW
- Base PV: 13.3 MW
- Low PV: 9.3 MW

» 2019 Generation Capacity: 128 MW

» 2040 Generation Capacity (MW)
- High PV: 516 MW
- Base PV: 411 MW
- Low PV: 327 MW





Electric Vehicle Forecast

ELECTRIC VEHICLE FORECAST

» Estimated EV count in PNM area for 2020 is about 3,400

» Forecasts based on fractions of new car sales

- Total New Mexico annual car sales are about 87,000
- US EV adoption ramps up from 2.3% to 20% by 2030, 35% by 2040
- NM adoption is about 41% of US adoption
- 75% of NM adoptions are in PNM territory
- EV annual energy use is about 4 MWh
- About 80% of charging is residential

Year	EV Share of New Vehicles (US)	EV Share of New Vehicles (NM)	Total Vehicles PNM Area	Annual MWh
2015	0.66%	0.30%	765	3,060
2020	3.04%	1.26%	3,443	13,772
2025	8.82%	4.07%	12,671	50,684
2030	20.00%	9.24%	37,207	148,828
2035	30.00%	13.86%	77,319	309,276
2040	35.00%	16.17%	127,083	508,332

EV SCENARIOS

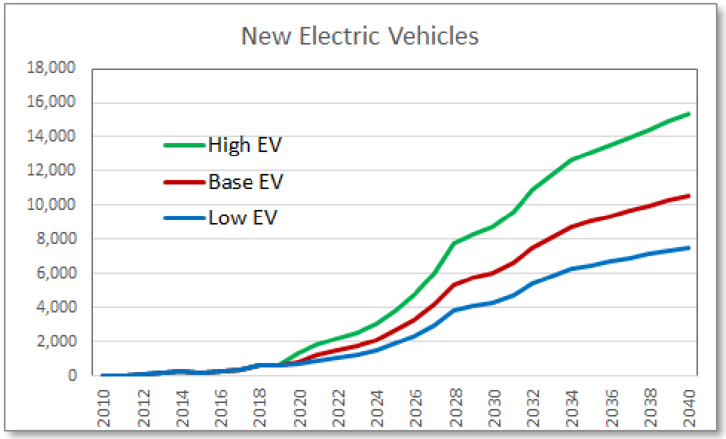
» Base Forecast developed by PNM Customer Operations Department

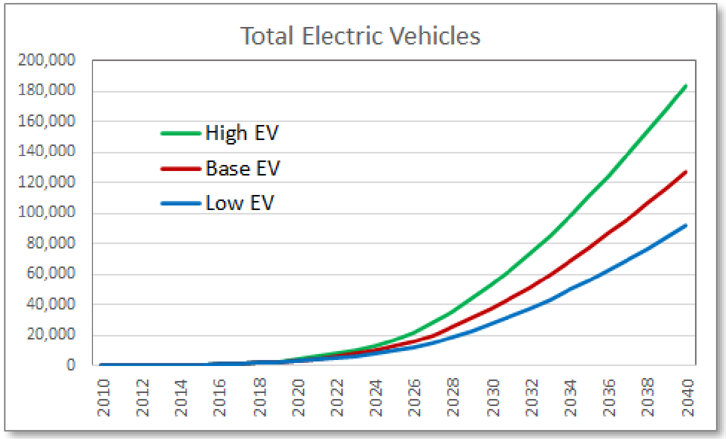
» Annual EV Additions 2021 to 2040

- High EV: Grows to 15,300 by 2040
- Base PV: Grows to 10,600 by 2040
- Low PV: Grows to 7,500 by 2040

» 2040 Electric Vehicle Count

- High PV: 183,000
- Base PV: 127,000
- Low PV: 92,000





Other Scenario Inputs

Building Electrification

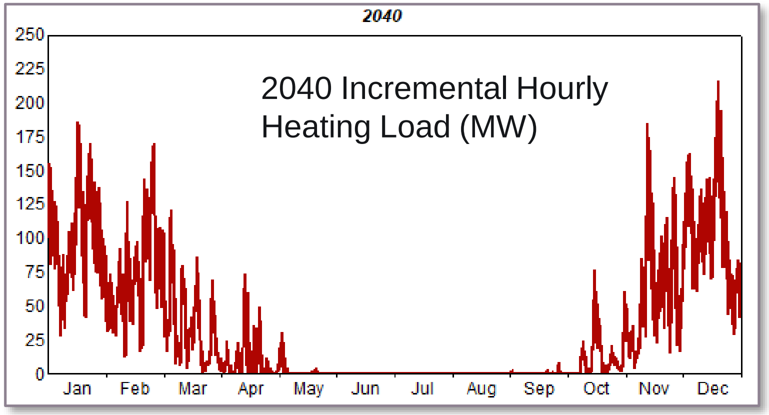
» New homes starting in 2023
- Natural Gas and Propane not allowed
- Electric heat share goes from 15% to 90%
- Mostly heat pumps 80% of the increase
- Less evaporative cooling, more central air

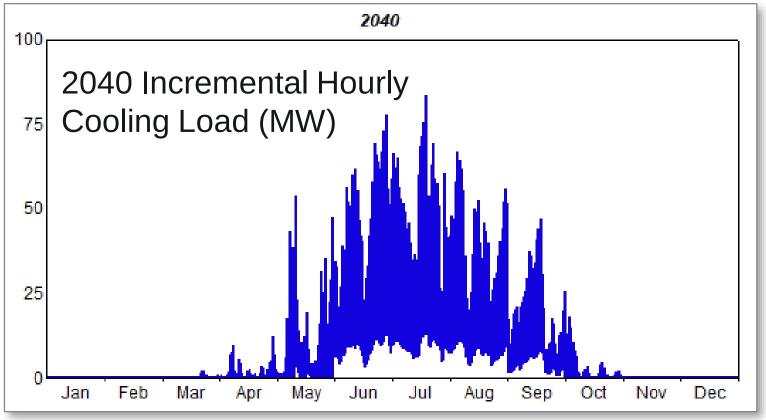
» Existing homes converted to heat pumps
- About 2% per year (7,000 homes)
- Evaporative cooling displaced in 40% of the 2%
- Incremental cooling UEC is 1700 KWh

» Heat pump heating UEC averages 2400 KWh

» Overall electric heating share increases:
- 15.5% in 2020 to 45% in 2040

» Heating/Cooling shapes from load research



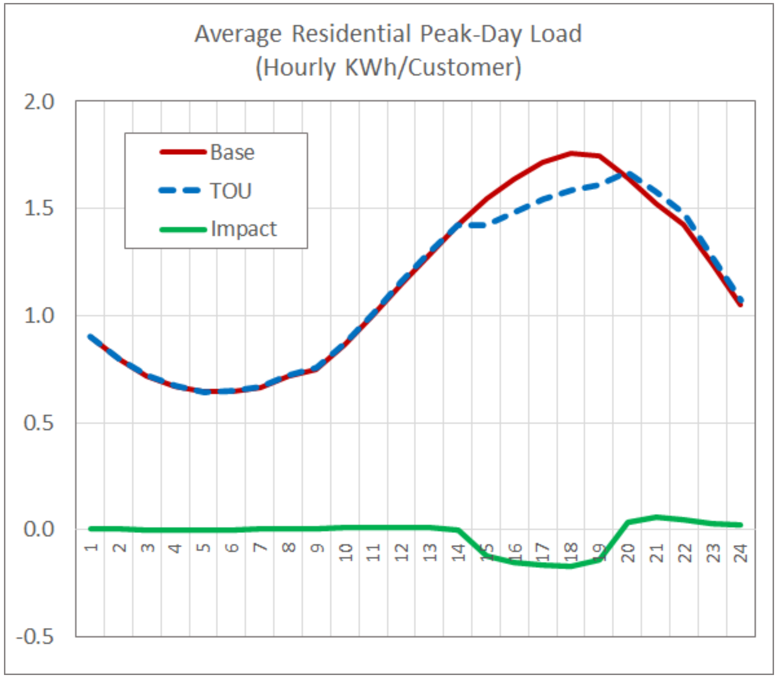


Residential Time of Use Rates

» Introduce Residential TOU in 2024
- 80% on TOU rate
- 20% on Dynamic (Event-Day) Rate
  – Events on Summer Weekdays > 79 degrees

» Impact hourly profile from pilot studies

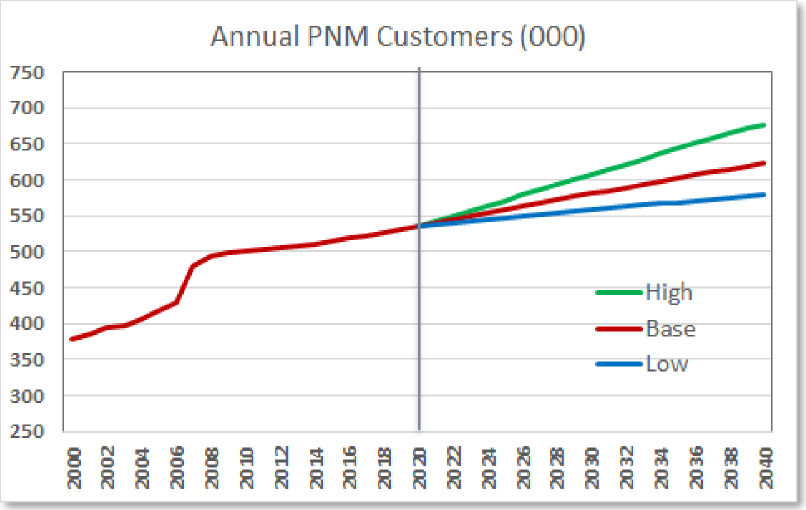
» Peak and energy impact levels from summary report by ACEEE of 50 pricing pilots
- Dynamic rate peak reduction: 21%
- TOU peak reduction: 7%
- Average peak reduction: 9.8%
- Average energy reduction: 1.8%



