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City of Farmington Integrated Resource Planning (IRP)

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Agenda

1. Executive Summary
2. IRP Process
3. Results and Recommendations

Executive Summary

IRP Process and Key Consideration

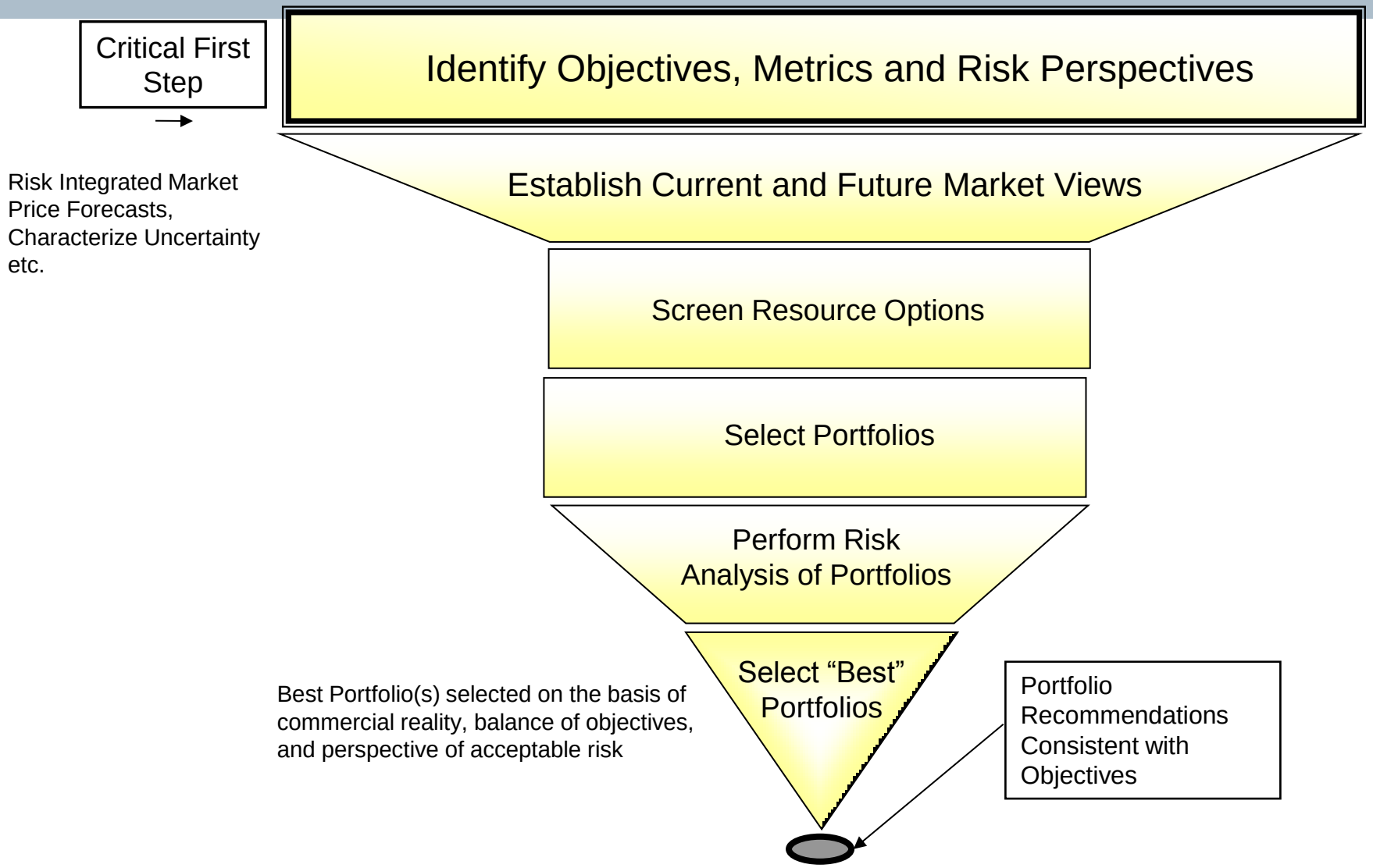
- Pace Global conducted the Farmington IRP analysis with a structured screening process to develop a variety of portfolio options to be tested under a rigorous stochastic modeling assessment.
- This risk-based approach identified the Preferred Resource Plan that best achieves Farmington's planning objectives including cost, risk, environmental and operational metrics under a variety of planning uncertainties and market conditions.
- Given the uncertainties around the San Juan Unit 4 coal plant retirement date, the IRP evaluated the impacts of two different coal retirement dates (2022 vs. 2027) to evaluated tradeoffs of cost and environmental metrics.
- The IRP also evaluated a broad range of new resource technologies including gas-fired generation facilities and viable solar capacity for the City.

