

The Siemens logo is displayed in a white box in the top left corner. The background of the entire slide is a composite image showing a gas flare on the left, a wind turbine in the center, and a high-voltage power transmission tower on the right.

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Forecasts and Assumptions for IRP

Prepared for PNM

September 2016

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Agenda

- Introduction
- Tools and Methodology
 - AuroraXMP – electric market dispatch analysis
 - GPCM – natural gas pipeline flow analysis
- Baseline Scenario Assumptions and Forecasts
- Alternate Scenario Assumptions and Forecasts
 - Approach
 - High
 - Low
- Questions and Discussion

Introduction

- Pace Global developed market assumptions for PNM's 2017 IRP process.
- The key inputs are natural gas prices, carbon prices and power prices.
- Pace Global used its comprehensive power market modeling tools to generate these forecasts under a Baseline and High and Low scenarios to reflect uncertainty of market conditions over the long-term planning horizon.

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

- This presentation summarizes the methodology used, assumptions and forecasts for the IRP process.



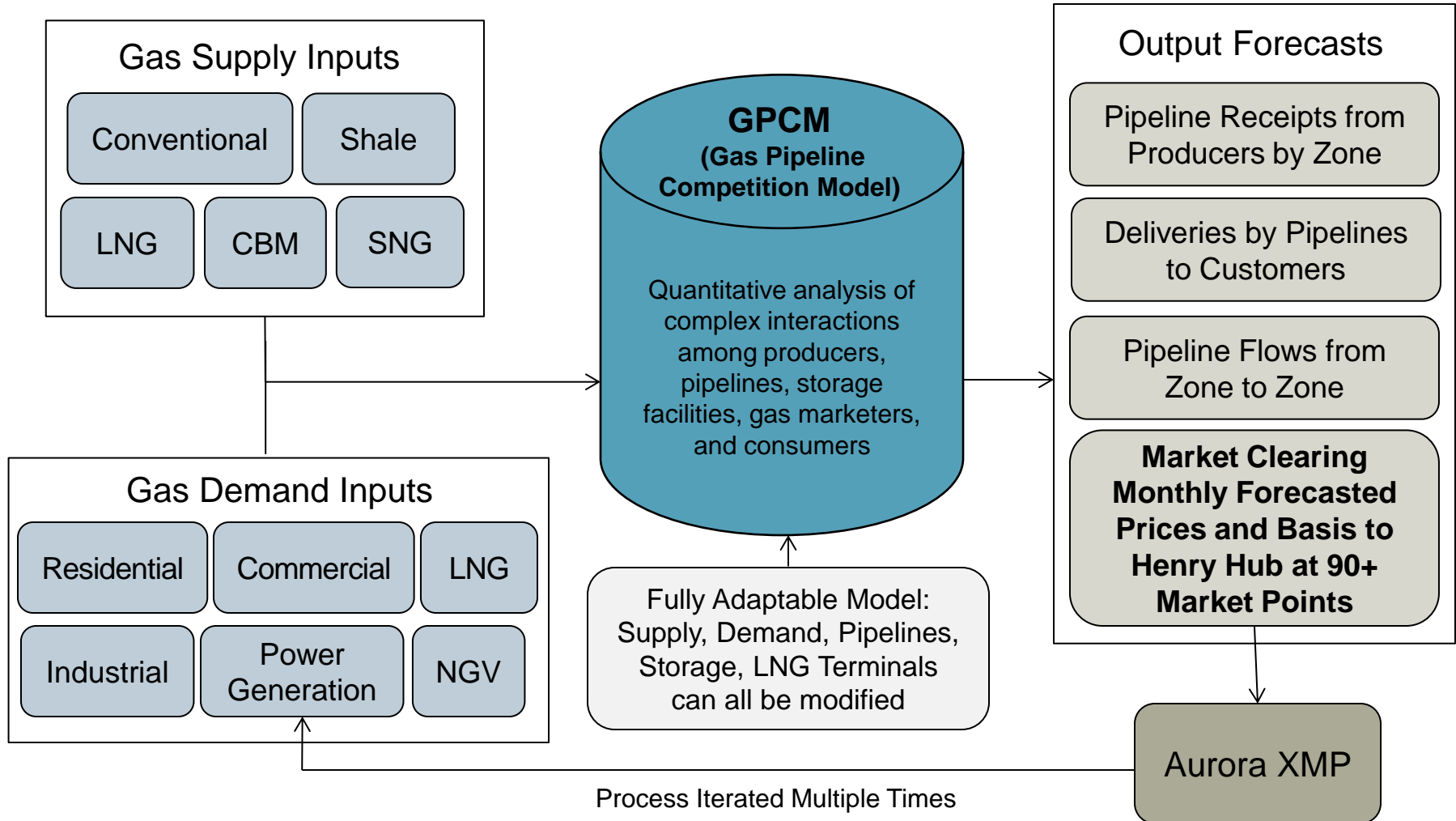
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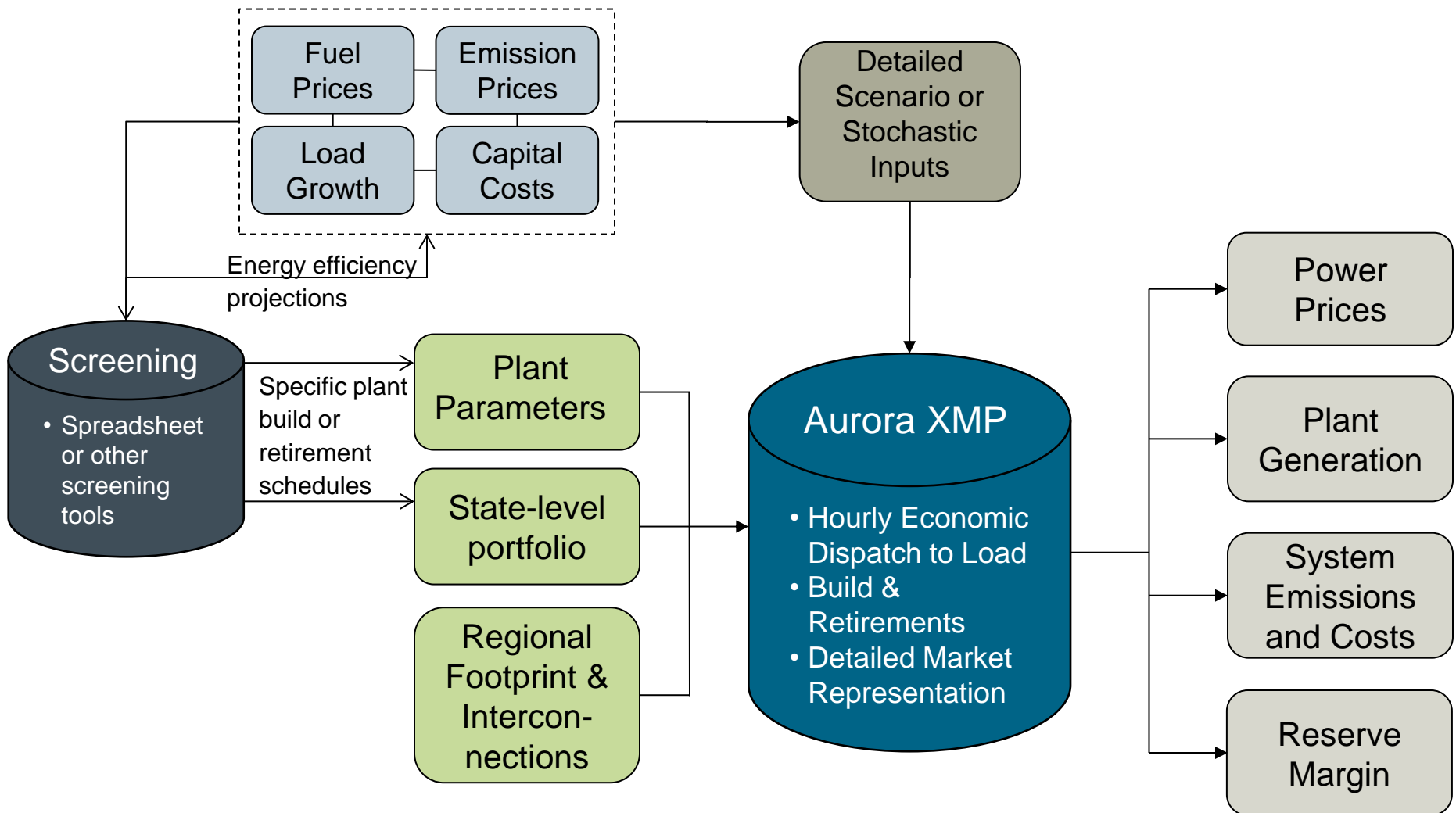
Tools and Methodology