Energy Modeling and Forecasts

PNM Customer Forecast

- Elasticity model for Residential
  - Population
- Elasticity model for Small Power (SP)
  - Population and Non-Manufacturing Employment
- Regression model for General Power (GP)
  - Population and Non-Manufacturing Employment
- Elasticity model for Large Power (LP4)
  - Non-Manufacturing Employment
- Manual Adjustment for Industrial Loads
  - Expected customer gains in LP35
  - Customer loss from LP5 for San Juan Coal Plant
- Scenarios reflect High/Low Economics



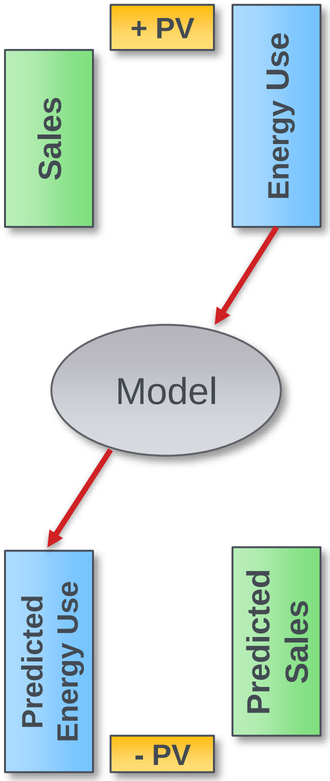
	Average Annual Customer Gain			
	Res	SP	GP	Total
2010-2020	2,908	356	6.4	3,276
2020-2030	3,868	417	10.0	4,295
2030-2040	3,605	357	9.2	3,971
	Average Annual Growth Rate			
	Res	SP	GP	Total
2010-2020	0.63%	0.69%	0.15%	0.63%
2020-2030	0.78%	0.75%	0.23%	0.78%
2030-2040	0.68%	0.60%	0.21%	0.67%

Energy Use and Energy Sales

» Monthly sales and monthly energy use:
- Sales = net delivery of energy through the customer meter
- Energy use = consumption of appliances and equipment
- Energy use is bigger than sales because of PV generation
- Models explain energy use

» Monthly Use Models
- Regression models
- Y is energy use per customer (UPC)
- X variables are end-use drivers and weighted CD and HD variables

» PNM Sales and Load
- Sales computed as Energy Use – PV Generation

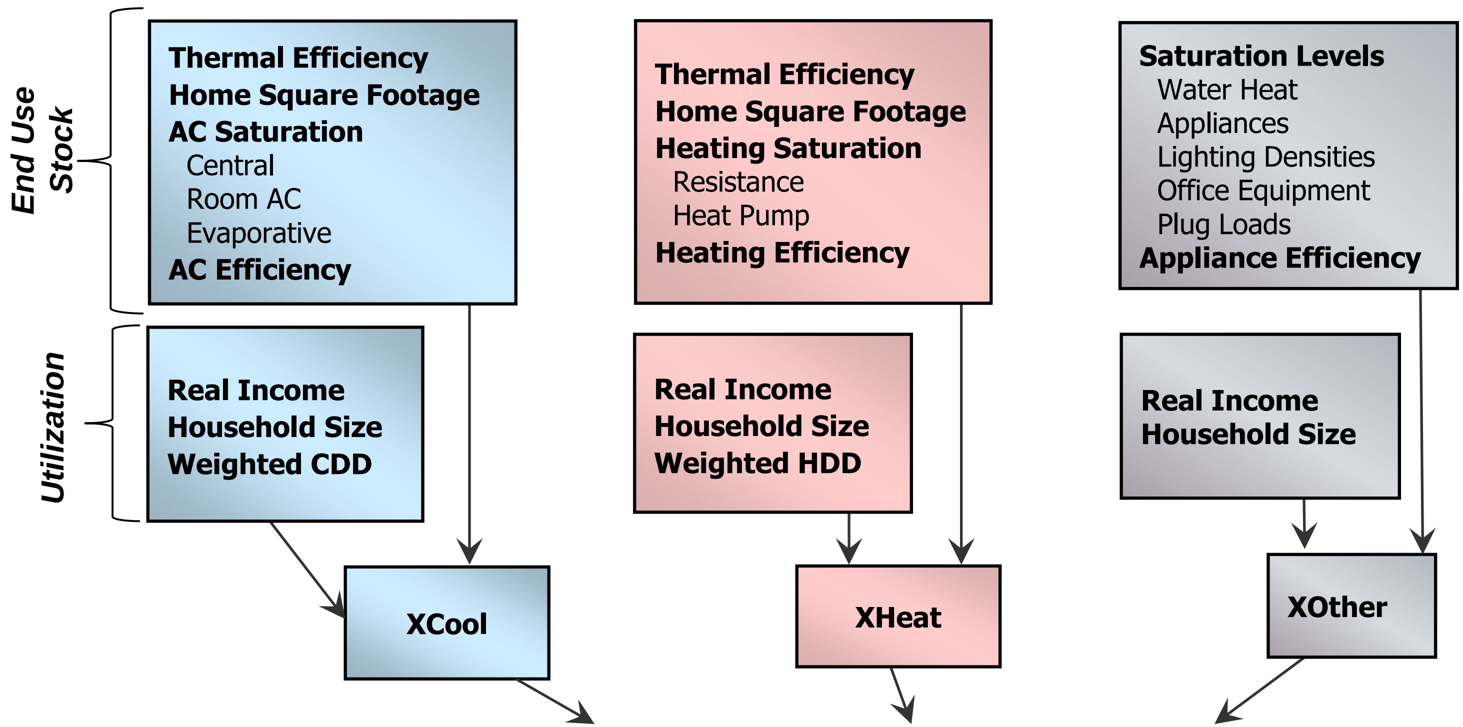


Statistically Adjusted End-Use Framework

- Residential and commercial models use Statistically Adjusted End-Use (SAE) Model
- SAE models account for:
  - Appliance and equipment efficiency
  - Thermal efficiency of buildings
  - Appliance saturation and equipment density
- Efficiency and saturation data initialized using 2018 EIA data for Mountain region
- Saturation and intensity values are modified to agree with PNM data
  - 2016 base-year intensities and saturations from PNM Efficiency Potential Study
  - Efficiency gains are accelerated in 2021 to 2025 to be consistent with PNM efficiency goals and potential study estimates
- Residential framework is shown on the next slide
- Commercial framework is similar (applied to SP, GP, LP)

Residential SAE Modeling Framework

SAE = Statistically Adjusted End-Use

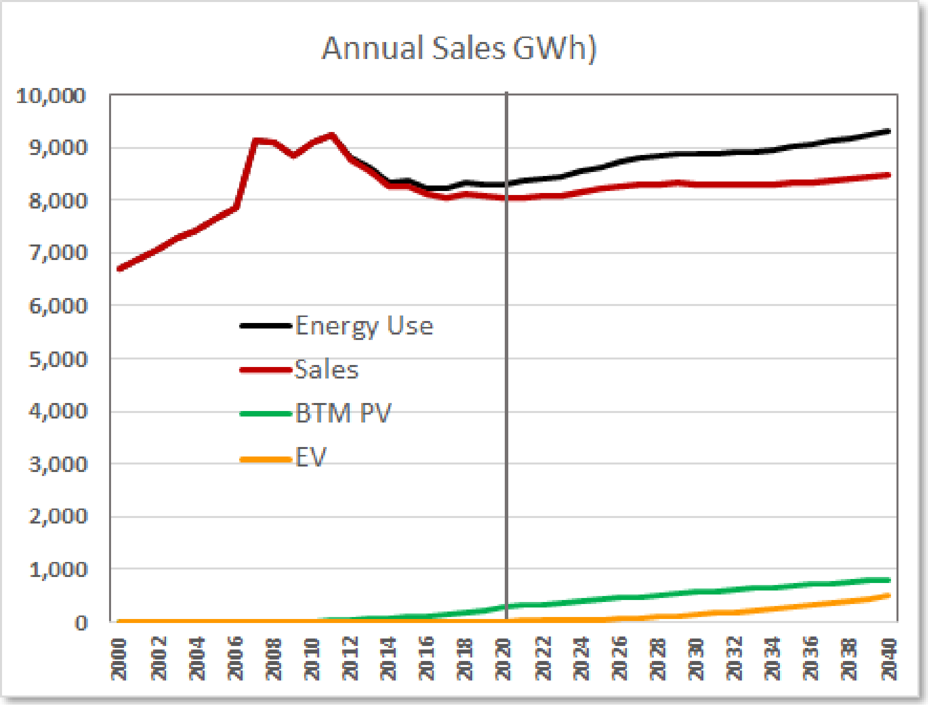


$$\mathrm{Sales}_m + \mathrm{PVGen}_m = a + b_c \times \mathrm{XCool}_m + b_h \times \mathrm{XHeat}_m + b_o \times \mathrm{XOther}_m + e_m$$

Energy Forecast Summary

Year	Customers	Sales (GWh)	EV Sales (GWh)	PV Output (GWh)
2010	501,523	9,088.9	0.0	8.7
2015	514,776	8,267.8	2.7	90.7
2020	534,634	8,035.5	12.3	270.3
2025	557,688	8,207.8	45.9	426.5
2030	580,481	8,298.7	137.5	563.7
2035	602,377	8,319.6	292.5	687.7
2040	623,102	8,490.7	490.2	801.8

