**From:** Hutchinson, Jasen C. - Mgr Corporate Records Compliance
**Sent:** Friday, December 20, 2019 1:08 PM
**To:** 'Powell, Stephen'
**Cc:** Granat, Sean; Garrett, Christopher; Teodorescu, Adina; Phillips, Jon; Harrell, Sonya; Public Records Request Mailbox
**Subject:** RE: PRR 32731 - JEA IRP
**Attachments:** RE: JEA IRP

---

**From:** Powell, Stephen
**Sent:** Friday, December 20, 2019 8:53 AM
**To:** Hutchinson, Jasen C. - Mgr Corporate Records Compliance
**Cc:** Granat, Sean ; Garrett, Christopher ; Teodorescu, Adina ; Phillips, Jon ; Harrell, Sonya
**Subject:** JEA IRP
**Importance:** High

[External Email - Exercise caution. DO NOT open attachments or click links from unknown senders or unexpected email.]

Jasen,

We have been made aware of the existence of a document in progress since 2018 called an "Integrated Resource Plan." We're informed that it should have reached, at least, draft form by the summer of 2019. I believe this is a 40-year plan, but not sure.

Can you assist us in locating this document in its current form (including all prior drafts)?

Thank you,
Steve

**Stephen J. Powell**
Chief, Tort & Employment Litigation
Office of General Counsel
City of Jacksonville
117 West Duval Street, Suite 480
Jacksonville, FL 32202
904-255-5071
904-255-5120 (facsimile)
SPowell@coj.net

contract formation in this matter shall occur only with manually-affixed original signatures on original documents.

**From:** McInall, Steven G. - VP & Chief Energy & Water Planning
**Sent:** Friday, December 20, 2019 10:08 AM
**To:** Gillespie, Jeanie M.
**Cc:** Hutchinson, Jasen C. - Mgr Corporate Records Compliance
**Subject:** RE: JEA IRP
**Attachments:** DRAFT JEA IRP Update_03212019_REV5.pptx

We don't have a draft or a final – I tapped the brakes on it to try to get some alignment with the McKinsey work.

Attached is an update presentation on the study from March.

Let me know if you want further materials. We are expecting to get a draft final in January.

**Steve McInall. P.E.**
Vice President, Energy and Water Planning
Direct: (904) 665-4309
Mobile: (904) 312-0739

---

**From:** Gillespie, Jeanie M.
**Sent:** Friday, December 20, 2019 9:06 AM
**To:** McInall, Steven G. - VP & Chief Energy & Water Planning
**Cc:** Hutchinson, Jasen C. - Mgr Corporate Records Compliance
**Subject:** FW: JEA IRP
**Importance:** High

Good morning Steve,

Can you please send me the new IRP as requested by OGC below. Last we discussed, you advised it is not complete, but they would like the draft if still not complete. Thanks so much!

**Jeanie Gillespie**
Public Records Compliance Specialist
Direct: (904) 665-7309

---

**From:** Hutchinson, Jasen C. - Mgr Corporate Records Compliance <hutcjc@jea.com>
**Sent:** Friday, December 20, 2019 9:02 AM
**To:** Gillespie, Jeanie M. <gilljm2@jea.com>

**Subject:** FW: JEA IRP
**Importance:** High

Can you help with this one? Thanks!

Jasen

---

**From:** Powell, Stephen <SPowell@coj.net>
**Sent:** Friday, December 20, 2019 8:53 AM
**To:** Hutchinson, Jasen C. - Mgr Corporate Records Compliance <hutcjc@jea.com>
**Cc:** Granat, Sean <SGranat@coj.net>; Garrett, Christopher <GarrettC@coj.net>; Teodorescu, Adina <Teodores@coj.net>; Phillips, Jon <JPhillips@coj.net>; Harrell, Sonya <SonyaH@coj.net>
**Subject:** JEA IRP
**Importance:** High