Motivating Questions for Farmington IRP

Factors	Key Questions
Cost, Risk & Environmental	What are the prudent, cost competitive and environmentally responsible approaches in Farmington's long term resource planning to address the trends in the energy industry and the utility space such as decreasing prices for renewables and energy storage, finalization of the carbon regulation, and the penetration of distributed energy resources? Answer: See the recommended portfolio.
New Resources Types	How do these new trends impact the requirement for any new generation resources that Farmington considers adding to its fleet? Answer: Solar begins to be economic in the long term.
Carbon Regulation	How will the potential New Mexico Clean Power Plan (CPP) compliance strategy impact Farmington's choice of a Preferred Resource Plan? Answer: The recommended portfolio is the same under both CPP options evaluated. Costs are higher under interstate trading.
Market Dependency	Should Farmington rely on market purchases to meet a portion of its peak load given the differences of its peak and average load? Answer: Yes. A portion of its requirements should be met with market purchases given relatively low forecasts for power prices.
Buy vs Build Decision	What are the pros and cons for Farmington to build generation resources versus purchase share(s) from a development project? Answer: Building provides a measure of control which give greater assurance of meeting load. Purchasing a share may have economies of scale associated with it.
Development and Control Risks	How should Farmington evaluate development risks and control risks as it considers adding new resources? Answer: Each risk can be explicitly factored into the balanced scorecard assessment.
Renewables Investments	Should Farmington consider solar generation additions after the expected reductions in capital costs? Answer: Yes, adding utility solar in later years of the study. In the near term, the City is progressing through steps towards a community solar project based on interest.
Load & System Integration	How much solar capacity can Farmington integrate into its system considering the characteristics of its current generation fleet and load profile? Answer: Farmington believes that the limit is up to 15 MW.

IRP Process

A Structured Approach to Risk-Integrated Resource Planning



IRP Analysis Process

The Pace Global IRP methodology utilizes a structured process that consisted of the following steps:

1. Identify overall objectives and metrics
2. Fundamental analysis to inform portfolio construction
    - Two CPP compliance cases
    - Provide load forecast
    - Technology screening analysis
    - Long vs short position analysis
3. Stochastic risk analysis of candidate portfolios to identify the Preferred Resource Plan
4. Develop strategy and recommendations

Step 1: Set Planning Objectives and Metrics

These metrics become the standards of evaluating portfolios

Objectives			Metrics
Cost	Cost	Minimize power supply costs and rate increases	2016-2035 Cost NPV ($ million) 2016-2035 Levelized Costs
Risks	Cost Stability	Achieve rate stability	2016-2035 95th Percentile Cost NPV ($ million)
	Development Risks	Minimize project development risks	Project development uncertainties
	Control Risks	Minimize operation risks and other uncertainties	Operational and control risks
	Market Risks	Decrease energy market purchase exposure	2016-2035 Energy market purchase exposures
Environmental	Environmental Stewardship	Decrease emissions and increase renewable generation	CO_2 emission in 2025 relative to 2016; Renewable generation percentage in 2035
Operational	Reserve Margin	Ensure reliability requirements with native capacity	2016-2035 Reserve margin
	Largest Contingency	Minimize largest contingency in the generation fleet	Size of the largest contingency unit in 2035