Year Range	Customers AGR	Sales AGR	Year	EV % of Sales	PV % of Sales
			2010	0.00%	0.10%
2010 to 2015	0.52%	-1.88%	2015	0.03%	1.10%
2015 to 2020	0.76%	-0.57%	2020	0.15%	3.36%
2020 to 2025	0.85%	0.43%	2025	0.56%	5.20%
2025 to 2030	0.80%	0.22%	2030	1.66%	6.79%
2030 to 2035	0.74%	0.05%	2035	3.52%	8.27%
2035 to 2040	0.68%	0.41%	2040	5.77%	9.44%



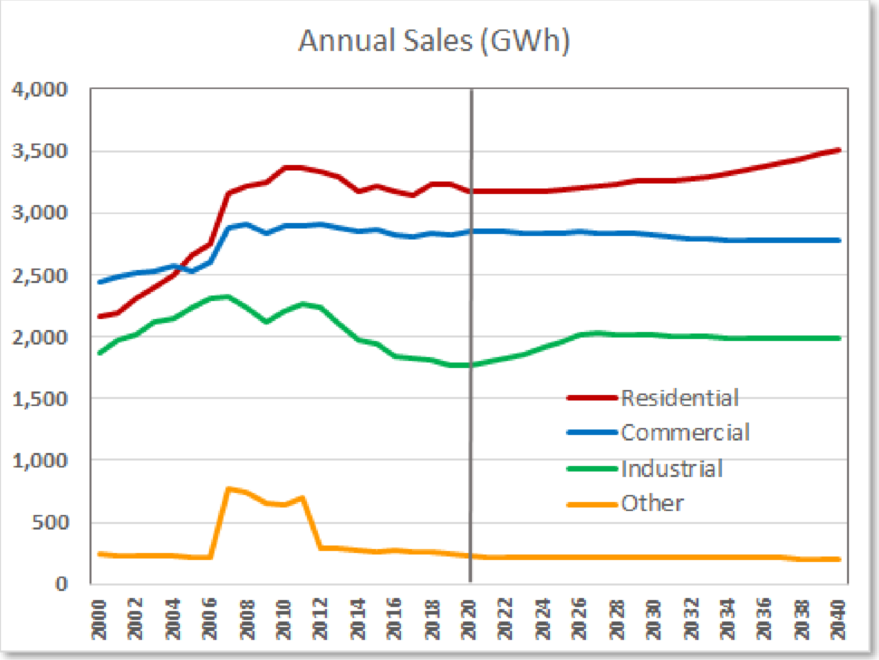
Excludes existing data centers and economic development loads

Energy Sales Forecast by Customer Class

Energy Sales in GWh					
Year	Residential	Commercial	Industrial	Other	Total
2010	3,367	2,887.1	2,202.2	632.9	9,088.9
2015	3,211	2,860.3	1,936.9	259.6	8,267.8
2020	3,176	2,855.1	1,773.3	231.1	8,035.5
2025	3,184	2,842.8	1,962.2	219.3	8,207.8
2030	3,258	2,815.9	2,010.1	215.2	8,298.7
2035	3,343	2,776.3	1,989.5	210.7	8,319.6
2040	3,513	2,783.4	1,987.5	206.9	8,490.7

Annual Growth Rate for Energy Sales					
Year Range	Residential	Commercial	Industrial	Other	Total
2010 to 2015	-0.94%	-0.19%	-2.53%	-16.32%	-1.88%
2015 to 2020	-0.22%	-0.04%	-1.75%	-2.30%	-0.57%
2020 to 2025	0.05%	-0.09%	2.04%	-1.04%	0.43%
2025 to 2030	0.46%	-0.19%	0.48%	-0.38%	0.22%
2030 to 2035	0.52%	-0.28%	-0.21%	-0.42%	0.05%
2035 to 2040	1.00%	0.05%	-0.02%	-0.36%	0.41%

Commercial is Small Power + General Power
Industrial is Large Power + Transmission
Other is Irrigation, Water, and Lighting
Industrial excludes existing data centers and economic development loads



Hourly Load and Peak Demand Forecast

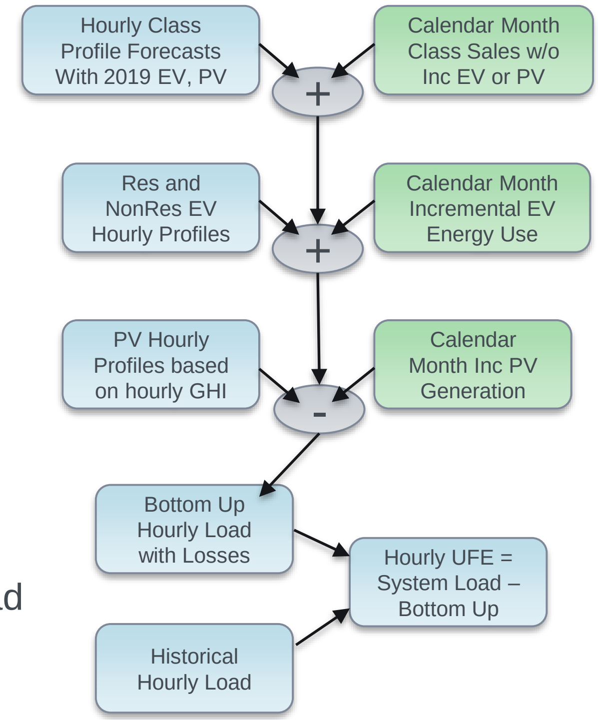
Hourly Load and Peak Load Forecasts

» Hourly load models for each class
- Estimated with hourly load research data for 2015 to 2019
- Forecasted using normal daily weather pattern

» Hourly shapes for EV and PV
- EV shapes: Idaho National Labs, EV Charging Reports
- PV shapes based on hourly GHI data (rotated from 2018)

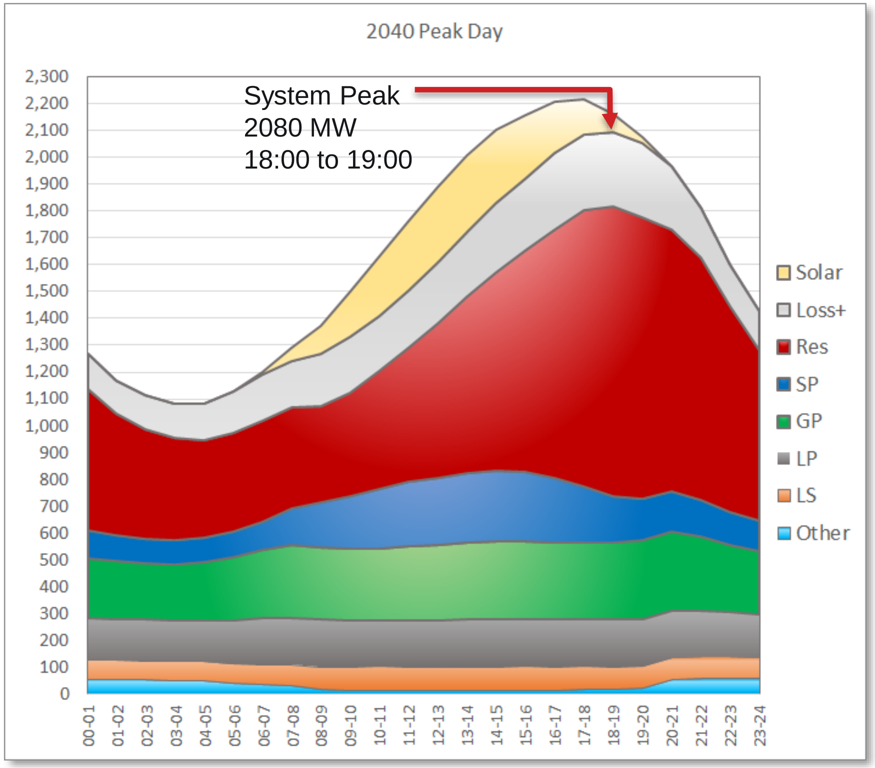
» Bottom up logic
- Calendar month sales forecast without incremental EV or PV
- Calibrate class hourly profile to calendar month energy value
- Scale EV profile to incremental EV energy, add to class load
- Scale PV profile to incremental PV energy, subtract from class load
- Multiply by annual loss factor based on voltage level
- Add across classes

» Compute and apply UFE adjustment factors by month and hour



Hourly Load on Peak Day

- » Bottom up process depiction
  - Class loads are at the meter
  - Class loads exclude existing data centers
  - Loss estimate includes
    - Loss factors by delivery voltage
    - Company use
    - 3rd party transmission
    - FERC Wholesale deliveries
    - Unaccounted for energy
- » Solar is total BTM generation at the customer meter and does not include avoided T&D losses