Natural Gas Prices Generated Using GPCM Integrated with Aurora XMP to Provide A Balanced and Iterative View of Gas Burn and Prices

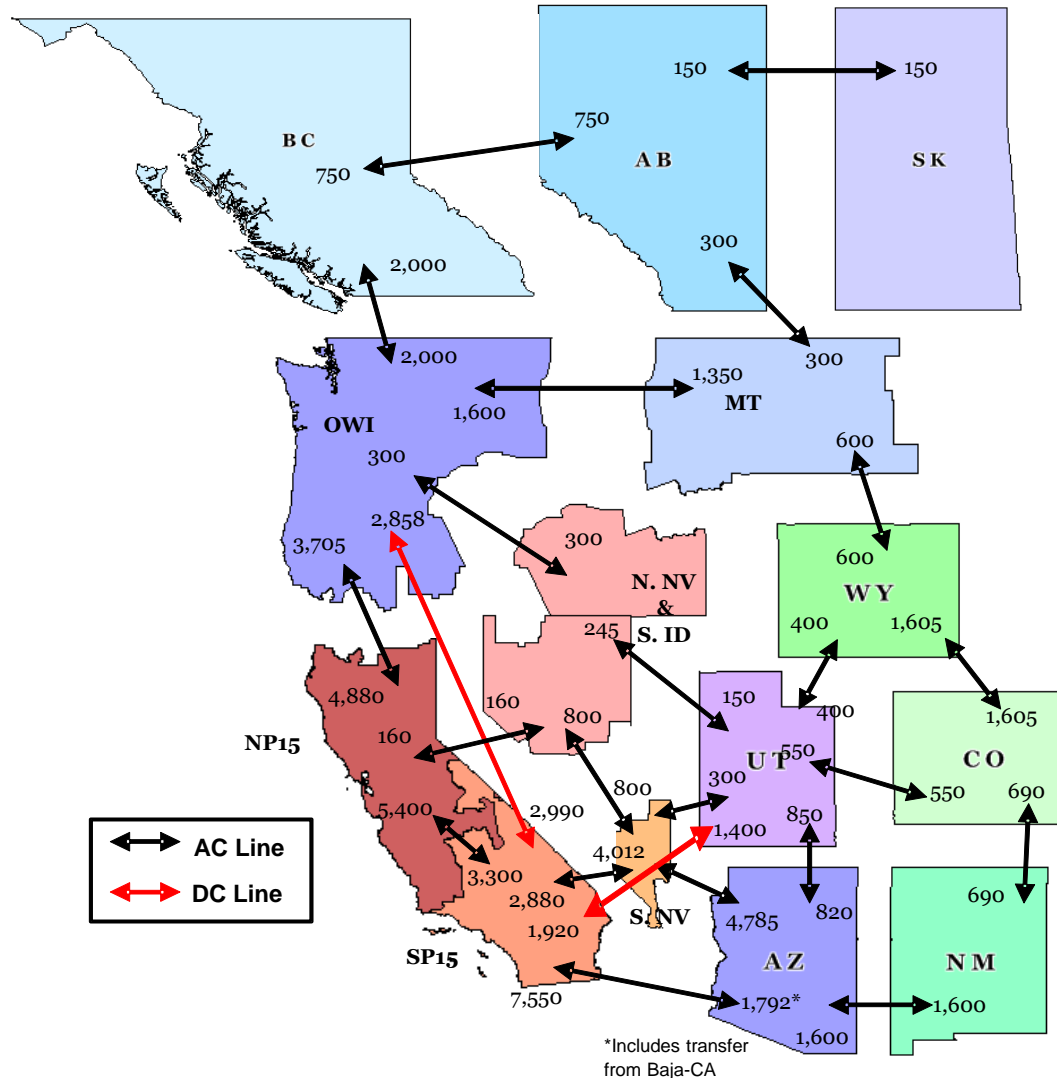


Pace Global Zonal Market Analysis, Aurora XMP

Comprehensive Tool for Analyzing Power Markets



Analysis Was Performed with Full WECC Footprint AuroraXMP Regional and National Analysis



Approach to Pricing Carbon Under the Clean Power Plan Starts with the Shadow Price for Carbon

The shadow price represents the marginal cost of carbon reduction for a given set of conditions – in this case limits under the Clean Power Plan (CPP).

- Accounts for operational parameters but does *not* directly account for capital costs and other longer-term costs that may be needed to comply with carbon limits
 - Measured in terms of \$/short ton CO₂ – can be converted to \$/MWh to represent ERC prices in rate regime
 - Pace Global relies on AURORAxmp's capabilities to solve for carbon shadow pricing within dispatch simulations
- Pace Global solves for the shadow price of carbon based on national dispatch analysis to determine Baseline carbon price.



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Baseline Scenario

Overview Baseline Assumptions

The Baseline Scenario

- Key assumptions driving the Baseline scenario are:
 - In the short-term (2016-2018), the Baseline assumes a business-as-usual perspective for all market drivers, consistent with market forwards.
 - By 2018, it is assumed that most states, including New Mexico will opt for a mass-based CPP compliance path, effective in 2022:
 - Easier to administer than rate-based
 - Retirements aid NM compliance
 - States will join to create liquid trading market
 - Gas prices increase somewhat from current low levels beginning around 2018 as demand catches up to shale supply.
 - Power prices move up with gas and as CPP compliance begins in 2022.
 - Long term, gas and power prices tend to level out in real terms.

	Baseline		
Time Frame:	ST	MT	LT
Load Growth	B	↗	↗
Gas Prices	B	↗	→
Coal Prices	B	↗	↗
CO2 Prices	B	↗	↗
Power Prices	B	↗	↗
Capital Cost - Gas	B	→	↘
Capital Cost - RE	B	↘	↘
Retirements	B	↗	↗
Additions	B	↗	↗
Economy	B	↗	↗

ST=2016-18, MT=2019-25, LT=2026-36

Natural Gas Supply Outlook by Source

Near Term – 2016

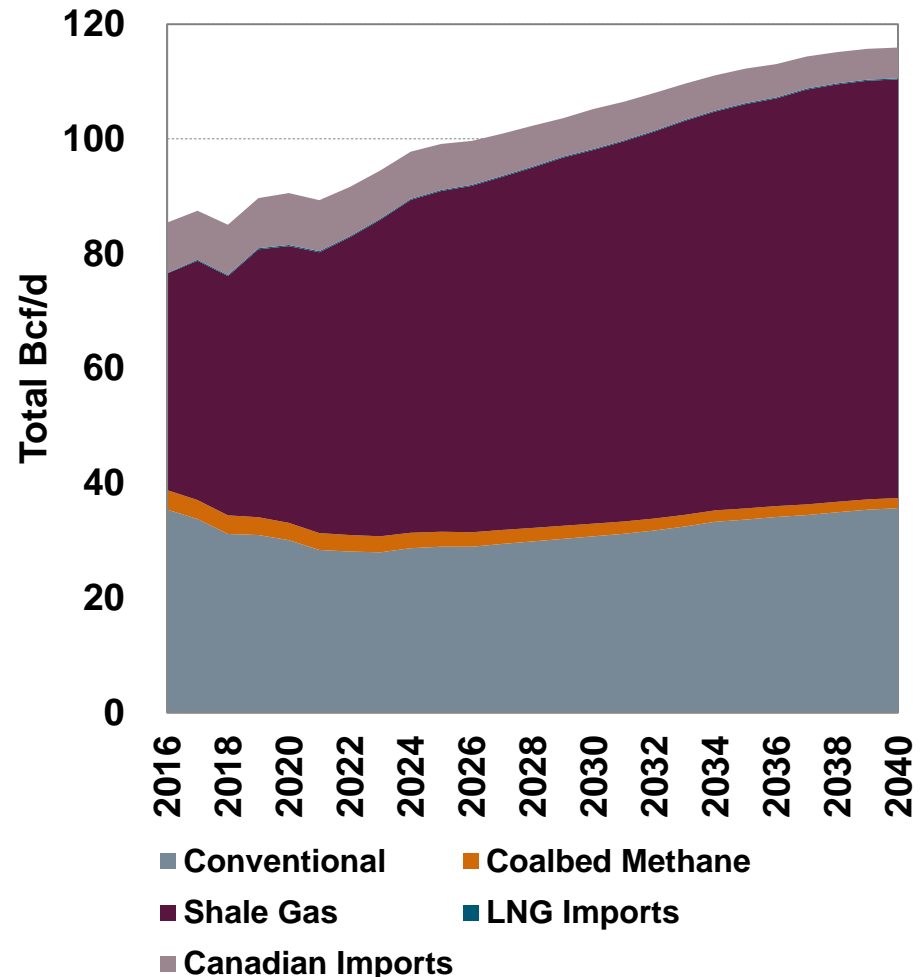
Production growth finally slows in 2016 as continued low gas prices begin to take a toll on gas producers.