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SPowell@coj.net

*Preliminary Results – Subject to Change*

nFRONT CONSULTING LLC
Power Industry Planners • Analysts • Advisors

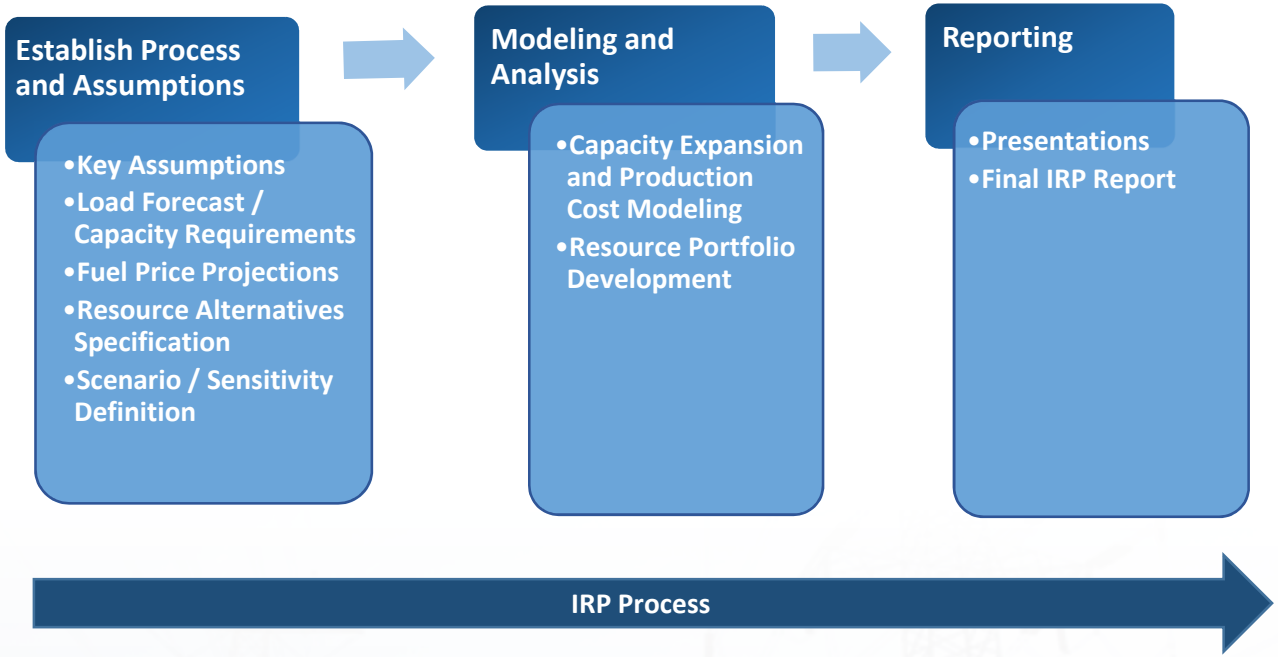
# JEA Electric System Integrated Resource Plan (IRP)

March 21, 2019

# Introduction

- Brad Kushner, Executive Consultant, nFront Consulting LLC
  - Prior to nFront, Director of Electric System Resource Planning Services offering for Black & Veatch Management Consulting
  - Provided electric system resource planning services to JEA while with Black & Veatch since early 2000s, including:
    - 2011-2012 JEA Integrated Resource Plan
    - 2004, 2009, 2014, and current Florida Energy Efficiency Conservation Act ("FEECA")