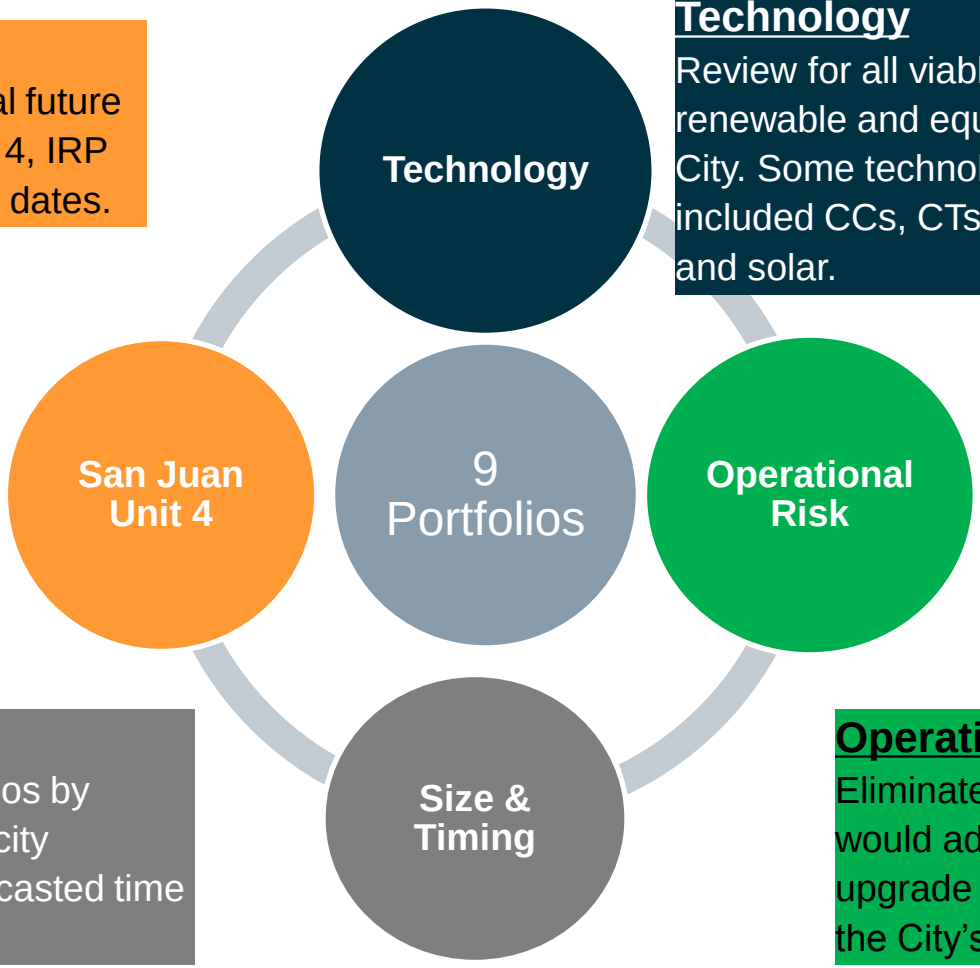
Step 2: Fundamental Analysis to Inform Portfolio Construction

Recommend two CPP Compliance Cases	Load Forecast	Technology Screening Analysis	Long vs Short Position	Portfolio Construction
• Test under multiple sets of CPP scenarios for the state of New Mexico to determine the overall impact to City of Farmington's portfolio costs.	• Determine City of Farmington's expected load forecast for the next 20 years in order to understand the City's future capacity and energy needs.	• Assess all traditional fuel and renewable energy resources, including operational parameters and capital costs, deemed plausible for the City.	• Consider and test whether building over capacity can provide any financial incentives for the City.	• Initiate and develop list of plausible set of portfolios to be considered for the City's latest IRP.

Portfolio Screening and Development Process were Driven by Key Input Factors

Nine distinct and viable candidate portfolios were developed for the City of Farmington's stochastic IRP analysis.

San Juan Unit 4
Due to uncertainty in potential future retirements of San Juan Unit 4, IRP tested for different retirement dates.



Technology
Review for all viable technologies, including renewable and equity stake options, for the City. Some technologies considered included CCs, CTs, reciprocating engines and solar.

Size and Timing
Test for robustness of portfolios by creating short and long capacity positions throughout the forecasted time period.

Operational Risk
Eliminate technology options that would add significant reliability upgrade costs and/or compromise the City's system reliability.

Step 2: Fundamental Analysis to Inform Portfolio Construction (Cont.)

- **Motivating Question:** Should the City of Farmington explore various portfolios that are significantly above its expected peak capacity for the 2016 IRP?
- **Setup:** Two test portfolios were developed and intended to track an overall cost and reserve margin data.

Portfolio "A"
- Farmington Assets & Contracts
- New CC > 100 MW

Portfolio "B"
- Farmington Assets & Contracts
- New CC < 50 MW

- **Approach:** Two portfolios were simulated in a model environment under a deterministic market conditions.
- **Preliminary Findings:** An initial cost assessment indicates that a significant surplus capacity portfolio ("Portfolio A") commands some cost premium for the City of Farmington under an assumed market conditions. It does not reward building long portfolios.

Portfolio "A"
Generally 15-20% premium in total portfolio costs than Portfolio "B".

Portfolio "B"
Generally 15-20% lower total portfolio costs than Portfolio "A".