Midterm – 2017-2020

L48 production growth will face some difficulty as low gas prices persist and producers face bankruptcy, but anticipated demand will help to buoy an increase in supply.

Long Term – 2021-2040

Production growth resumes robust growth in the long-term, with the majority of growth coming from shale.



Source: Pace Global

Natural Gas Demand Outlook by End Use Sector

Near Term – 2016

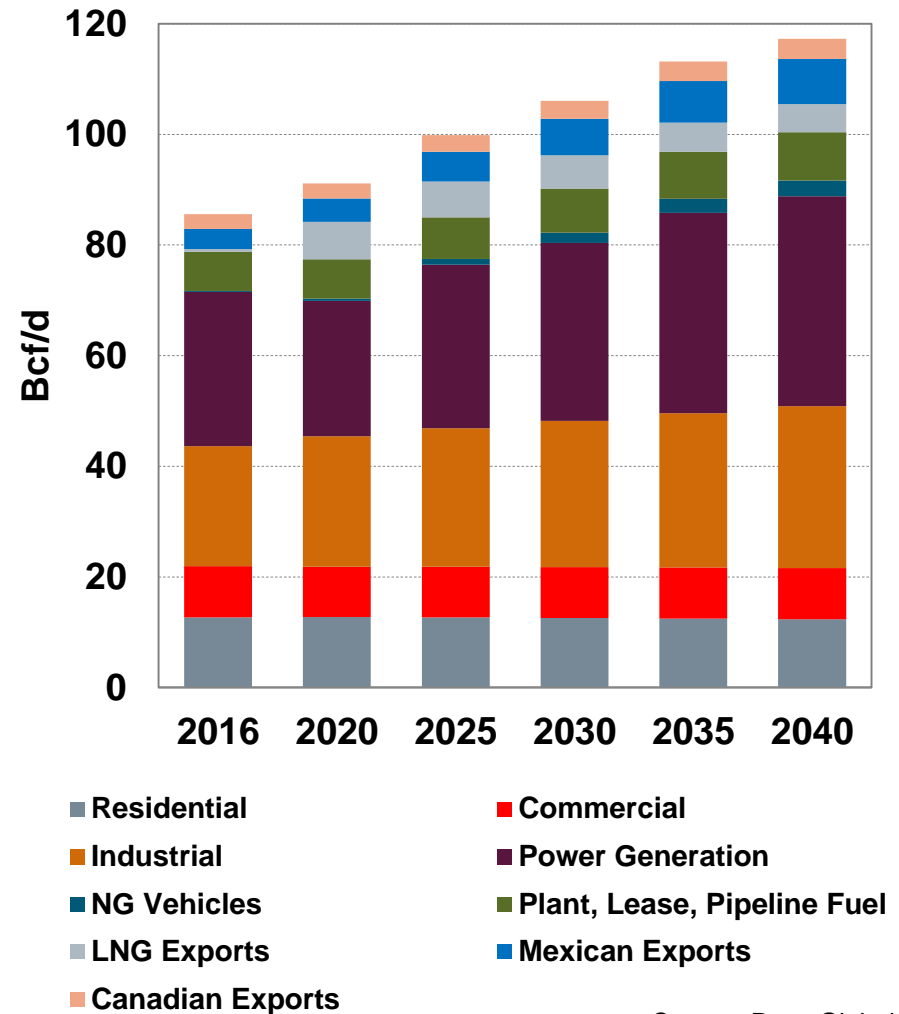
Power burn YTD in 2016 has averaged 24.2 Bcf/d, on a similar path to 2012 when gas prices were low. Summer burn is expected to push this average upward.

Midterm – 2017-2020

A ramp-up in demand from LNG exports, Mexican exports, and industrial demand will add 8.7 Bcf/d by 2020 over 2016.

Long Term – 2021-2040

Demand will continue to grow, with the power sector continuing to take market share from coal-fired generation and as a complement to intermittent renewables.



Source: Pace Global

Power Sector Natural Gas Generation Outlook

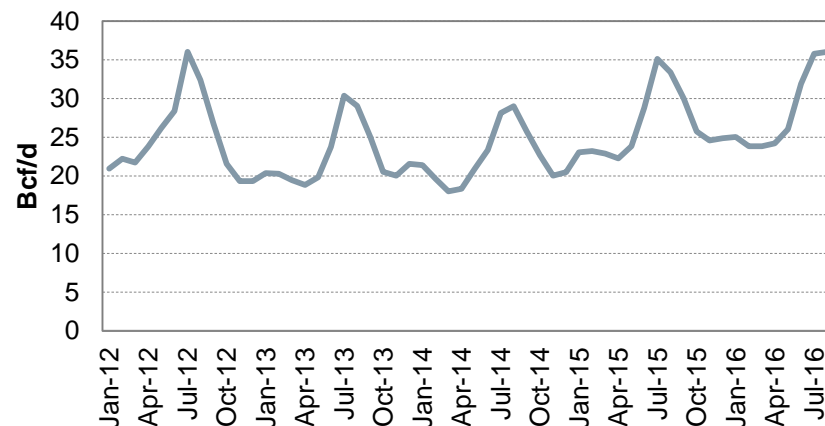
Power Sector Gas Burn Since 2012

Continued low gas prices are supporting higher gas burn levels, both in the summer trough months and in the peak winter months. Power sector gas consumption is likely to be strong in 2016-17 with a continuation of low gas prices.

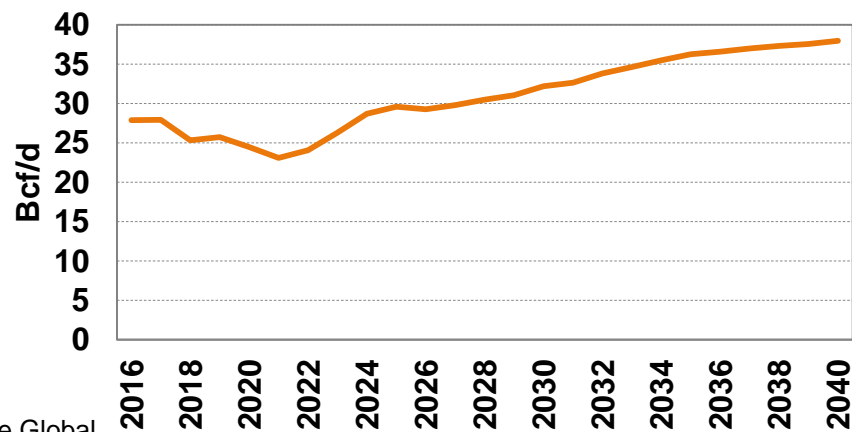
Outlook for Power Sector Gas Burn

While the CPP was issued in Aug. 2015, a recent SCOTUS stay has put many states' plans on hold. Expected gas burn will see a ramping up as the plan enters into the compliance period post-2022.