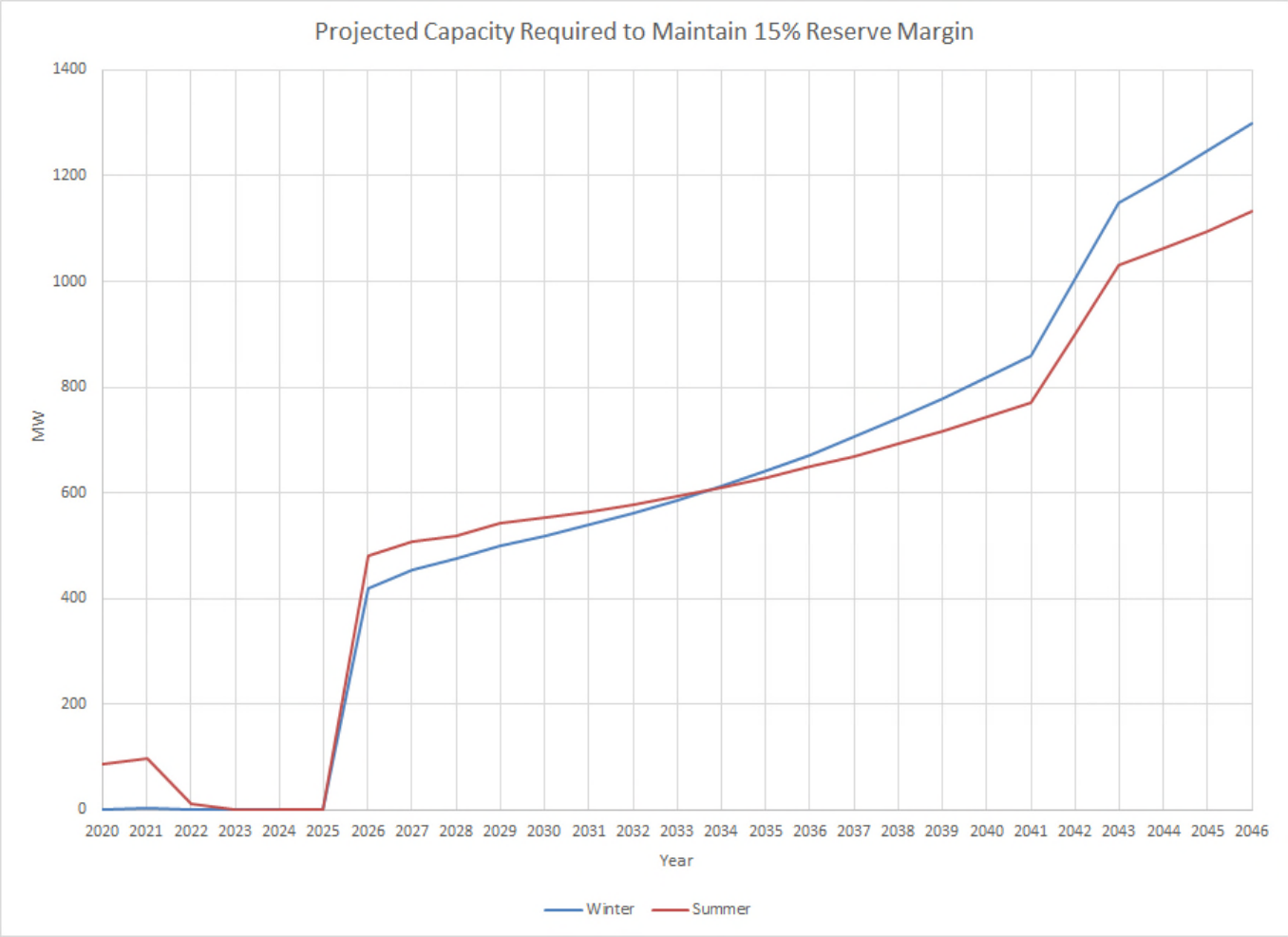
# IRP Process



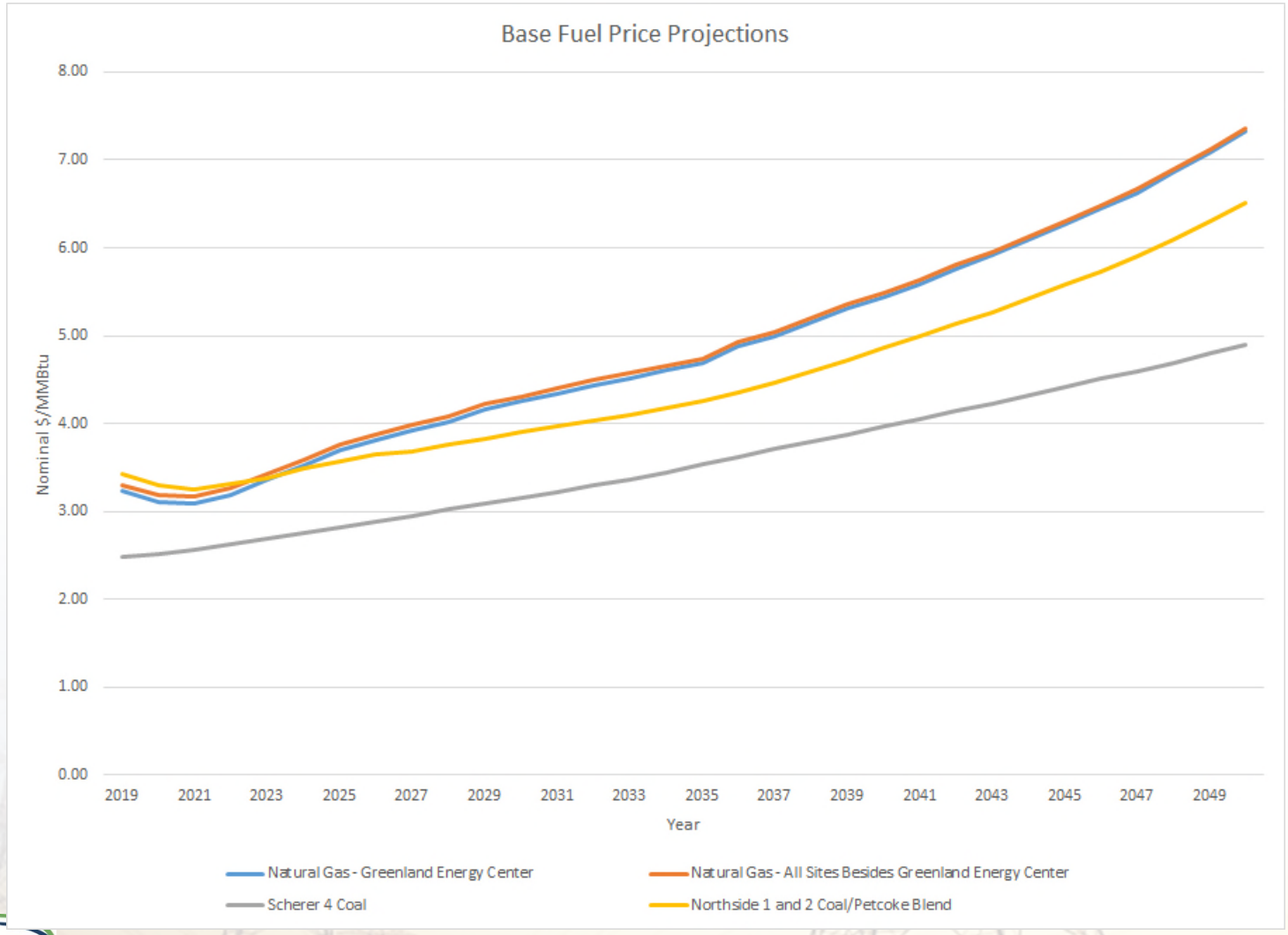

- Development of IRP is a complex process
- Intend to use base IRP expansion plan in current FEECA process
  - FEECA is undertaken every 5 years, and establishes JEA's numeric conservation goals that are approved by the Florida Public Service Commission

# Baseline Assumptions

# Projected Capacity Requirements



# Fuel Price Projections



# Supply-Side Options (following LCOE Screening – see subsequent slides)

| | Utility Scale Solar PV | | Combined Cycles | | | | Reciprocating Engines | Simple Cycle Combustion Turbines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Solar PV w/o Storage (Note 1) | Solar PV w/ 4 Hours Storage (Notes 1, 2) | GE 7HA.02 1x1 | GE 7FA.05 1x1 | Greenland Energy Center 1x1 CC Conversion (Note 3) | Greenland Energy Center 2x1 CC Conversion (Note 3) | Jenbacher 5xJ920 | GE LMS100 | GE 7FA.05 SCCT | GE 7HA.02 SCCT |
| **Installed Cost ($/kW based on full load average ambient output shown below)** | | | | | | | | | | |