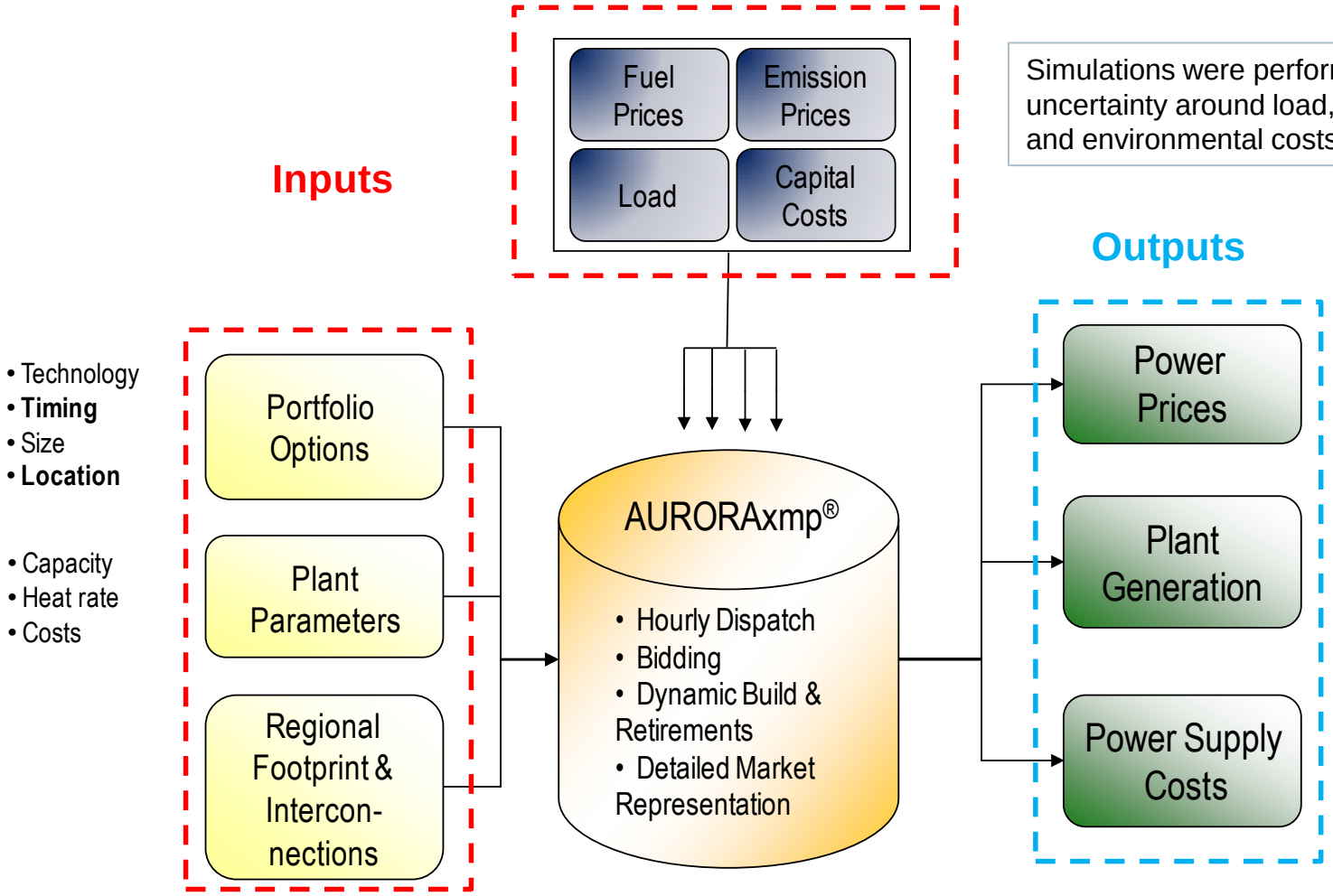
Step 3: Construction of Candidate Portfolios

Nine Candidate Portfolios for Stochastic Analysis	
Portfolio 1	Build a 39 MW GE 1xLM6000 PF in 2018 and convert this unit to 58 MW LM6000 PF 1x1 CC with duct fire in 2028.
Portfolio 2	Purchase 50 MW share from CPEC in 2021 and an additional 50 MW from the same plant in 2028.
Portfolio 3	Build two 8.6 MW reciprocating engines in 2018 and a 59 MW SCC-800 1x1 CC in 2028.
Portfolio 4	Build two 8.6 MW reciprocating engines in 2018; 58 MW LM6000 PF 1x1 CC with duct fire in 2028, and 5 MW solar in 2032.
Portfolio 5	Build a 58 MW LM6000 PF 1x1 CC with duct fire in 2023.
Portfolio 6	Build a 18 MW LM2500 in 2018 and a 59 MW SCC-800 1x1 CC in 2023.
Portfolio 7	Build a 44 MW LM6000 in 2018 and 15 MW solar in 2023.
Portfolio 8	Build a 18 MW LM2500 in 2018, 71 MW SCC-800 CC with duct fire in 2023 and 15 MW solar in 2030.
Portfolio 9	Build two 8.6 MW reciprocating engines in 2018; 58 MW LM 6000 PF 1x1 CC with duct fire in 2023, and 5 MW solar in 2032.