Monthly U.S. Gas Burn Since 2012

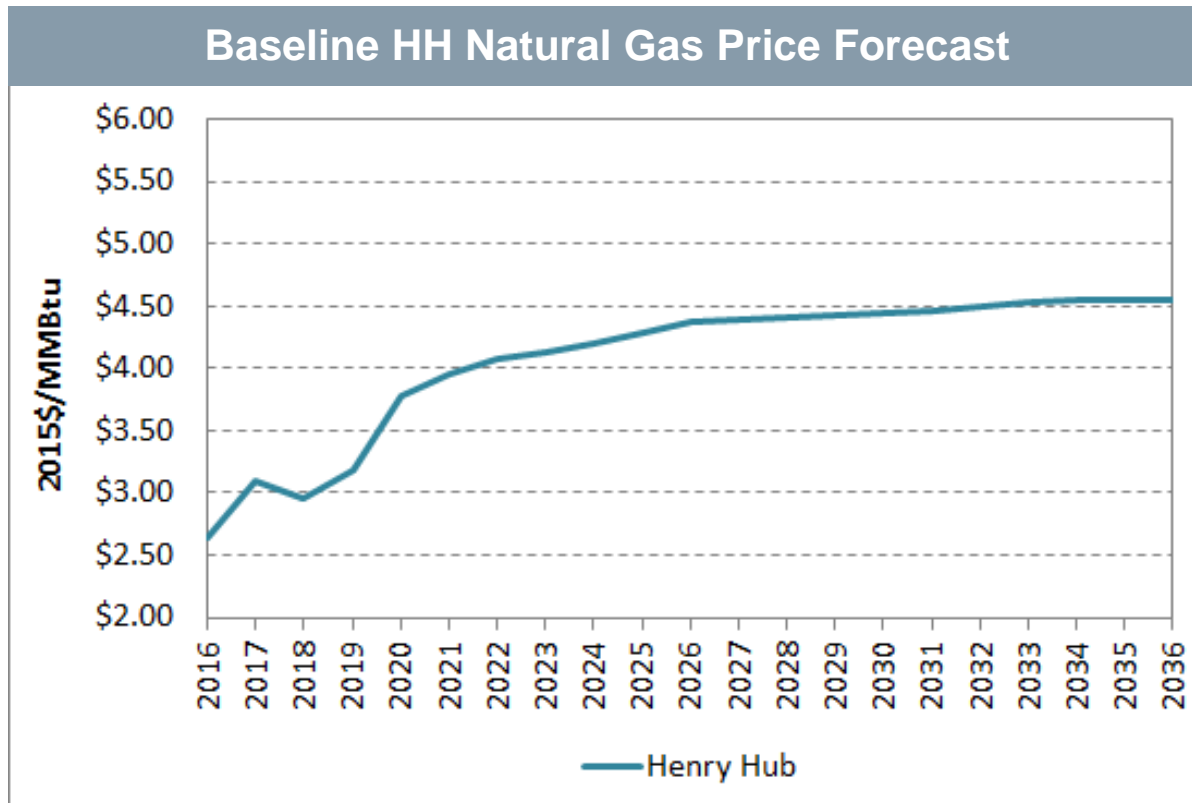


Forecasted Annual U.S. Gas Burn



Source: Pace Global

Baseline Natural Gas Prices – Henry Hub

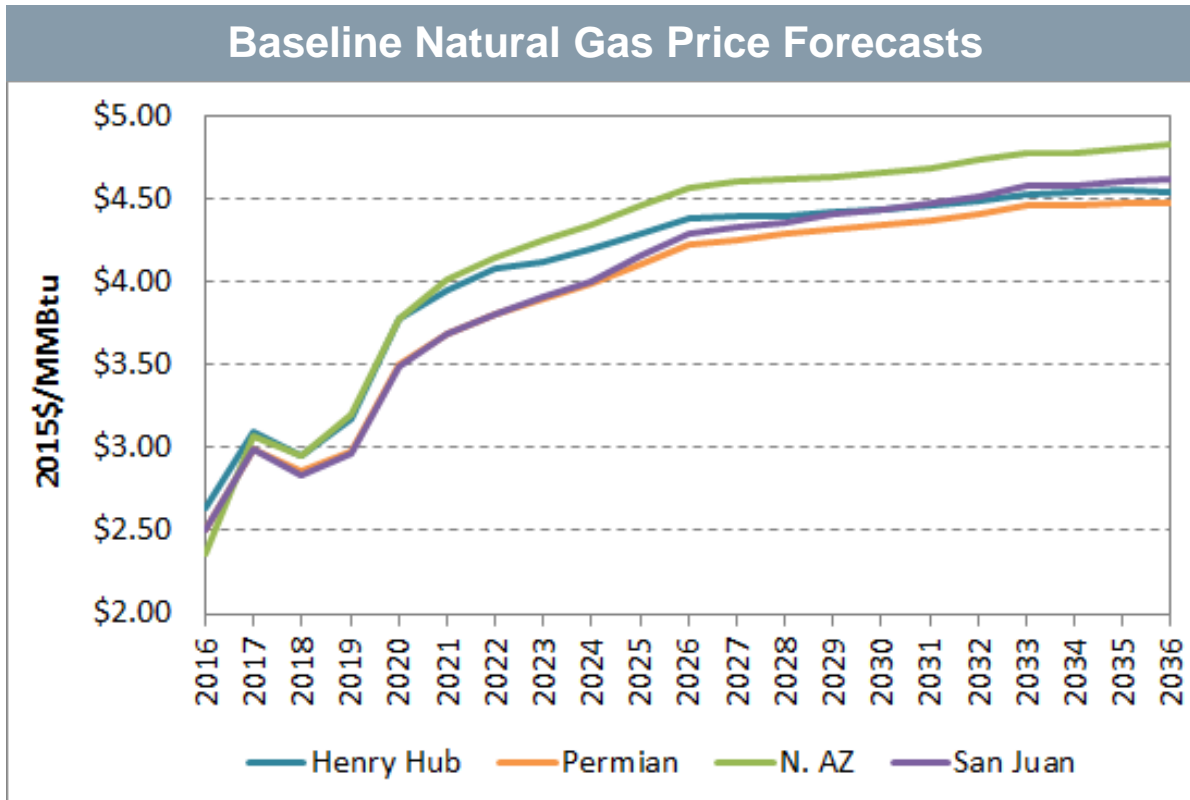


Henry Hub

- **Near Term** - forwards indicate average price near between \$2.50-\$3/MMBtu, shale gas oversupply
- **Mid-Term** - Gulf Coast prices expected to rise as a new demand (LNG and Mexican exports, industrial use) turn the region into a premium market
- **Long-Term** - Ample shale supplies will constrain prices to between \$4.00-5.00, gradually increasing over time.

Note: Forecast based on NYMEX forwards as of July 2016

Baseline Natural Gas Prices – Henry Hub and Key Southwest Hubs



Note: Forecast based on NYMEX forwards as of July 2016

Permian

- Longstanding production region in southwest NM / western TX. Permian gas is less competitive than new shale gas sources (Eagle Ford, Utica, Marcellus) that are meeting new Gulf Coast demand (LNG, etc.) driving negative basis for the forecast period.

San Juan

- Longstanding conventional production region in northwest NM into southern CO. Production of gas fallen significantly w/ shale economics, expect narrowing basis turning positive with higher prices and increasing demand.