| Capital Cost per kW (2018 $) | 723 | 1,503 | 893 | 1,183 | 1,781 | 1,594 | 1,434 | 1,068 | 476 | 485 |
| **Average Day Ratings** | | | | | | | | | | |
| Capacity (MW) | 75 | 75 | 545 | 350 | 310 | 622 | 45 | 109 | 223 | 342 |
| Heat Rate (HHV, Btu/kWh) | N/A | N/A | 6,519 | 6,843 | 6,935 | 6,905 | 7,962 | 8,581 | 9,675 | 9,079 |
| **Summer Ratings** | | | | | | | | | | |
| Capacity (MW) | 75 | 75 | 508 | 325 | 290 | 582 | 45 | 90 | 207 | 314 |
| Heat Rate (HHV, Btu/kWh) | N/A | N/A | 6,535 | 6,832 | 7,021 | 6,990 | 7,967 | 8,897 | 9,774 | 9,206 |
| Winter Ratings | | | | | | | | | | |
| Capacity (MW) | 0 (at Winter Peak) | 75 | 559 | 349 | 321 | 644 | 45 | 113 | 232 | 352 |
| Heat Rate (HHV, Btu/kWh) | N/A | N/A | 6,592 | 6,938 | 6,977 | 6,947 | 7,962 | 8,472 | 9,489 | 8,934 |
| Variable O&M (2018 $/MWh) | 0 | 0 | 2.26 | 2.67 | 2.72 | 2.64 | 9.59 | 4.16 | 14.92 | 17.41 |
| Fixed O&M (2018 $/kW-year) | 12.00 | 20.48 | 6.95 | 9.90 | 10.94 | 6.58 | 42.11 | 12.27 | 8.00 | 5.64 |

Notes:

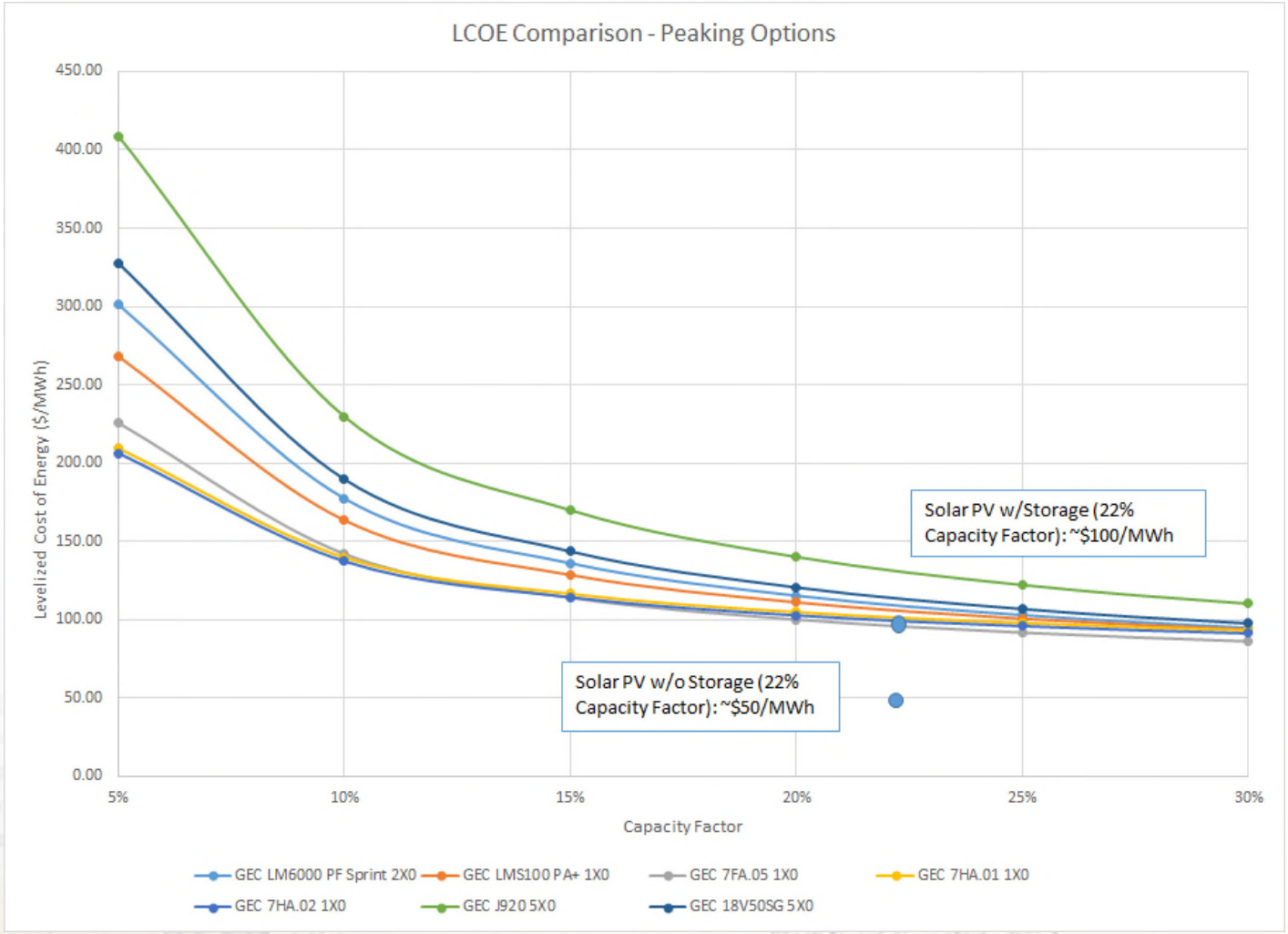
(1). Capital Cost per kW for Solar PV w/o Storage and Solar PV with Storage do not reflect projected decline in costs; assumed to be 6% annually for 5 years. 30% Investment Tax Credit is not reflected but is accounted for in economic analyses.

(2). Solar PV w/Storage does not include costs for battery capacity refreshes, which may be required over time to maintain storage capability.