SJ4 Retires in 2027 **SJ4 Retires in 2022**

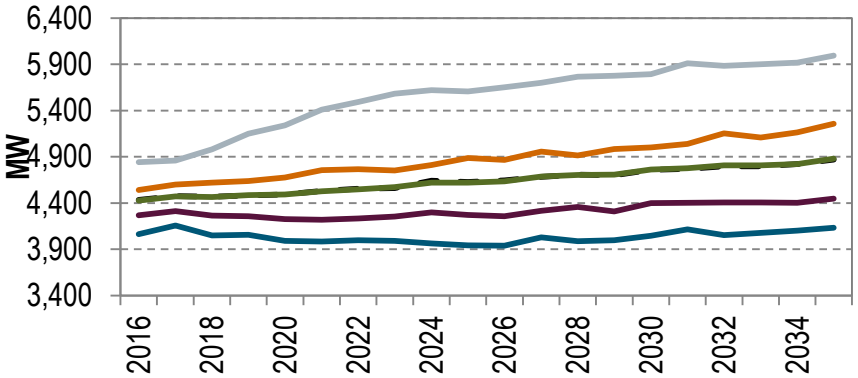
Note: (1) San Juan unit 4 retirement year is an assumption for the IRP modeling purpose only. The coal unit, as of the date of this analysis, has not announced a potential retirement date. (2) CPEC is the proposed Clean Path Energy Center, an early stage development project of combined cycle natural gas-fired capacity of 715 MW and solar photovoltaic (PV) capacity of 55 MW, with a target commercial on line date by April 2021.

Step 4: Stochastic Assessment of Nine Portfolios

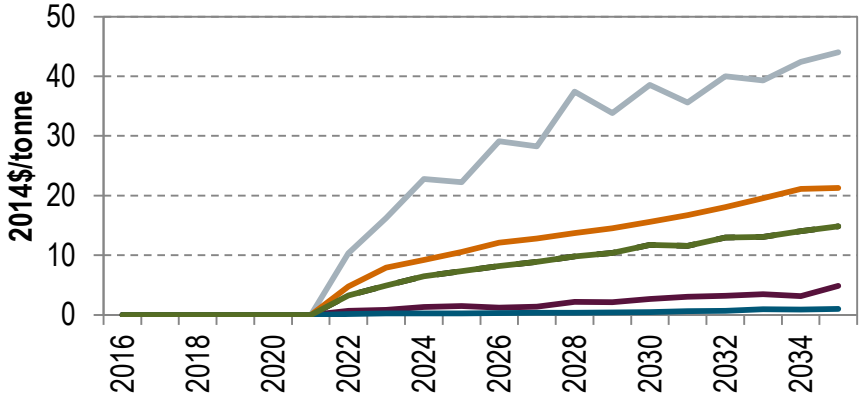


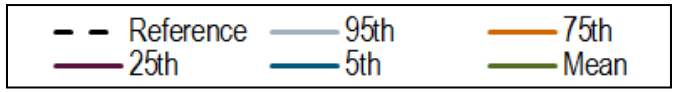
Stochastic Market Input Drivers for the City of Farmington IRP 2016

Demand (NM Peak Demand)

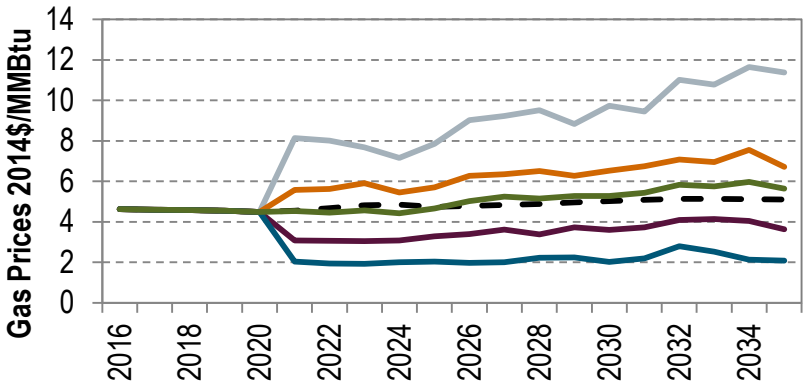


Environmental Price (Mass Based CO_2)