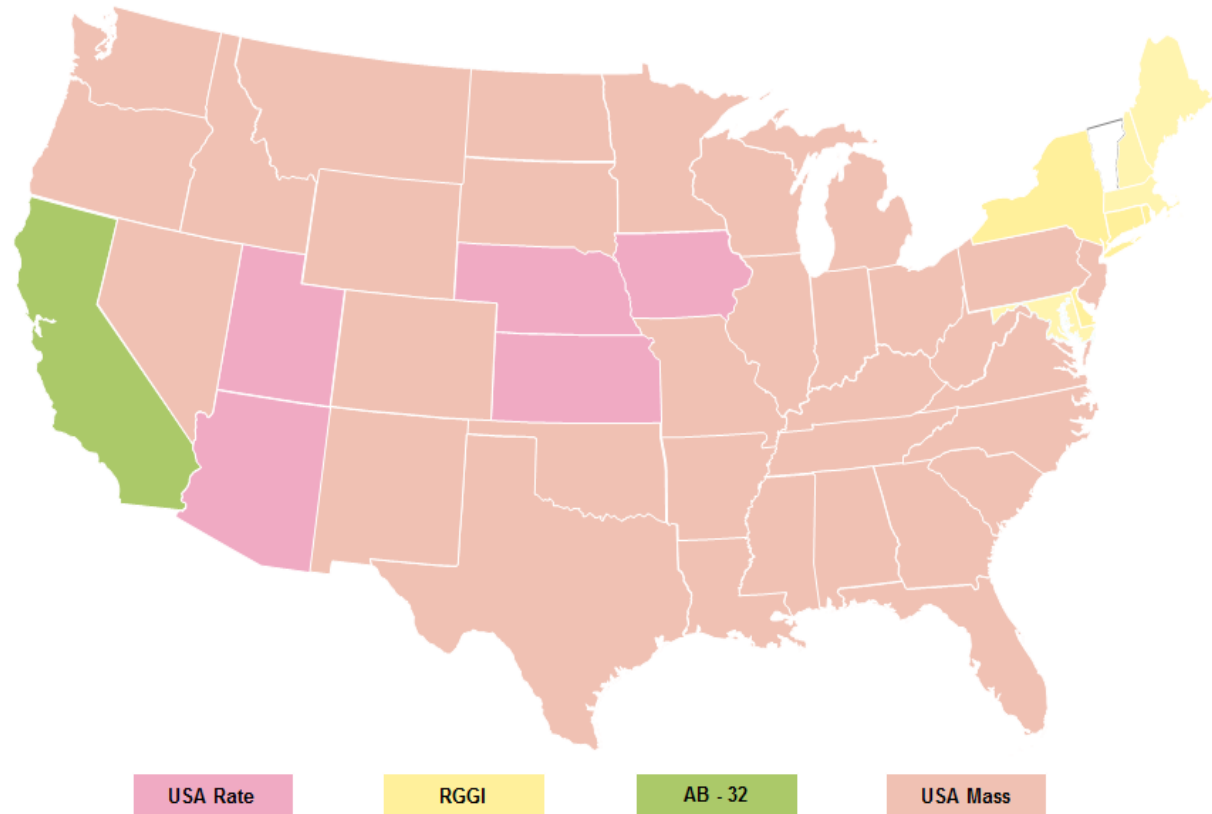
Northern Arizona

- Price point in N. AZ. Commands positive basis over HH due to strong demand in Arizona, Southern California and Mexico; regional is less impacted by eastern shale supply displacement.

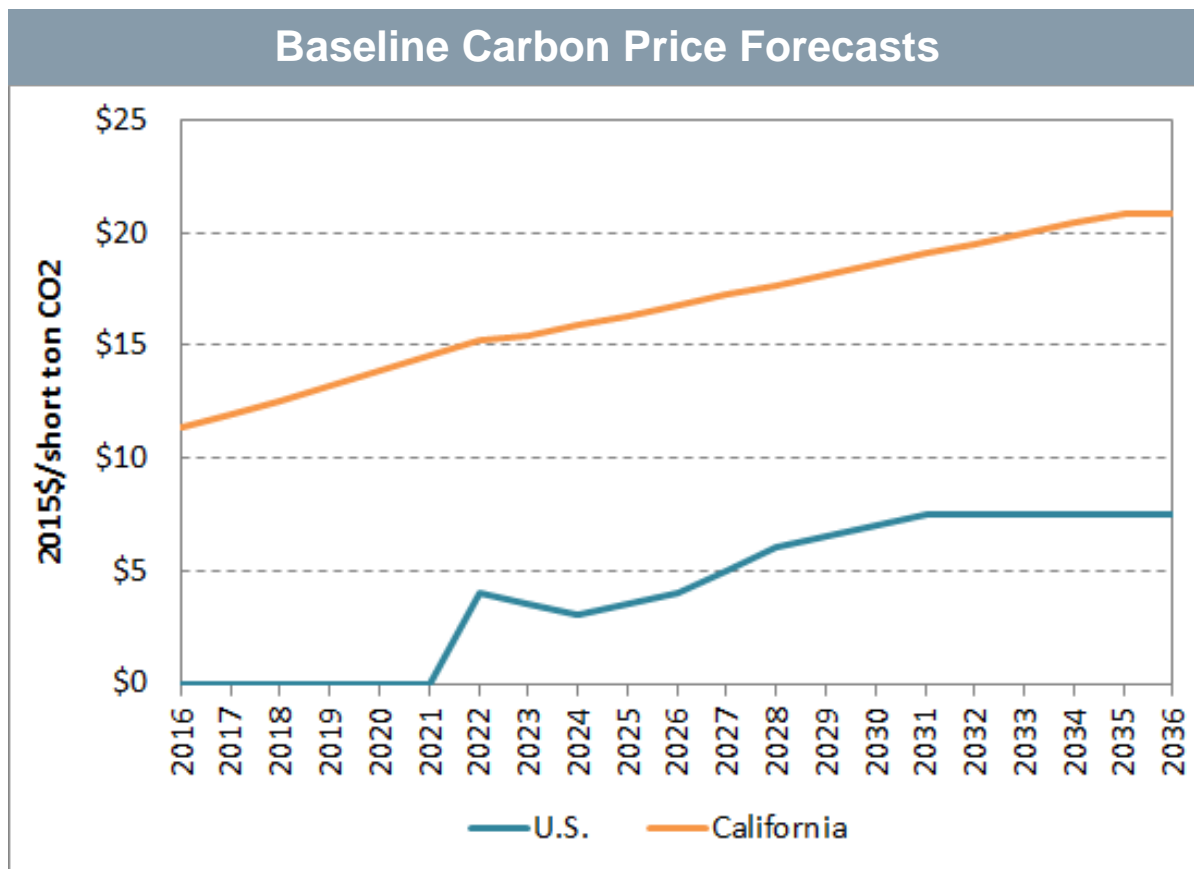
Carbon Prices Based on Assumptions Regarding State Approaches to Comply with the CPP

- Noting uncertainties of the CPP, Pace Global defined states' expected approach to comply with the CPP in the Baseline scenario.
- California and RGGI states maintain trading under existing programs – California maintains caps lower than CPP goal to meet more aggressive state reductions.
- States with strong propensity to meeting a rate goal take this approach – others take mass goal w/ interstate trading.

Reference View of State Rate-Mass Designation



Baseline Carbon Prices – U.S. and California



U.S.

- **Near Term** – no national price on carbon before 2022
- **Mid-Term** – CPP as finalized becomes effective in 2022 with liquid opt-in national trading, market trades at a premium in early years as the market finds equilibrium
- **Long-Term** – Moderate gas prices and planned coal retirements help to mitigate the carbon price under the \$10/ton level

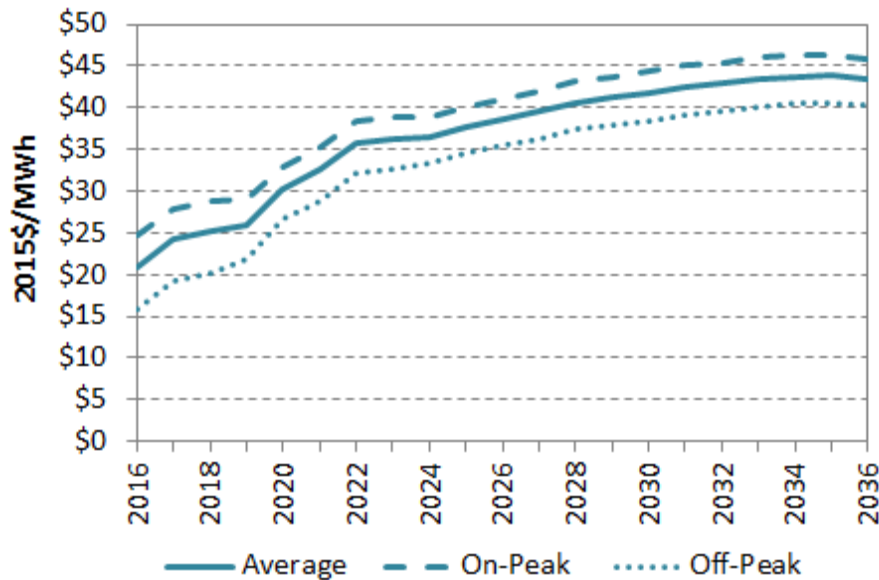
California

- Projections for the currently oversupplied AB32 trading market increase in line with auction price floor through 2020 – beyond this time the program continues to meet the State’s 2030 goals of 40% reduction over 1990 levels.