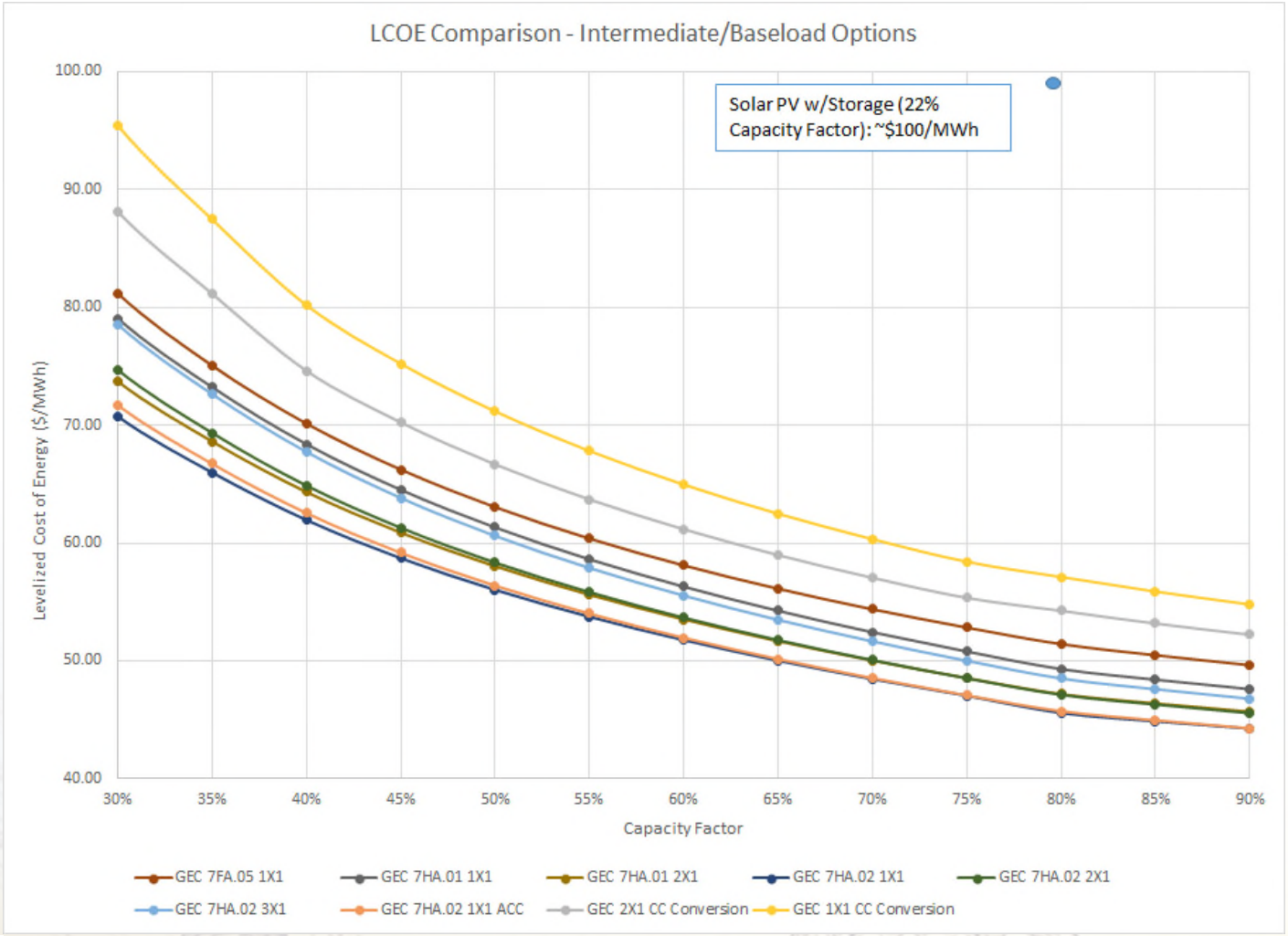
(3). Capital Cost per kW for Greenland Energy Center Combined Cycle Conversions reflect incremental capacity associated with conversions; Capacity and O&M shown reflect entire capacity of converted GEC Combined Cycles