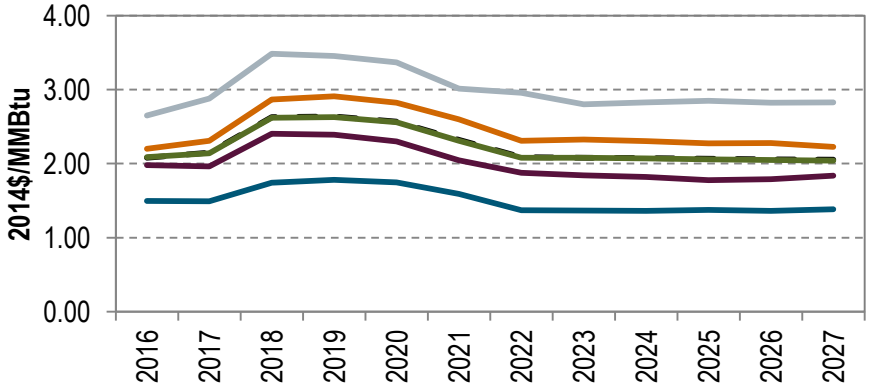




Delivered Gas Price

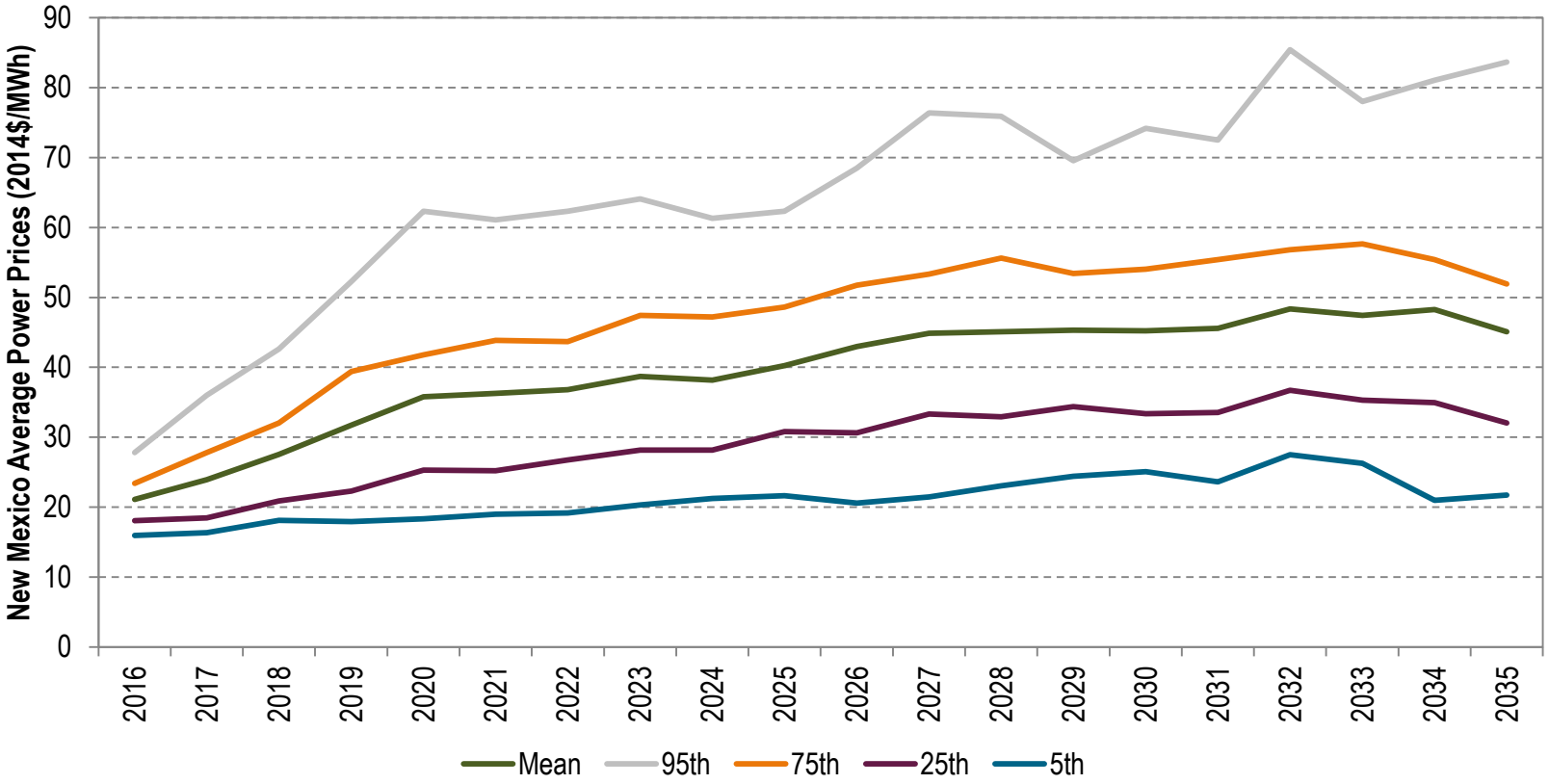


Delivered Coal Price

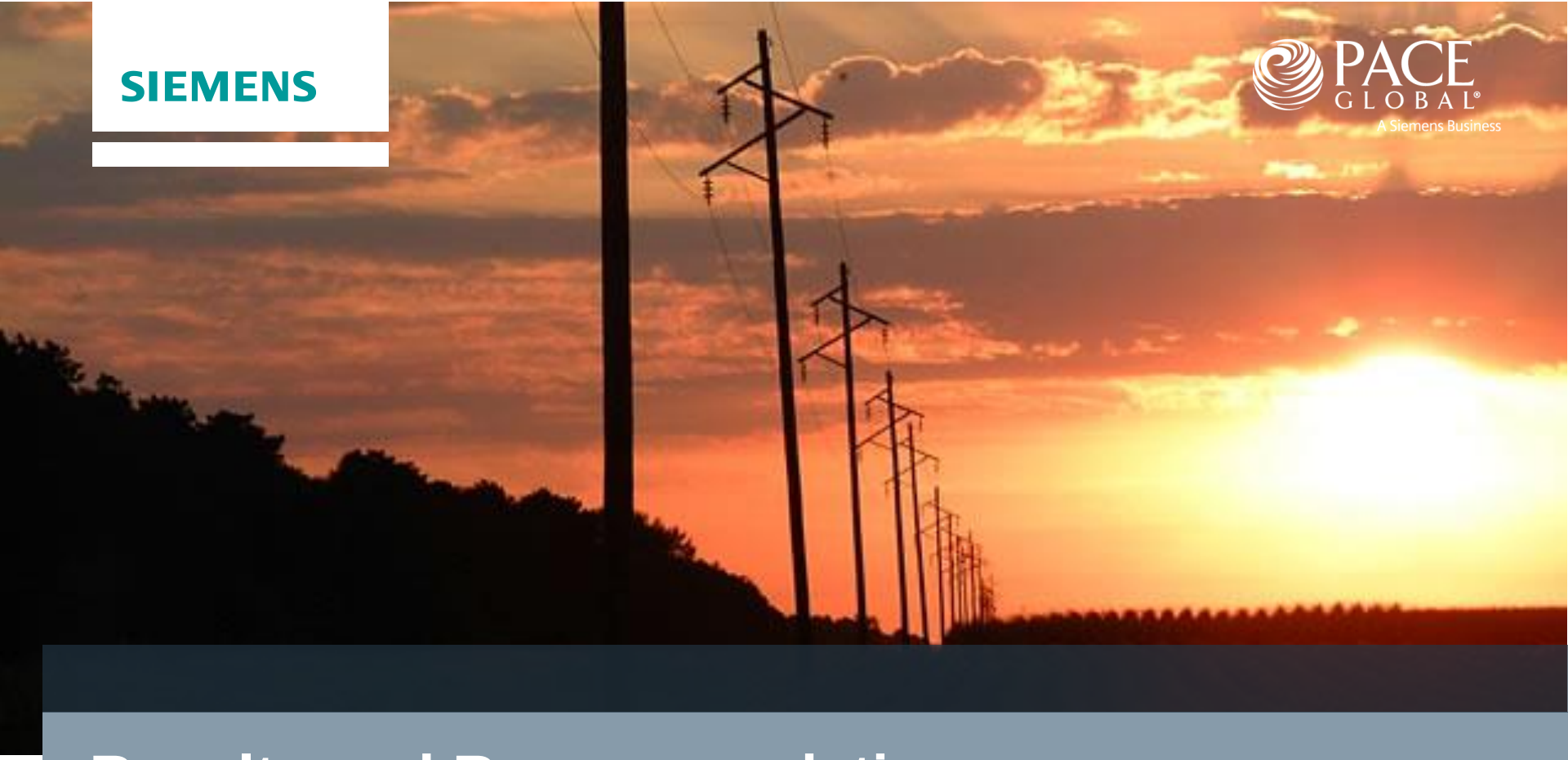


Note: The delivered gas and coal prices reflects contract positions of Farmington during the term of the contracts.

Pace Global Stochastic Analysis Indicates Power Prices in New Mexico is Expected to Remain below $50/MWh by 2035



Note: The prices are under the mass-based interstate stochastic results for the New Mexico power zone. The prices under the mass-based intrastate stochastic results are similar but generally ~2% lower than what is shown in this slide.