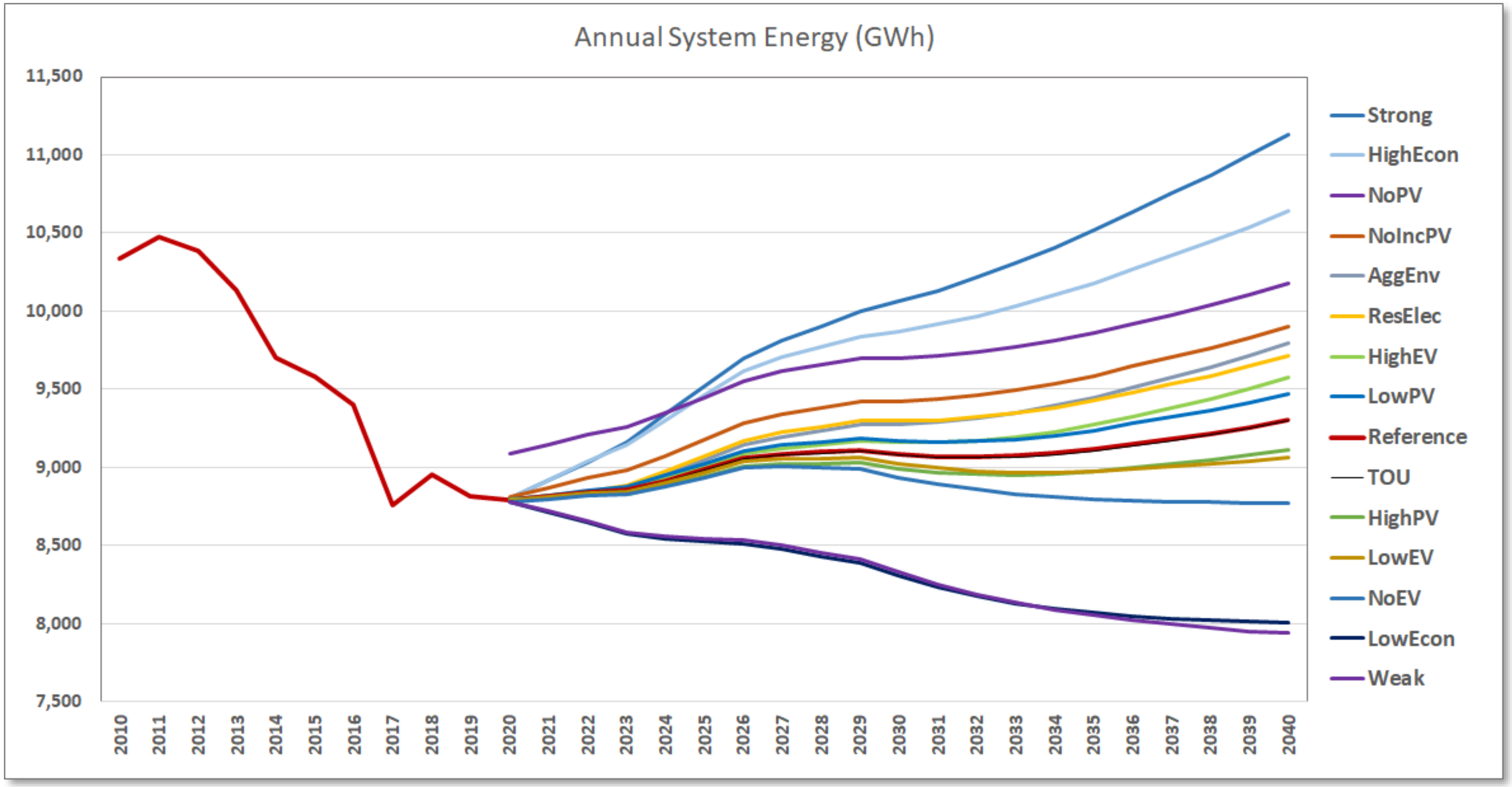
Excludes existing data centers and economic development loads

Forecast Scenarios

Scenario Definitions

	Scenario	Economic Forecast	BTM PV	EV Adoption	Building Electrification	TOU	Description
A	Reference Forecast	Mid	Mid	Mid	No	No	Base Forecast
B	High Economics	High	Mid	Mid	No	No	Strong Econ, Strong Misc. End Use Growth
C	Low Economics	Low	Mid	Mid	No	No	Weak Econ, Weak Misc. End Use Growth
D	Strong Energy Growth	High	High	High	Yes	No	Strong Econ, Strong Misc. End Use Growth, Strong PV, Strong EV, Res Electrification
E	Weak Energy Growth	Low	Low	Low	No	No	Weak Econ, Weak Misc. End Use Growth, Weak PV, Weak EV
F	High BTM PV	Mid	High	Mid	No	No	Strong PV
G	Low BTM PV	Mid	Low	Mid	No	No	Weak PV
H	Zero Incremental PV	Mid	Zero Inc	Mid	No	No	Zero Incremental PV
I	Zero PV	Mid	Zero	Mid	No	No	No PV Ever
J	High EV Adoption	Mid	Mid	High	No	No	Strong EV
K	Low EV Adoption	Mid	Mid	Low	No	No	Weak EV
L	Aggressive Environmental Regulation	Mid	High	High	Yes	No	Strong PV, Strong EV, Res Electrification
M	Residential Electrification	Mid	Mid	Mid	Yes	No	Res Electrification
N	TOU Pricing	Mid	Mid	Mid	No	Yes	TOU Impacts

Annual System Energy Scenarios



Excludes existing data centers and economic development loads

Growth Scenarios

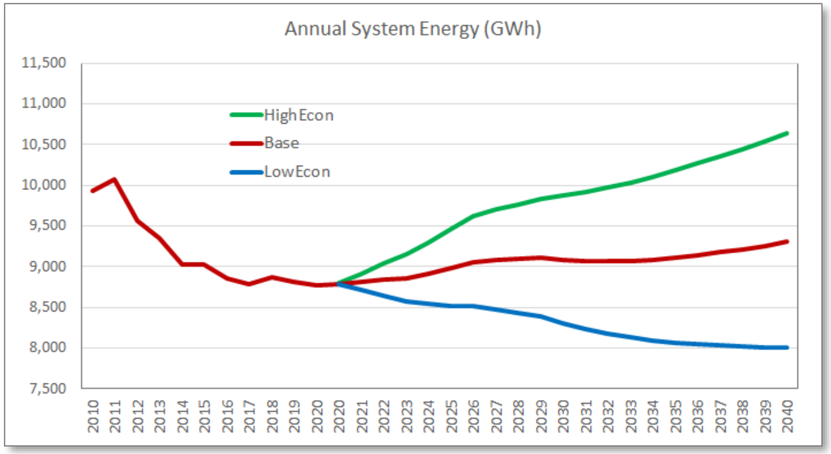
» Reference Case

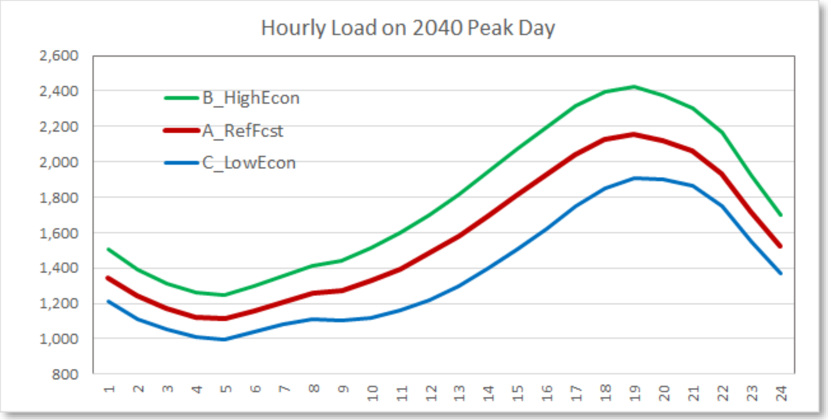
» High Economic Growth
- High Population, Employment, Income
- High Miscellaneous end-use growth

» Low Economic Growth
- Low Population, Employment, Income
- Low Miscellaneous end-use growth

Year	Annual Sales (GWh)			Annual Peak (MW)		
	Base	High Econ	Low Econ	Base	High Econ	Low Econ
2020	8,791	8,800	8,782	1,862	1,862	1,861
2025	8,985	9,460	8,524	1,881	1,970	1,795
2030	9,086	9,871	8,309	1,921	2,074	1,773
2035	9,113	10,182	8,067	1,982	2,192	1,788
2040	9,304	10,639	8,007	2,080	2,348	1,835

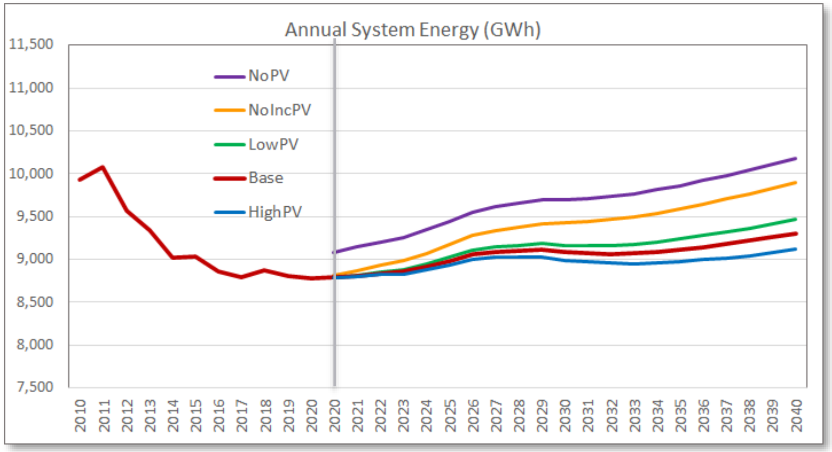
Excludes existing data centers and economic development loads