# Levelized Cost of Energy and Expansion Planning/Production Cost Modeling

# LCOE – Peaking Options



# LCOE – Intermediate/Baseload Options



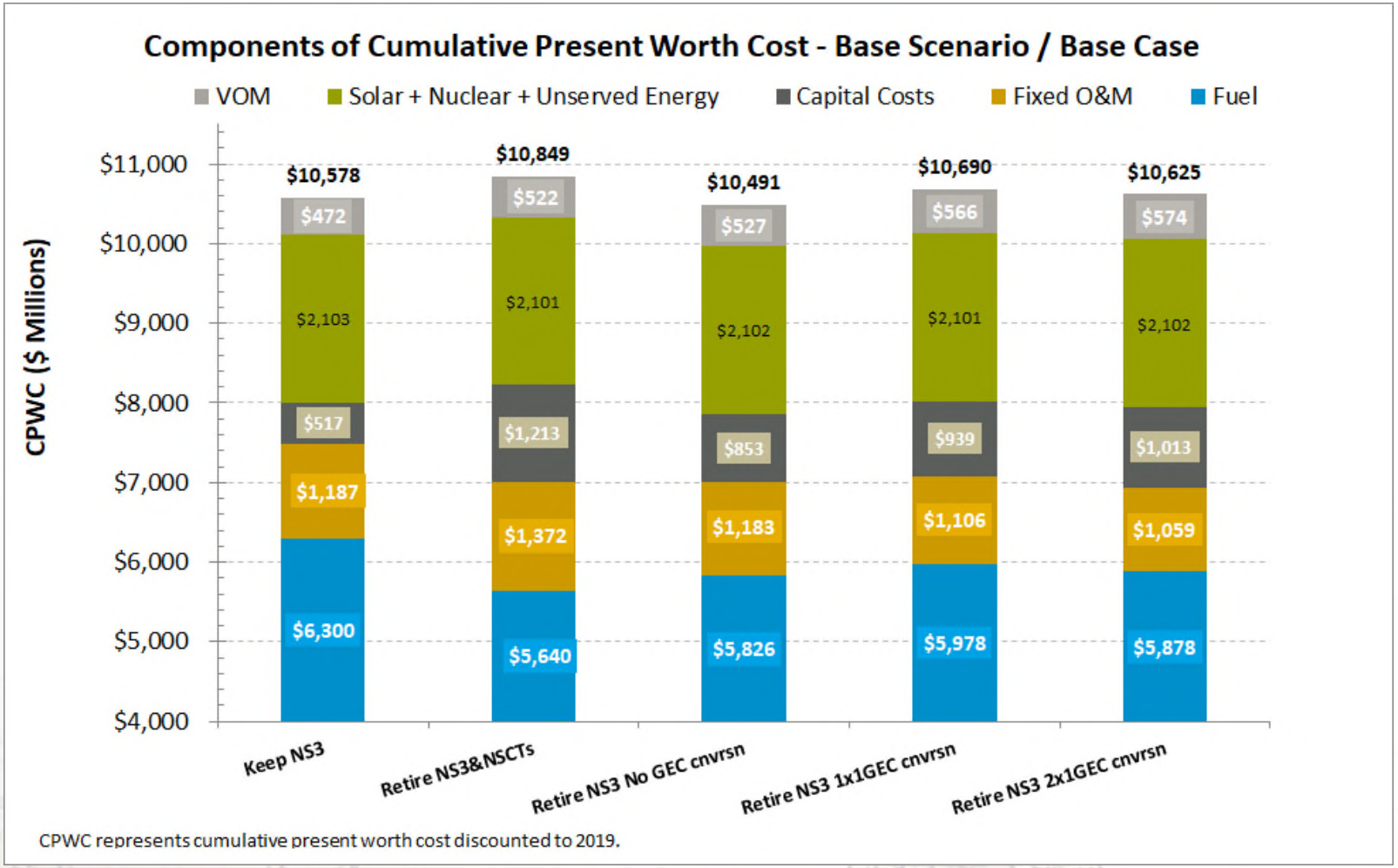
# Scenarios and Sensitivities

# Scenario Matrix

| Area | Metric | Baseline | Load Erosion | Increased Electrfication | Green Economy |
|---|---|---|---|---|---|
| Financial | Interest During Construction & Discount Rate | 4.50% | 6% | 4.50% | 4.50% |
| | Escalation Rate | 2.00% | 3.00% | 2.00% | 2.00% |
| Demand | Total Net Energy Requirements Forecast | AAGR: 0.87% | Energy requirements decline by 1.0% /year for 10 years; then no growth | Energy requirements increase at 2.0%/year until achieve +20% over Baseline forecast; then Baseline AAGR of 0.87% thereafter {See Comment} | AAGR: 0.89% |
| | Net Firm Peak Demand Forecast | AAGR Winter: 0.86%<br>AAGR Summer: 0.70% | Winter and Summer net firm peak demand declines at 1.0% for 10 years; then no growth | Winter and Summer net firm peak demand increase at 2.0%/year until achieve +20% over Baseline forecast; Baseline Winter and Summer AAGR thereafter | AAGR Winter: 1.6%<br>AAGR Summer: 1.6% |
| | EE/Conservation | Current Portfolio | Embedded in Energy Forecast | Embedded in Energy Forecast | Embedded in Energy Forecast |
| | Direct Load Control | None | None | None | None |
| | Interruptible Load | Current Portfolio | Embedded in Peak Demand Forecast | Embedded in Peak Demand Forecast | Embedded in Peak Demand Forecast |
| | PEV | 0.5% by 2027<br>3.6% by 2046 | Embedded in Energy and Peak Demand Forecasts | Embedded in Energy and Peak Demand Forecasts | Embedded in Energy and Peak Demand Forecasts |
| | Net Metering | Current Portfolio | Embedded in Energy and Peak Demand Forecasts | Embedded in Energy and Peak Demand Forecasts | Embedded in Energy and Peak Demand Forecasts |
| Environmental Regulations | Carbon Tax Rate | None | None | None | ~ $11.50/ton in 2020, increasing at 5% annually |
| | Clean Energy Standard (CES) | None | None | None | Reflect 30% carbon neutral by 2030 |
| Supply | Fuel Cost & Availability | Gas supply remains adequate with moderate pricing | Gas supply remains adequate with moderate pricing | Gas supply remains adequate with moderate pricing | Gas supply inadequate with high pricing |
| | Construction Cost | Costs increase at inflation | Costs increase at inflation | Costs increase at inflation | Costs increase at inflation through 2020, inflation + 1% thereafter |
| | Unit Retirements | Northside 3: 2025;<br>Solid Fuel: none expected | Northside 3: 2025;<br>Solid Fuel: none expected | Northside 3: 2025;<br>Solid Fuel: none expected | Northside 3: 2025;<br>Solid Fuel: 2030 |