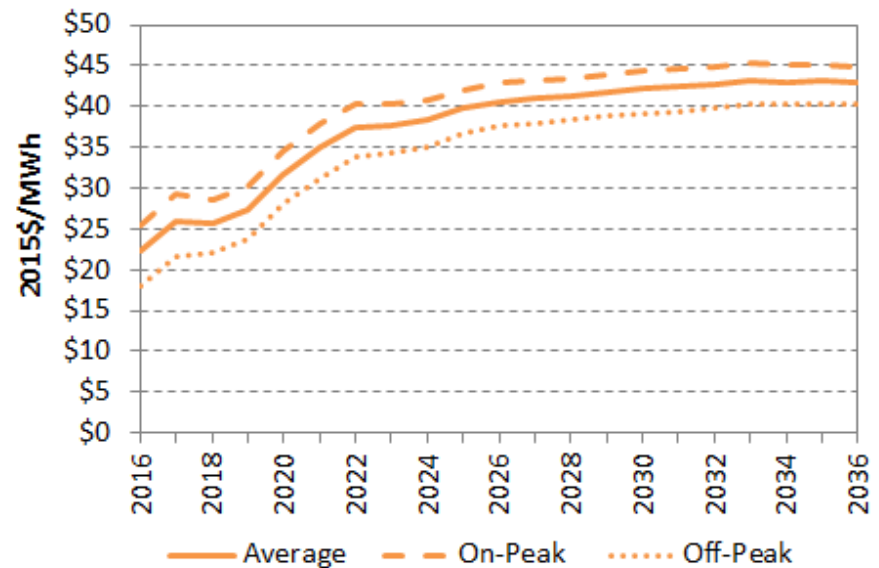
Baseline Zonal Power Prices – Four Corners and Palo Verde

- Baseline power prices in the region projected to increase through much of the forecast period due to:
 - Natural gas prices increasing from current levels
 - The introduction of a price on carbon in the U.S. in 2022 which increases through 2030
 - Steady load growth in New Mexico and southwest (CAAGR ~0.6 percent over forecast period)

Four Corners



Palo Verde



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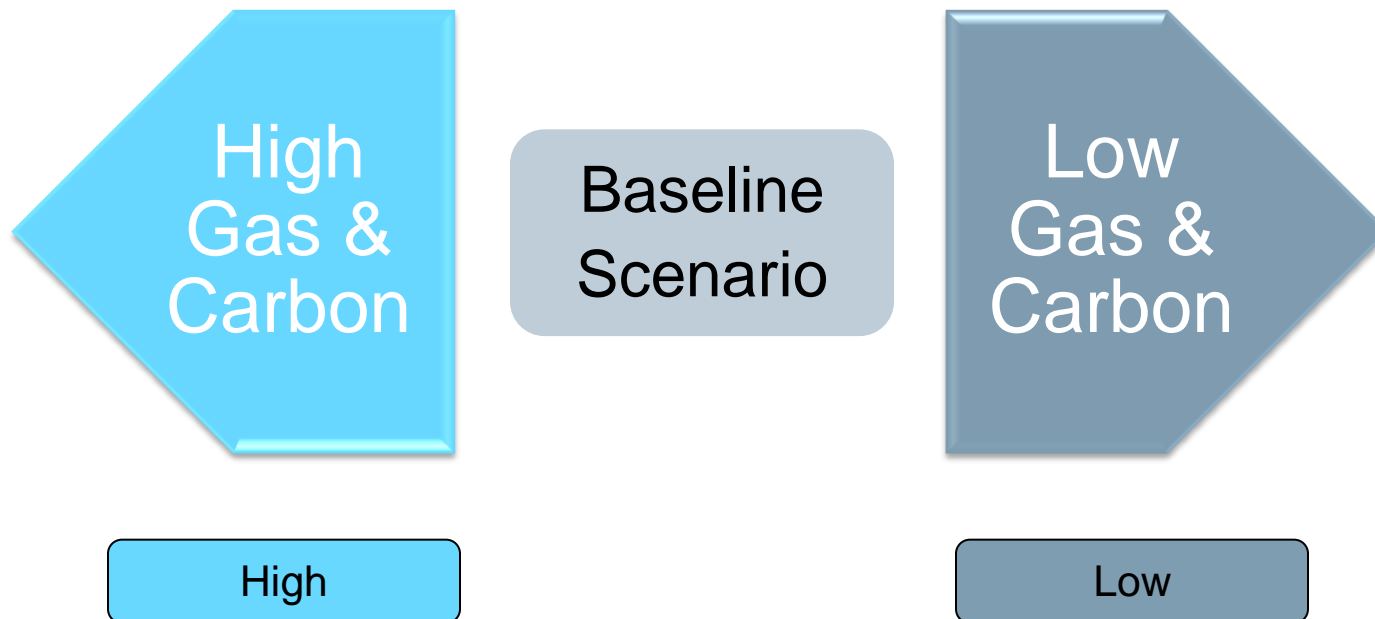
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The background of the slide is a photograph of several high-voltage power transmission towers and their associated power lines. The scene is captured during sunset or sunrise, with the sky transitioning from a bright orange near the horizon to a clear blue at the top. The towers are silhouetted against the sky, and the power lines create a complex web of lines across the frame.