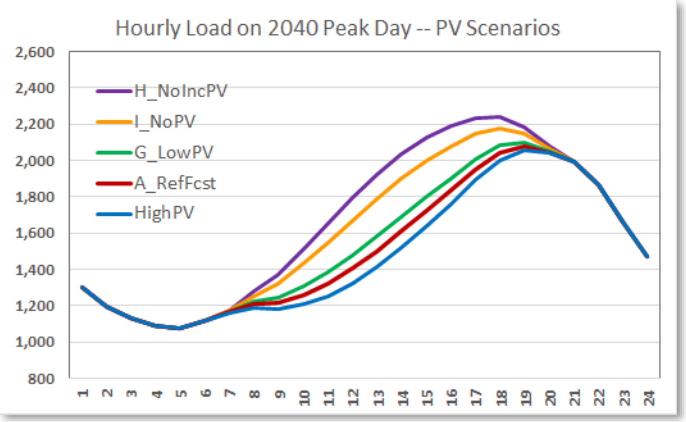
Behind the Meter PV Scenarios

- » PV Capacity in 2040
  - Base – 411 MW in 2040
  - High – 516 MW in 2040
  - Low – 327 MW in 2040
  - No Incremental – 128 MW in 2040
- » Peak Hour
  - » Without PV, hour ending 17 or 18 (4 pm to 6 pm)
  - » With PV, hour ending 19 (6 pm to 7 pm)



Year	Annual Sales (GWh)					Annual Peak (MW)				
	Base	High PV	Low PV	NoIncPV	No PV	Base	High PV	Low PV	NoIncPV	No PV
2020	8,791	8,791	8,791	8,813	9,085	1,862	1,862	1,862	1,870	1,958
2025	8,985	8,941	9,024	9,175	9,449	1,881	1,872	1,890	1,937	2,026
2030	9,086	8,994	9,168	9,425	9,700	1,921	1,902	1,939	2,000	2,088
2035	9,113	8,973	9,238	9,588	9,862	1,982	1,965	1,997	2,074	2,150
2040	9,304	9,115	9,472	9,902	10,177	2,080	2,058	2,100	2,177	2,238

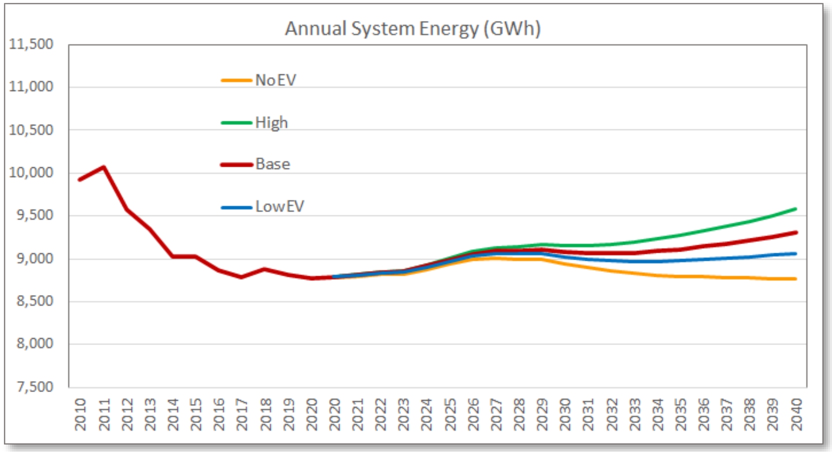
Excludes existing data centers and economic development loads



Electric Vehicle Scenarios

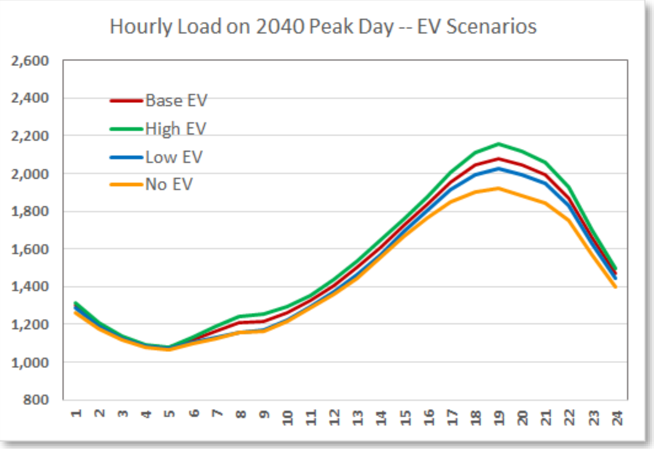
» The Reference forecast includes base levels of EV adoption. In the three scenarios, the number of vehicles in 2040 are as follows:
  - High PV: 183,000
  - Base PV: 127,000
  - Low PV: 92,000

» Annual sales and peak results are summarized below



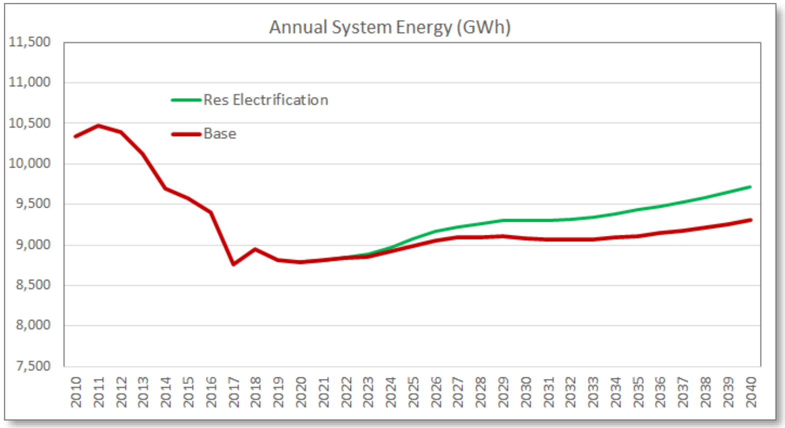
Year	Annual Sales (GWh)				Annual Peak (MW)			
	Base	High EV	Low EV	No EV	Base	High EV	Low EV	No EV
2020	8,791	8,793	8,791	8,778	1,862	1,862	1,861	1,859
2025	8,985	9,005	8,968	8,935	1,881	1,886	1,878	1,868
2030	9,086	9,159	9,023	8,936	1,921	1,939	1,907	1,881
2035	9,113	9,274	8,974	8,795	1,982	2,026	1,949	1,885
2040	9,304	9,576	9,067	8,772	2,080	2,155	2,025	1,919

Excludes existing data centers and economic development loads



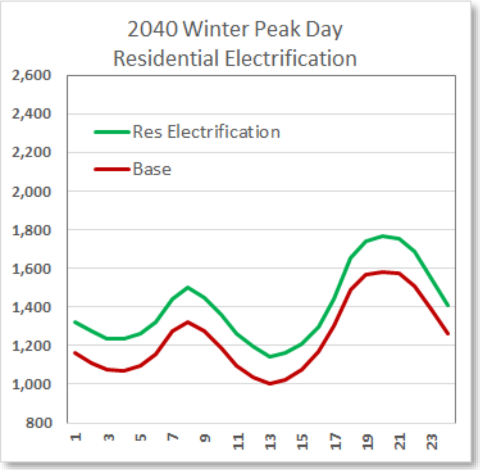
Residential Electrification

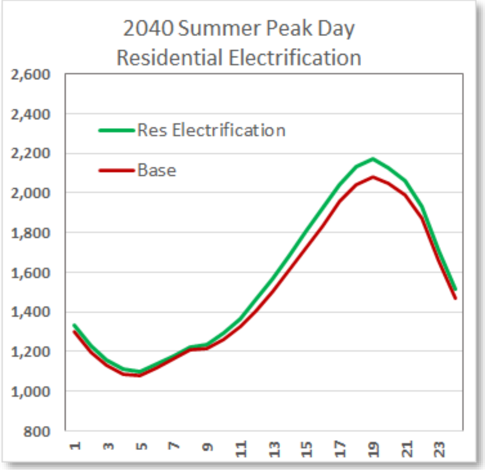
» Residential Electrification Scenario
- Gas/Propane not allowed in new homes
- Conversion incentives for existing homes
- Electric heat share rises from 15% to 45%
- Increased cooling loads as heat pumps replace evaporative cooling



Year	Annual Sales (GWh)		Annual Peak (MW)	
	Base	Building Electrification	Base	Building Electrification
2020	8,791	8,791	1,862	1,862
2025	8,985	9,069	1,881	1,899
2030	9,086	9,296	1,921	1,965
2035	9,113	9,429	1,982	2,050
2040	9,304	9,713	2,080	2,170

Excludes existing data centers and economic development loads





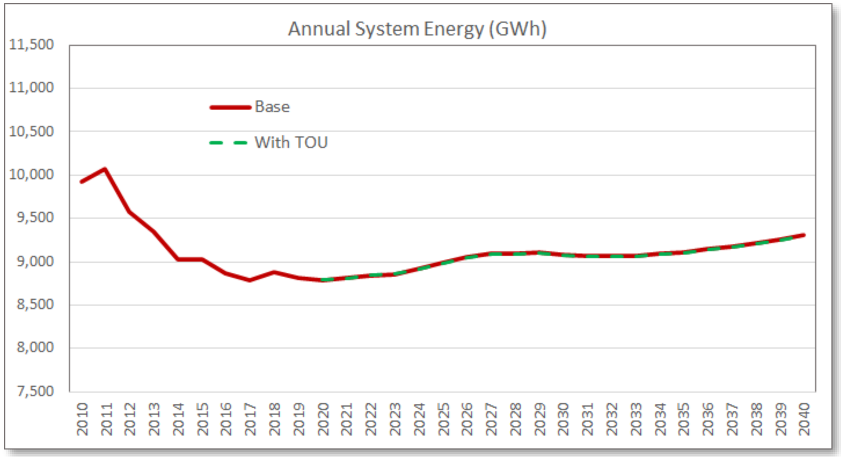
TOU Scenario

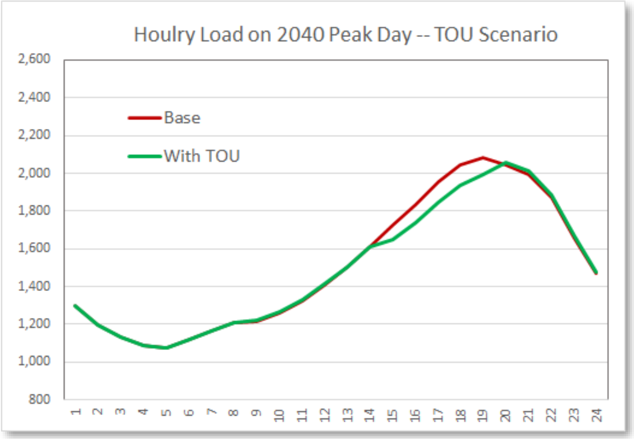
» The TOU scenario introduces residential TOU rates in 2024
  - 80% on simple TOU rate
  - 20% on Dynamic (Event-Day) Rate
    - Events on Summer Weekdays > 79 degrees