Results and Recommendations

Portfolio 1-4 Balanced Score Card Summary

San Juan Coal Plant Retirement After 2027

	Criteria	Cost (Inter/Intra)	Risk	Environmental	Operational	Overall Rating
1	Build a 39 MW GE 1xLM6000 PF in 2018 and convert this unit to 58 MW LM6000 PF 1x1 CC with duct fire in 2028.	$743M $727M				
2	Purchase 50 MW share from CPEC in 2021 and an additional 50 MW from the same plant in 2028.	$717M $703M				
3	Build two 8.6 MW reciprocating engines in 2018 and a 59 MW SCC-800 in 2028	$745M $728M				
4	Build two 8.6 MW reciprocating engines in 2018; 58 MW LM 6000 PF 1x1 CC with duct fire CC in 2028, and 5 MW solar in 2032.	$737M $721M				

Score Rating: Favorable Neutral Unfavorable

Note: CPEC is the proposed Clean Path Energy Center, an early stage development project of combined cycle natural gas-fired capacity of 715 MW and solar photovoltaic (PV) capacity of 55 MW, with a targeted commercial on line date by April 2021.

Portfolio 5-9 Balanced Score Card Summary

San Juan Coal Plant Retirement After 2022

Criteria		Cost (Inter/Intra)	Risk	Environmental	Operational	Overall Rating
5	Build a 58 MW LM6000 PF 1x1 CC with duct fire in 2023.	$751M $743M				
6	Build a 18 MW LM2500 in 2018 and a 59 MW SCC-800 in 2023.	$781M $773M				
7	Build a 44 MW LM6000 in 2018 and 15 MW solar in 2023.	$749M $739M				
8	Build a 18 MW LM2500 in 2018, 71 MW SCC-800 CC with duct fire in 2023 and 15 MW solar in 2030.	$763M $755M				
9	Build two 8.6 MW reciprocating engines in 2018; 58 MW LM6000 PF 1x1 CC with duct fire in 2023, and 5 MW solar in 2032.	$757M $748M				

Score Rating: Favorable Neutral Unfavorable

Executive Summary of Preferred Resource Plan

- Pace Global recommends the Preferred Resource Plan that performs the best across a variety of objectives including cost, risk, environmental and operational metrics under a variety of planning uncertainties and market conditions.

Near Term Decision	• Build two 8.6 MW reciprocating engines in 2018. • This is driven by: (1) expiration of 25 MW Tri-State contract in 2017, (2) the economics of utilizing existing gas contract, and (3) need of flexible unit for voltage support.
Mid Term Decision	• Build CC (~58 MW) based on the load and timed to replace the City's share of San Juan Unit 4. • This is primarily driven by the need to backfill the City's share of San Juan Unit 4 due to retirement.
Long Term Decision	• Build solar project (~5 MW) depending on load. • This is driven by: (1) diversification of the portfolio, (2) lower costs, and (3) environmental benefits.

Note: (1) When Pace Global selected new generation options for inclusion in portfolios, a particular unit design based on an actual product is chosen as representative of a class of similar units. (2) In all cases, there is at least one additional unit available from a different manufacturer with similar enough characteristics that competitive bidding will be possible at the time a project is implemented.

Key Findings Under the CPP Mass-based with Interstate Trading

CPEC Option

- Purchasing a portion of the CPEC plant provides the lowest cost portfolio option. This is largely driven by the assumption of the plant's advertised heat rate (~6,152 btu/KWh) over Farmington's other smaller CCs options considered in this study (~7,500 btu/KWh or greater). An additional benefit of this option includes addition of solar capacity on a pro rata basis.
- However, whether CPEC option can be realized is fraught with uncertainties beyond Farmington's control.

Capital Investments

- Market conditions do not reward building long portfolios because of high capital costs incurred, especially in the early 2020s.
- However, a phased approach to add smaller and incremental capacity resources on a need basis provides overall lower cost benefits for the City as well as maintain flexibility in the face of future uncertainties.

Summary of the Two Preferred Portfolios (Portfolio 4 & 9)

- Portfolio 4 and 9 ranks the best in an overall ranking when we assume two different San Juan 4 retirements.
- Between the two best portfolios, Portfolio 4 results in ~3% lower expected costs than Portfolio 9.

Cost

Cost
• Portfolio 4 $737M
• Portfolio 9 $757M

Risk

Cost Stability (20 Years)	Market Risk (20 Years)	Development & Control Risk
• Portfolio 4 $968M	~55%	Low
• Portfolio 9 $1,013M	~55%	Low

Environmental

CO2 Emissions (2025/2016)	Renewables (2035)
• Portfolio 4 129%	7.4%
• Portfolio 9 98%	7.4%

Operational

Reserve Margin (20 Years)	Largest Contingency
• Portfolio 4 -10%	Bluffview CC
• Portfolio 9 - 9%	Bluffview CC

* Above results are the mass-based interstate trading stochastic results.