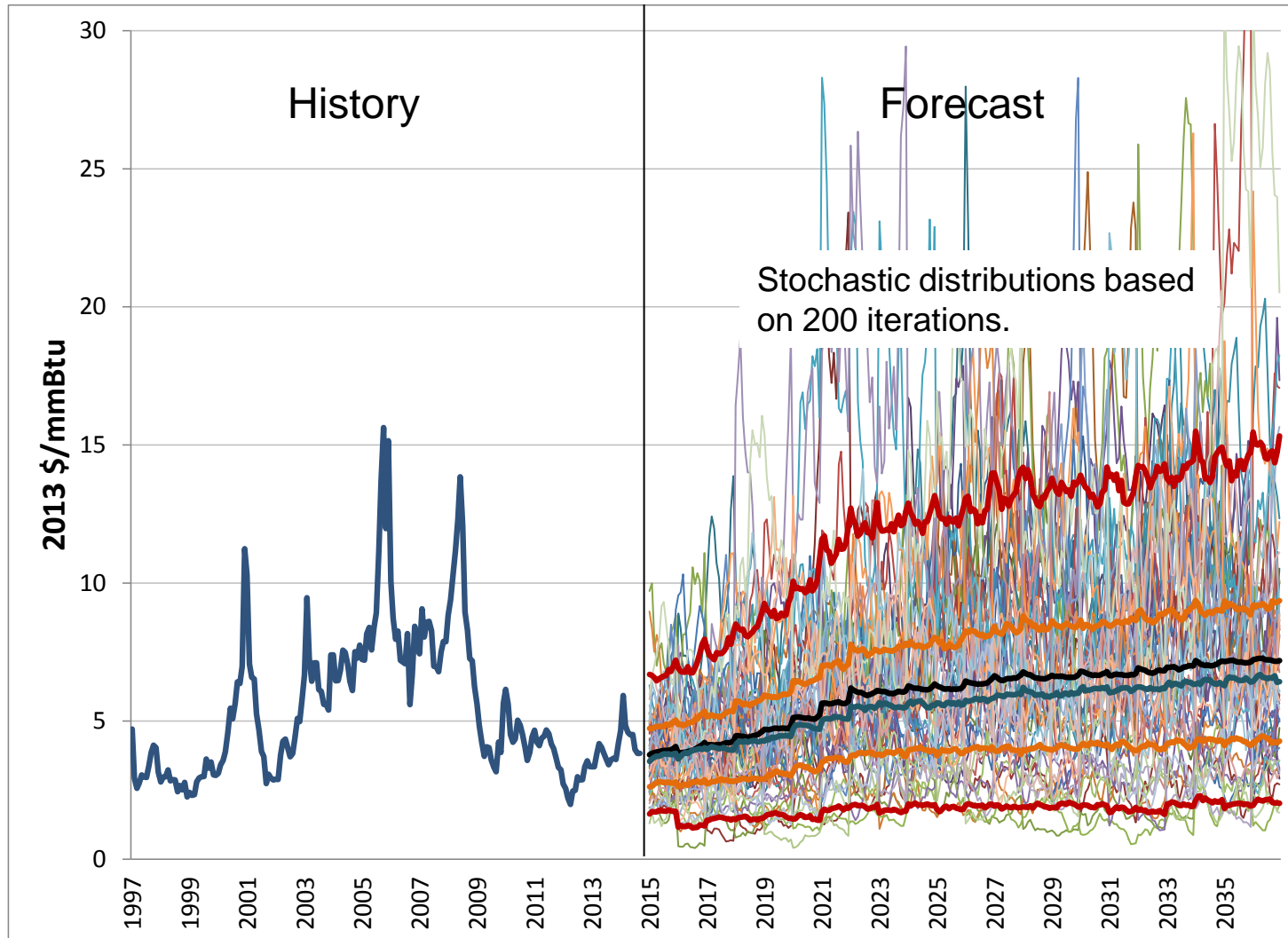
Alternate Scenarios

Scenario Development for IRP Analysis

- Pace Global and PNM identified natural gas price and carbon price as the two major drivers of portfolio performance.
- High natural gas and carbon and low gas and carbon price assumptions drove the two alternate scenarios.
- Stochastic distributions were used to develop the high and low assumptions based on a one standard deviation delta from the baseline.



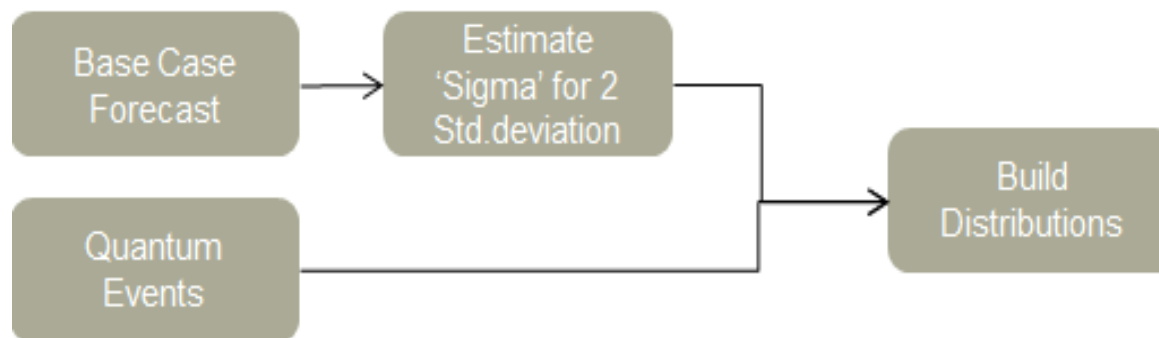
Stochastic Distributions Inform High and Low Scenarios (Illustrative Example)



Carbon Stochastics Developed in Absence of Historical Data – Reflecting CPP

- The technique to develop carbon costs distributions, unlike the previous variables, is based on the “expert-opinion” based projections due to lack of historical data.
 1. Stress test analysis to determine range of shadow prices under the CPP – high / low
 2. High and low treated as 16th, 50th and 84th percentiles from which statistical techniques are used to calculate the standard deviation values.
 3. The distributions are then adjusted to incorporate probabilities such as “ the probability of a CO2 program not taking effect”, “greater chance of a nation-wide CO2 regime starting in, say 2022” etc.

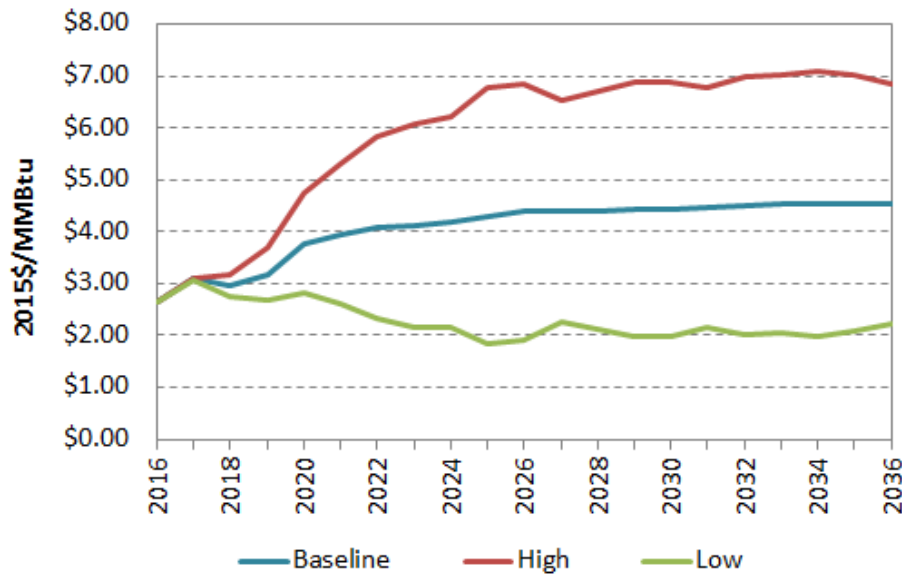
Method for Distribution Generation



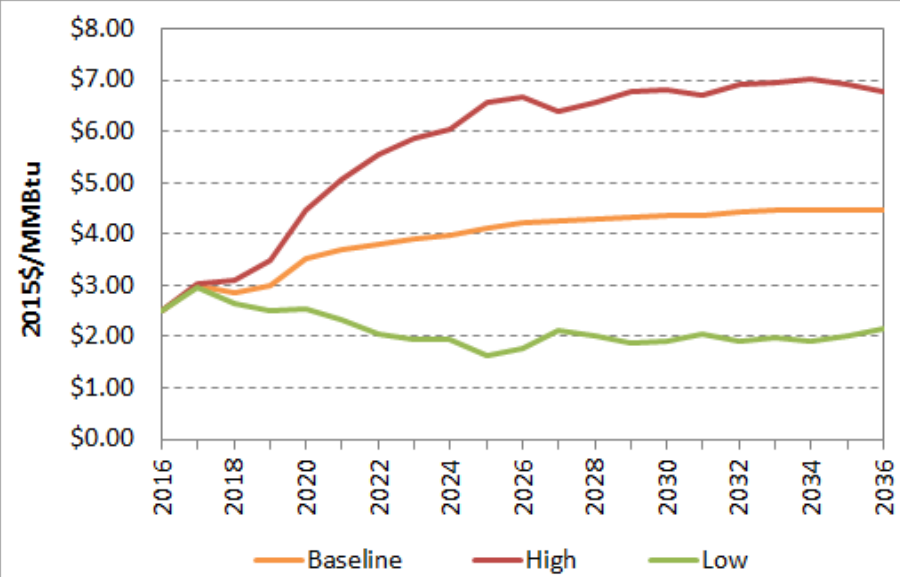
High and Low Natural Gas Prices – Henry Hub and Permian Basin

- High natural gas prices could result from restrictions on gas production (i.e. fracking regulations) increasing the cost to produce, greater than expected LNG and pipeline exports, and/or a stronger economy driving demand.
- Lower natural gas prices could result from energy storage technology breakthrough (resulting in lower gas demand), a weaker economy, or lower export scenarios.