» TOU peak and energy impacts and the hourly profile of the impacts are taken from pilot studies

Year	Annual Sales (GWh)		Annual Peak (MW)	
	Base	TOU	Base	TOU
2020	8,791	8,791	1,862	1,862
2025	8,985	8,978	1,881	1,797
2030	9,086	9,078	1,921	1,869
2035	9,113	9,106	1,982	1,949
2040	9,304	9,297	2,080	2,057

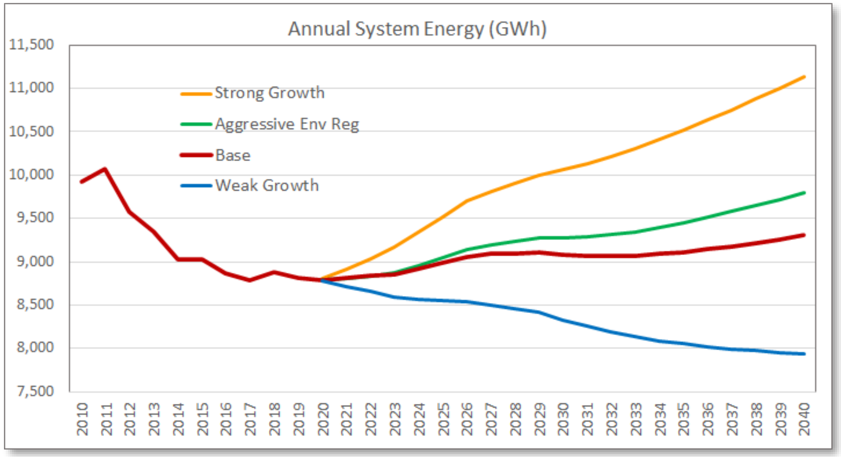
Excludes existing data centers and economic development loads





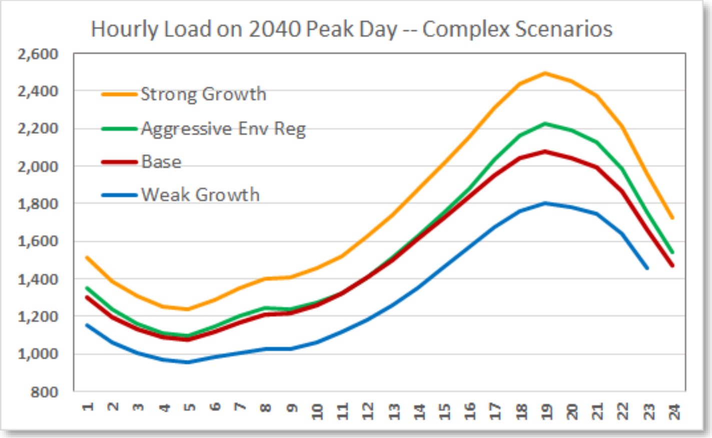
Complex Scenarios

- » Strong Growth Scenario
  - High Econ Growth, High PV, High EV, Residential Electrification
- » Weak Growth
  - Low Econ Growth, Low PV, Low EV
- » Aggressive Environmental Regulation
  - High PV, High EV, Residential Electrification



Year	Annual Sales (GWh)				Annual Peak (MW)			
	Base	Strong Growth	Weak Growth	Aggressive Env Reg	Base	Strong Growth	Weak Growth	Aggressive Env Reg
2020	8,791	8,802	8,781	8,793	1,862	1,863	1,860	1,862
2025	8,985	9,521	8,546	9,046	1,881	1,983	1,800	1,894
2030	9,086	10,062	8,328	9,276	1,921	2,115	1,773	1,966
2035	9,113	10,517	8,052	9,449	1,982	2,288	1,771	2,078
2040	9,304	11,131	7,937	9,797	2,080	2,491	1,800	2,223

Excludes existing data centers and economic development loads

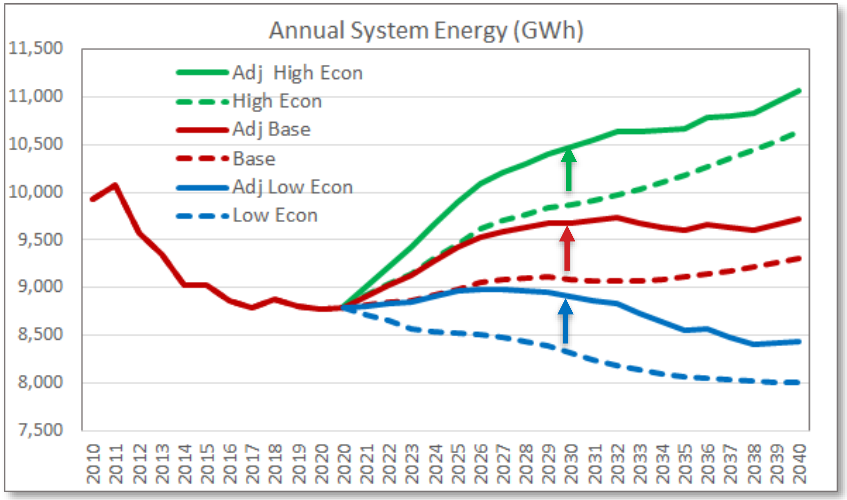


Putting EE on the Supply Side

» The forecast scenarios all include the same aggressive assumptions about Energy Efficiency.

» EIA efficiency forecasts for the region were accelerated to reflect aggressive levels of PNM program activity.

» To put EE on an equal footing with supply-side options, the scenario forecasts are adjusted upward to remove the impacts of incremental program activity, including:
  - The Program bundle for 2021 to 2025
  - Bundles A to E for 2026 and beyond



» To compute the adjustments, load shape impacts by EE bundle are accumulated across years based on average measure life of each bundle. The cumulative impacts are then added to the hourly scenario forecast. The resulting adjusted hourly load shapes are the basis for the IRP process treating EE programs as a supply-side resource. The chart depicts the impact of this adjustment process for annual system energy in the three economic growth scenarios.

THANK YOU

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Effective Load Carrying Capability Study
Astrapé Consulting

PNM ELCC Analysis and Preliminary Results

Astrapé Consulting

August 2020

ASTRAPÉ CONSULTING
innovation in electric system planning

Astrapé Consulting

- **Energy consulting firm with a focus on Resource Adequacy and Resource Planning**
  - Performs resource adequacy studies for utilities throughout the U.S. and internationally including California, MISO, SPP, ERCOT, TVA, Southern Company, Duke energy and others
    - Target Reserve Margin Studies
    - ELCC Studies for solar, wind, and battery
    - Renewable Integration Studies
    - Licenses and provides consulting services using proprietary SERVM model

Nick Wintermantel

Principal

Chase Winkler

Consultant

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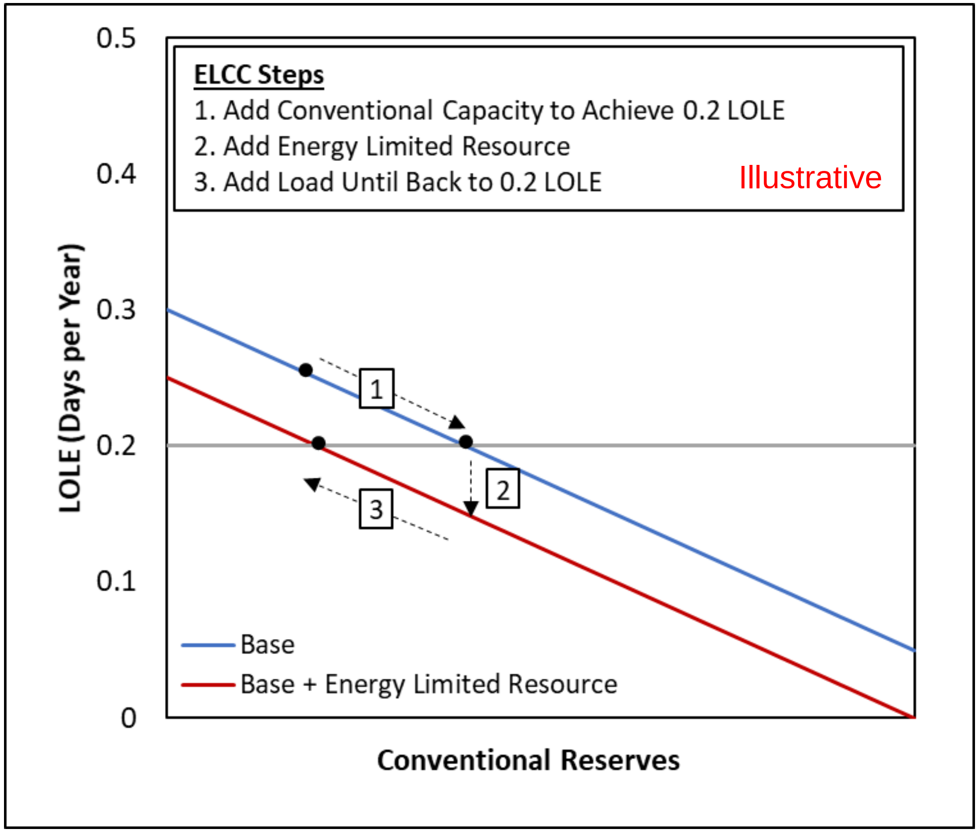
Purpose

- **The purpose of this study is to quantify the reliability contribution of the following resource types on the PNM system:**
  - Energy Limited Resources (Demand Response, Energy Storage), and
  - Non-dispatchable Resources (Wind, Solar PV)

Analysis was performed for anticipated load and resources by 2023.

Effective Load Carrying Capability

Effective Load Carrying Capability (ELCC) describes the reliability contribution of an energy limited or non-dispatchable resource



Effective Load Carrying Capability (ELCC) analysis adds load to offset the reliability contribution of the resource type under study. For example, an energy limited resource may be added to the system to improve reliability. This may be offset with load until the reliability target is achieved to quantify the reliability benefit.

The same process may be performed on a non-dispatchable resource.

0.2 Loss of Load Expectation (LOLE) is utilized as the reliability target and equates to 2 days with generation shortage every 10 years.

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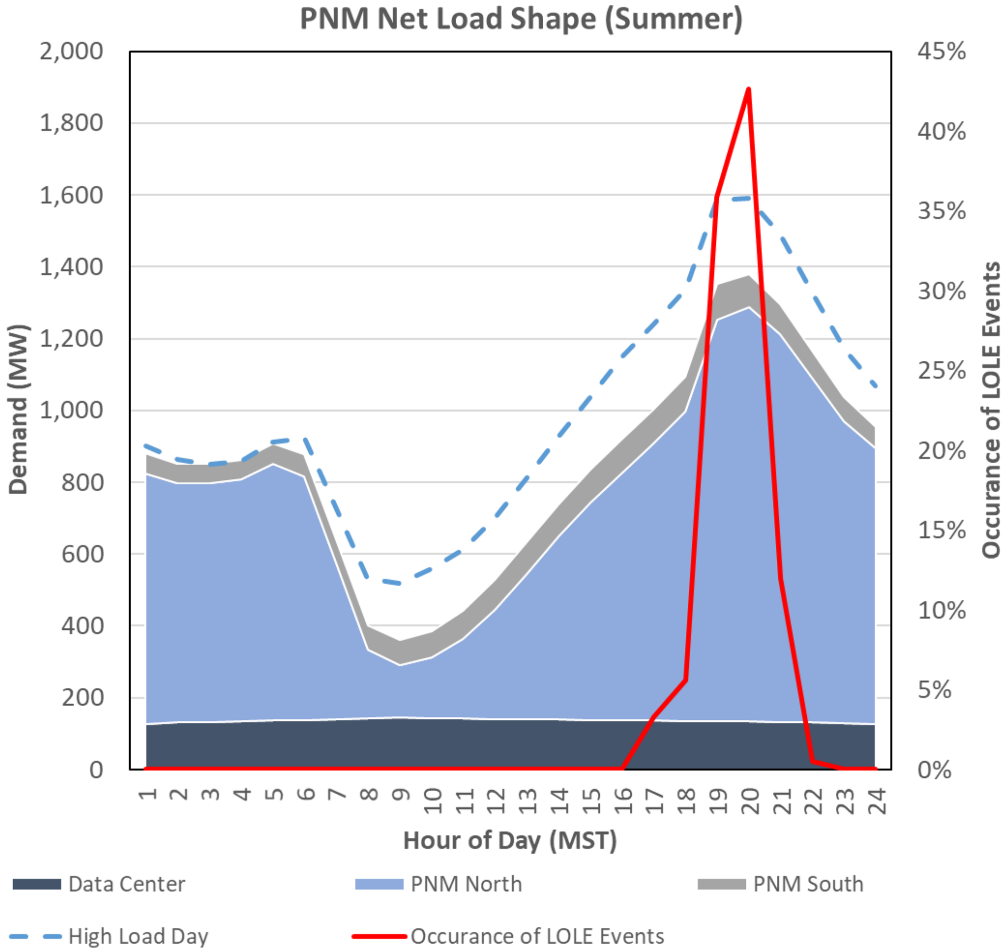
PNM Net Load and Reliability Hours

By 2023, the reliability risk hours shift to 19-20 due to increased solar penetration



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Preliminary Results

Wind Nameplate Capacity	Capacity Value MW	Average ELCC	Incremental ELCC
607	185	30%	31%
1,000	228	23%	11%
1,500	252	17%	5%
2,000	262	13%	2%
2,500	263	11%	1%
Solar Nameplate Capacity	**Capacity Value MW**	**Average ELCC**	**Incremental ELCC**
1,026	144	14%	14%
1,200	162	14%	10%
1,500	183	12%	7%
2,000	209	11%	5%
2,500	210	8%	0%
Battery Nameplate Capacity*	**Capacity Value MW**	**Average ELCC**	**Incremental ELCC**
300	297	99%	99%
500	463	93%	83%
700	615	88%	76%
1,000	755	75%	46%
1,500	895	60%	28%
DR Nameplate Capacity	**Capacity Value MW**	**Average ELCC**	**Incremental ELCC**
60	54	90%	90%
120	102	85%	80%
180	144	80%	70%

Results are Preliminary and are being validated and reviewed

*Results shown with 4 hour duration. Additional analysis is being performed for other durations

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Technology Review & Candidate Resources

Technology Review & Candidate Resources

- Renewable Resources
  - Wind
  - Solar PV (Single-Axis Tracking)

- Dispatchable Storage / Energy Limited Resources
  - Lithium-Ion Batteries
  - Flow Batteries**
  - Compressed Air Storage**
  - Liquified Air Storage**
  - Pumped Hydro Storage**
  - Gravitational Storage**
  - Thermal Energy Storage**

- Dispatchable Resources (Not Energy Limited Resources)
  - Natural Gas (Aero Derivative)**
  - Natural Gas (Aero Derivative) with Hydrogen Conversion**
  - Small Modular Reactors**
  - Natural Gas with CCUS**

***Preliminary and subject to change**

**PNM continuing to review and work with RFI respondents and other sources to finalize data for modeling.

Technology Review & Candidate Resources

- Renewable Resources
  - Wind
  - Solar PV (Single-Axis Tracking)

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***Preliminary and subject to change**

**PNM continuing to review and work with RFI respondents and other sources to finalize data for modeling.

Existing Demand Response

- Existing Demand Response Programs performance summary from 2019 & 2020 to date

  - Existing programs are voluntary and allow participants to opt out of events at will

  - Power Saver provided virtually no contribution to 10-minute response (mainly due to how the program cycles participants during events).
  - Average hourly reduction of approx. 21.5 MW

  - In 2020 to date, Peak Saver has on average only been able to meet 66% of its nominated capacity, approx. 15.5 MW. The most resent four events (August 2020) average to only approximately 11 MW.
  - The capacity provided by Peak Saver typically contributes fully to 10-minute response.

Modeling characteristics of existing DR will be updated.

PNM Futures, Scenarios & Sensitivities
PNM & E3

Defining Terminology

- **A Scenario describes a set of decisions made by PNM which specify retirement dates for various generator**
  - The Core Scenario is based on the current retirement schedule and defines the starting place for examining retirement scenarios
- **A Future describes a set of forecasts that describe the state of the world. Generally, PNM has no ability to influence factors that determine which future becomes reality**
  - The Reference Future is defined by what PNM believes to be the most likely set of forecasts
- **Sensitivities describe perturbations from the Reference Future or other future, in which a single element of the future is changed to understand how sensitive the results are to the changed variable**

Scenario Analysis Framework

	Upstream IRP Studies	Initial Scenario Analysis	Sensitivity Analysis	Action Plan Risk Analysis
	0	1	2	3
Overview:	Conduct any studies needed to inform inputs & assumptions for IRP, including ELCC studies for renewables & storage, RFI for technology details, DSM potential studies	Run “core” scenario analysis to determine optimal portfolio under “Reference Case” assumptions	Study core and non-core scenarios under a range of alternative futures and core scenario under finer sensitivities to examine how key uncertainties could affect optimal short- and long-term decisions.	After freezing key decisions in “Action Plan” window, test resilience of scenario to most impactful uncertainties identified by sensitivity analysis
Key Models:	SERVM (Reliability)	Encompass (Capacity Expansion & Production Simulation); SERVM (Reliability)	Encompass (Capacity Expansion)	Encompass (Capacity Expansion)

Early analysis will determine a “core scenario”

Scenario	Four Corners Final Year	Reeves Final Year	Other Key Decision Points
1	2024	2030*	…
2	2028	2030*	…
3	2031	2030*	…
4	2024	2039	…
5	2028	2039	…
6	2031	2039	…
…	…	…	…

*approximate end of depreciable life based on current rates

Examples of decisions to consider – not exhaustive, nor binding

Futures explore a range of plausible forecast combinations – though not every future will be run for every scenario