Henry Hub

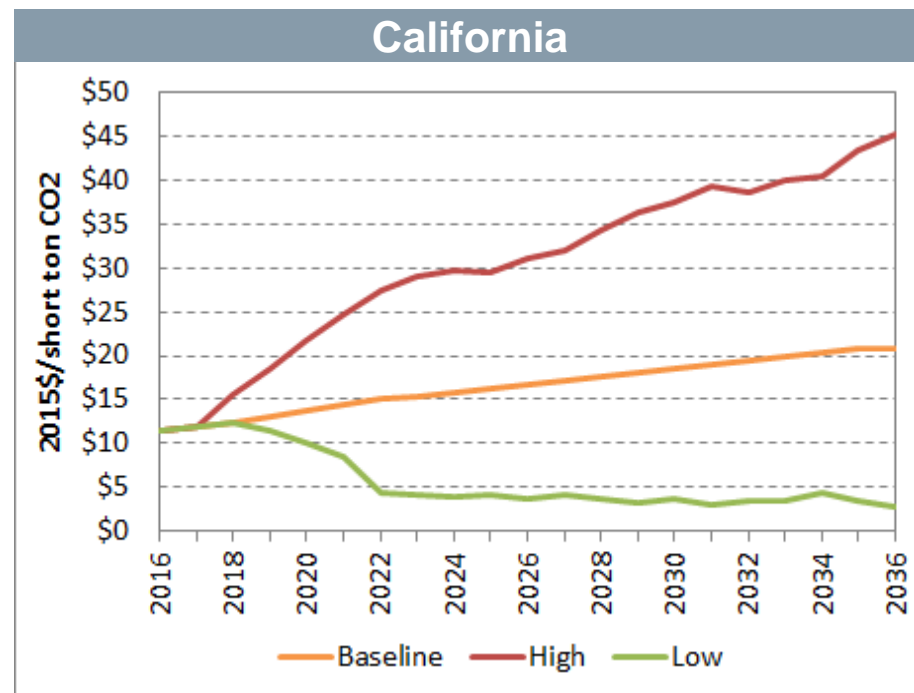
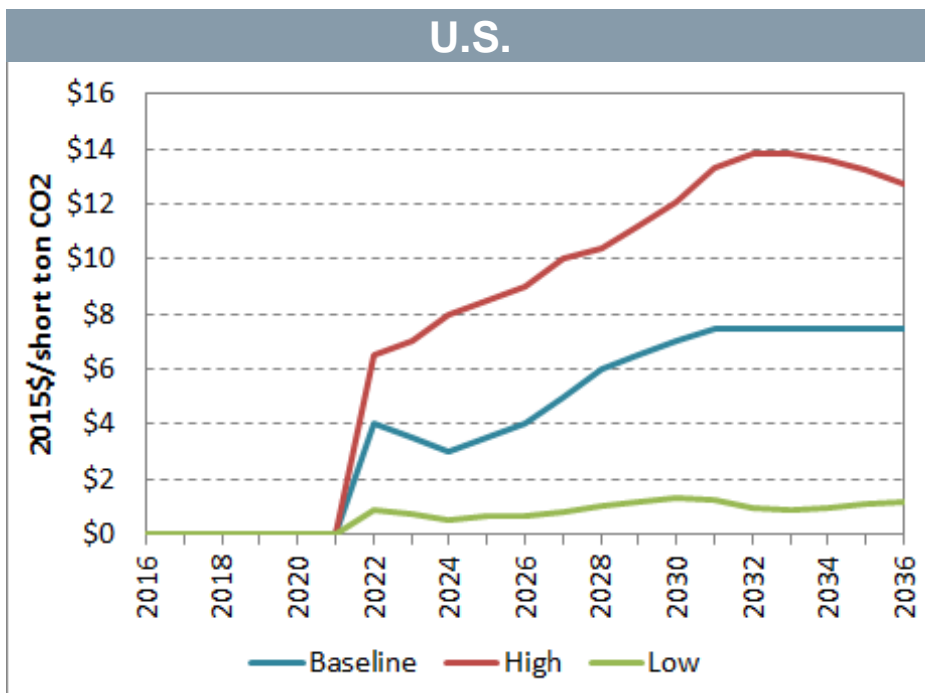


Permian



High and Low Carbon Prices – U.S. and California

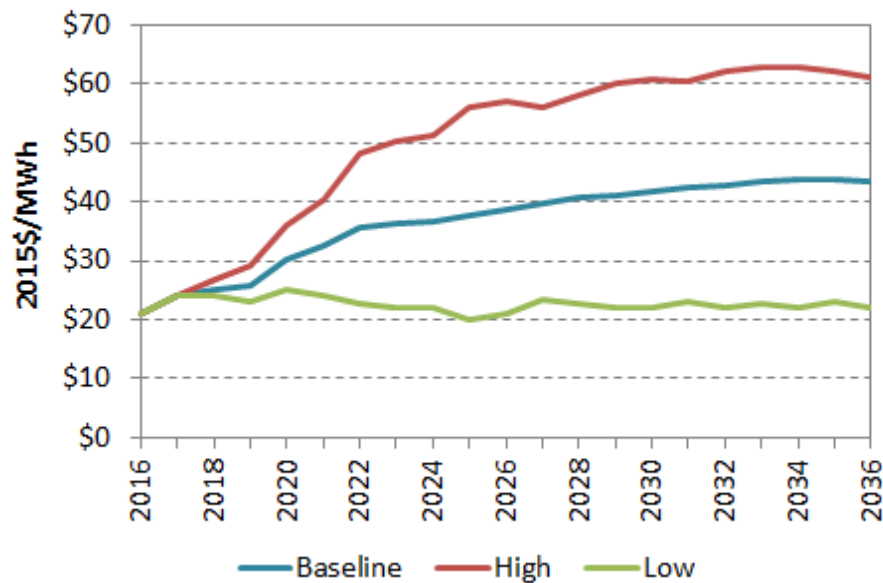
- The high carbon price scenario reflects the possibility of high gas price trajectory due to less efficient implementation of the CPP (less interstate trading), high natural gas prices, speculation driving prices above actual cost to comply.
- The low carbon price scenario could result from low natural gas prices, a very active national trading market where most low cost states decide on a national interstate trading scheme, and/or greater than expected retirements of coal and other gas units “affected” under the CPP.



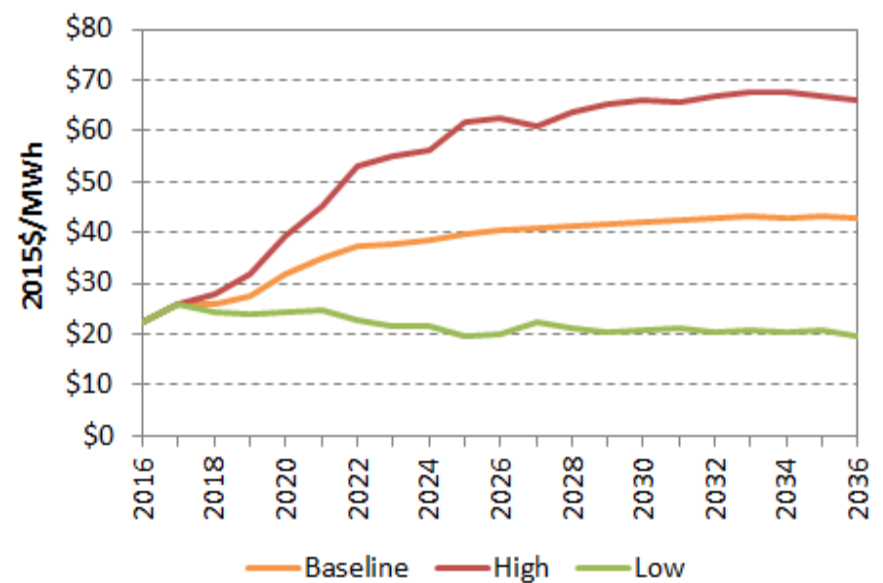
High and Low Power Prices – Four Corners and Palo Verde

- High case power forecast driven by high natural gas prices and inefficient implementation of the CPP driving higher cost of carbon resulting in high power prices.
- Low case driven by natural gas prices declining from current levels for the forecast period and a minimal national price on carbon and low load growth.

Four Corners



Palo Verde





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Questions