Future* / Component	Load Forecast	BTM PV Forecast	EV Adoption Forecast	Building Electrification Forecast	Gas Price Forecast	CO2 Price Forecast	Renewable & Battery Capital Costs	Federal Tax Credits
(A) Reference Future	Mid	Mid	Mid	Mid	Mid	Mid	Mid	Expire
(D) High Economic Growth	**High**	**High**	**High**	**High**	Mid	Mid	Mid	Expire
High Economic Growth + New Data Center Load	**Very High**	**High**	**High**	Mid	Mid	Mid	Mid	Expire
(E) Low Economic Growth	**Low**	**Low**	**Low**	Mid	**Low**	Mid	Mid	Expire
Low Econ Growth + Loss of Large Customers	**Very Low**	**Low**	**Low**	Mid	**Low**	Mid	Mid	Expire
(L) Aggressive Environmental Regulation	Mid	**High**	**High**	**High**	**High**	**High**	Mid	**Renewed**
Aggressive Environmental Regulation + Fast Technology Advancement	Mid	**High**	**High**	**High**	**High**	**High**	**Low**	**Renewed**
Aggressive Environmental Regulation + Slow Technology Advancement	Mid	**High**	**High**	**High**	**High**	**High**	**High**	**Renewed**

*Parenthetical letters indicate corresponding load forecast from earlier slides

Examples of futures – not exhaustive, nor binding

Futures analysis of core scenarios to be more extensive than analysis of non-core scenarios

Future* \ Scenario	Core Scenario	Alternative 1	Alternative 2	…
(A) Reference Future	✓	✓	✓	…
(D) High Economic Growth	✓		✓	…
High Economic Growth + New Data Center Load	✓			…
(E) Low Economic Growth	✓		✓	…
Low Econ Growth + Loss of Large Customers	✓			…
(L) Aggressive Environmental Regulation	✓	✓	✓	…
Aggressive Environmental Regulation + Fast Technology Advancement	✓	✓		…
Aggressive Environmental Regulation + Slow Technology Advancement	✓	✓		…

*Parenthetical letters indicate corresponding load forecast from earlier slides

Examples – not exhaustive, nor binding

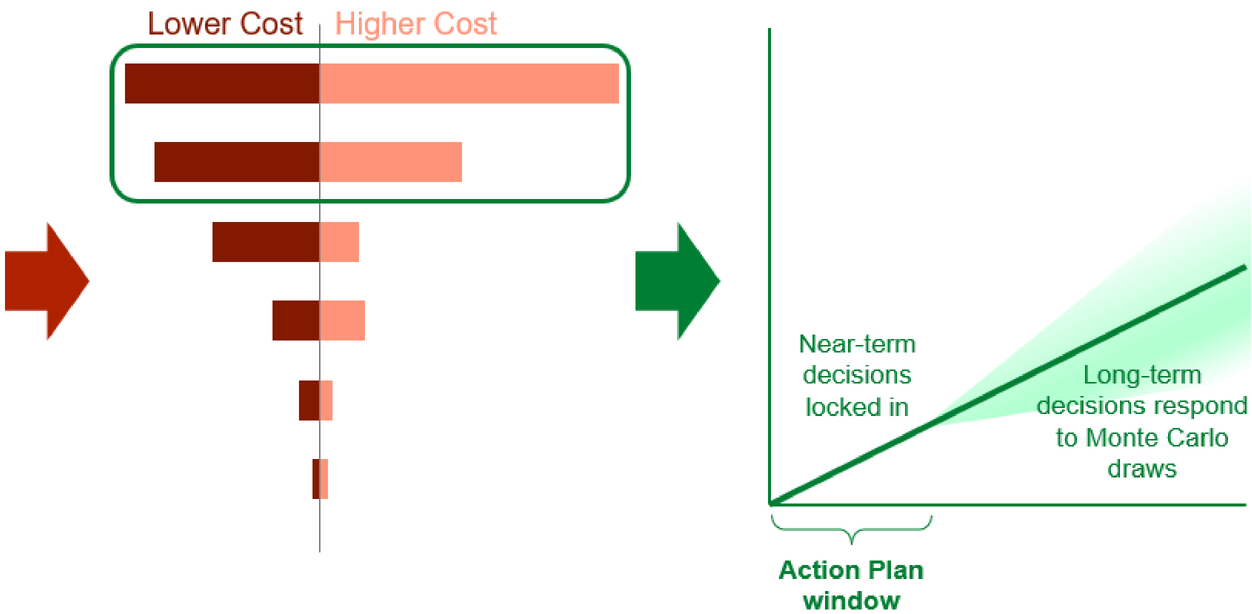
Futures analysis of core scenarios to be more extensive than analysis of non-core scenarios

Component / Sensitivity*	Load Forecast	BTM PV Forecast	EV Adoption Forecast	Building Electrification Forecast	Gas Price Forecast	CO2 Price Forecast	Renewable & Battery Capital Costs	Federal Tax Credits
(B) High Load	**High**	Mid	Mid	Mid	Mid	Mid	Mid	Expire
Super-high Load	**Super High**	Mid	Mid	Mid	Mid	Mid	Mid	Expire
(C) Low Load	**Low**	Mid	Mid	Mid	Mid	Mid	Mid	Expire
(N) TOU Pricing	**TOU Load Shaping**	Mid	Mid	Mid	Mid	Mid	Mid	Expire
(F) High BTM PV	Mid	**High**	Mid	Mid	Mid	Mid	Mid	Expire
(G) Low BTM PV	Mid	**Low**	Mid	Mid	Mid	Mid	Mid	Expire
(I) Zero BTM PV	Mid	**Zero**	Mid	Mid	Mid	Mid	Mid	Expire
(J) High EV Adoption	Mid	Mid	**High**	Mid	Mid	Mid	Mid	Expire
(K) Low EV Adoption	Mid	Mid	**Low**	Mid	Mid	Mid	Mid	Expire
(M) High Building Electrification	Mid	Mid	Mid	**High**	Mid	Mid	Mid	Expire
High Gas Price	Mid	Mid	Mid	Mid	**High**	Mid	Mid	Expire
Low Gas Price	Mid	Mid	Mid	Mid	**Low**	Mid	Mid	Expire
IRP Rule $40 CO2 Price	Mid	Mid	Mid	Mid	Mid	**$40/ton**	Mid	Expire
IRP Rule $20 CO2 Price	Mid	Mid	Mid	Mid	Mid	**$20/ton**	Mid	Expire
IRP Rule $8 CO2 Price	Mid	Mid	Mid	Mid	Mid	**$8/ton**	Mid	Expire
PNM High CO2 Price	Mid	Mid	Mid	Mid	Mid	**High**	Mid	Expire
PNM Mid CO2 Price	Mid	Mid	Mid	Mid	Mid	Mid	Mid	Expire
PNM Low CO2 Price	Mid	Mid	Mid	Mid	Mid	**Low**	Mid	Expire
Fast Technology Advancement	Mid	Mid	Mid	Mid	Mid	Mid	**Low**	Expire
Slow Technology Advancement	Mid	Mid	Mid	Mid	Mid	Mid	**High**	Expire
Tax Credits Extension	Mid	Mid	Mid	Mid	Mid	Mid	Mid	**Renewed**

*Parenthetical letters indicate corresponding load forecast from earlier slides
Examples – not exhaustive, nor binding

Sensitivity results inform foci of risk analysis

Sensitivity*
(B) High Load
Super-high Load
(C) Low Load
(N) TOU Pricing
(F) High BTM PV
(G) Low BTM PV
(I) Zero BTM PV
(J) High EV Adoption
(K) Low EV Adoption
(M) High Building Electrification
High Gas Price
Low Gas Price
$40 CO2 Price
$20 CO2 Price
$8 CO2 Price
$0 CO2 Price
Fast Technology Advancement
Slow Technology Advancement
Tax Credits Extension



*Parenthetical letters indicate corresponding load forecast from earlier slides
Examples – not exhaustive, nor binding

Audience Future, Scenario & Sensitivity Ideas

- Online Participants – please feel free to enter scenario suggestions in the Chat window. They will be read out loud and captured.

Audience Future, Scenario & Sensitivity Ideas (Received to Date)

- Economic Cycles / Tax Policies*
- EV's & Home Batteries*
- Ancillary Service Rates#
- Additional DC Interconnects#
- Carbon Free by 2030#
  - PSH
  - Thermal Storage
- Major Carbon Pricing*

*PNM believes these are captured within PNM futures and scenarios, but would appreciate audience discussion and feedback

#Requires additional discussion/clarification

Next Meeting September 8, 2020

- Deep into ELCC Analysis?
- Final updates on modeling parameters
- Final updates on PNM Futures, Scenarios & Sensitivities
- Finalize Stakeholder Futures, Scenarios & Sensitivities

Tentative Meeting Schedule Through November 2020

July 31:	Kickoff, Overview and Timeline
August 20:	The Energy Transition Act & Utilities 101
August 29:	Resource Planning Overview: Models, Inputs & Assumptions
September 6:	Transmission & Reliability (Real World Operations)
September 24:	Resource Planning "2.0"
October 22:	Demand Side/EE/Time of Day
November 19:	Battery and Energy Storage; Sandia National Laboratory Guest Presentation
January 14:	Technology Review
August 25, 2020:	Current Events, Commodities Forecast, Load Forecast, Modeling Updates, ELCC Study, Process and Scenario Update
September 8, 2020:	Finalize Scenarios and Modeling Updates
October 20, 2020:	Process Update
November 25, 2020:	Draft IRP Completed

*NOTE: Date Change

** NOTE: Topic Change

Registration for Upcoming Sessions

Please register for each upcoming session separately. You will receive a reminders two days in advance and the day of the event.

To access documentation presented so far and to obtain registration links for upcoming sessions, go to:

www.pnm.com/irp

Other contact information:

irp@pnm.com for e-mails

THANK YOU