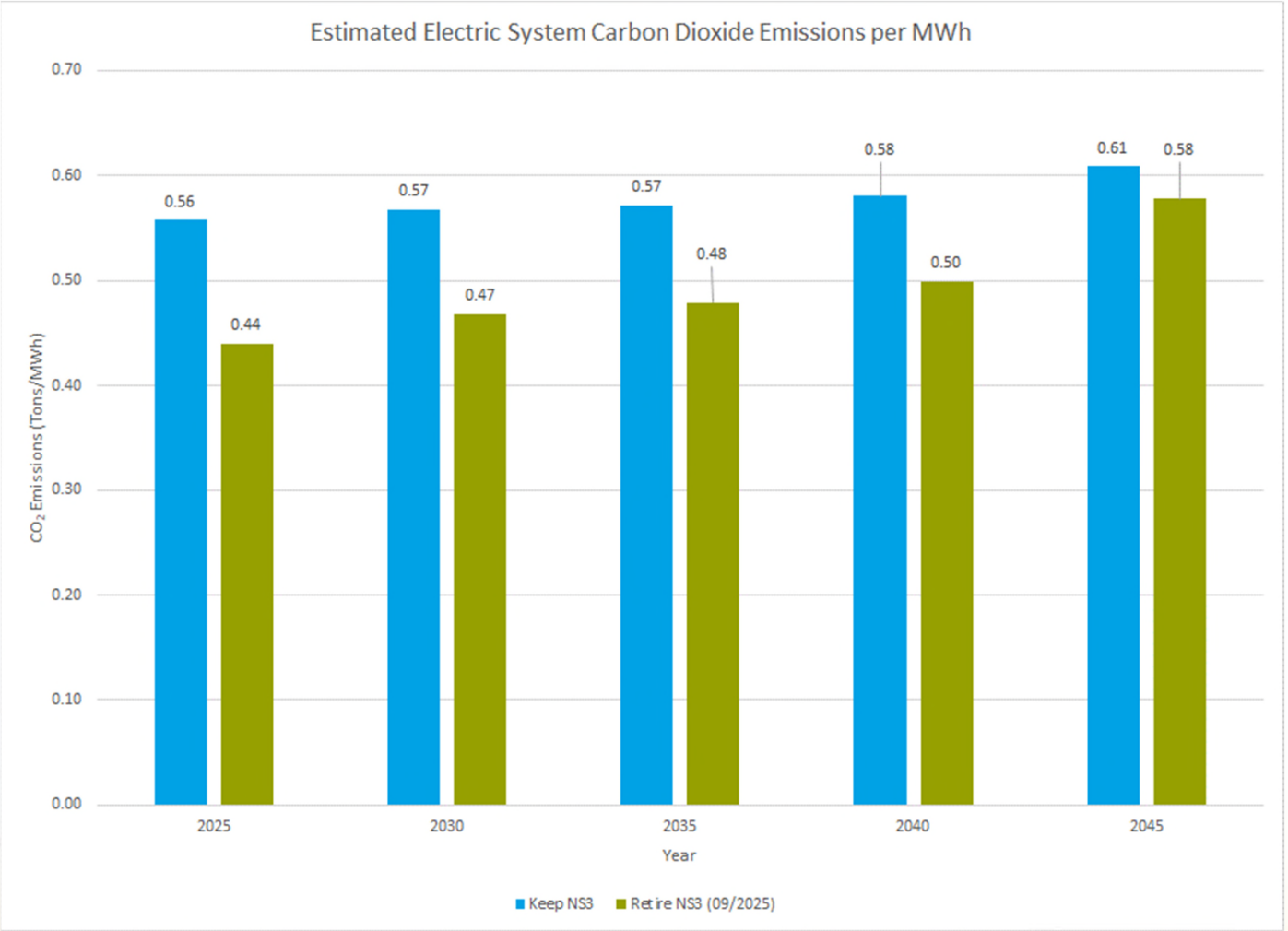
# Analysis – Baseline Scenario

# CPWC Components – Baseline Analysis




CPWC represents cumulative present worth cost discounted to 2019.

# Estimated Carbon Dioxide Emissions per MWh – Baseline Analysis

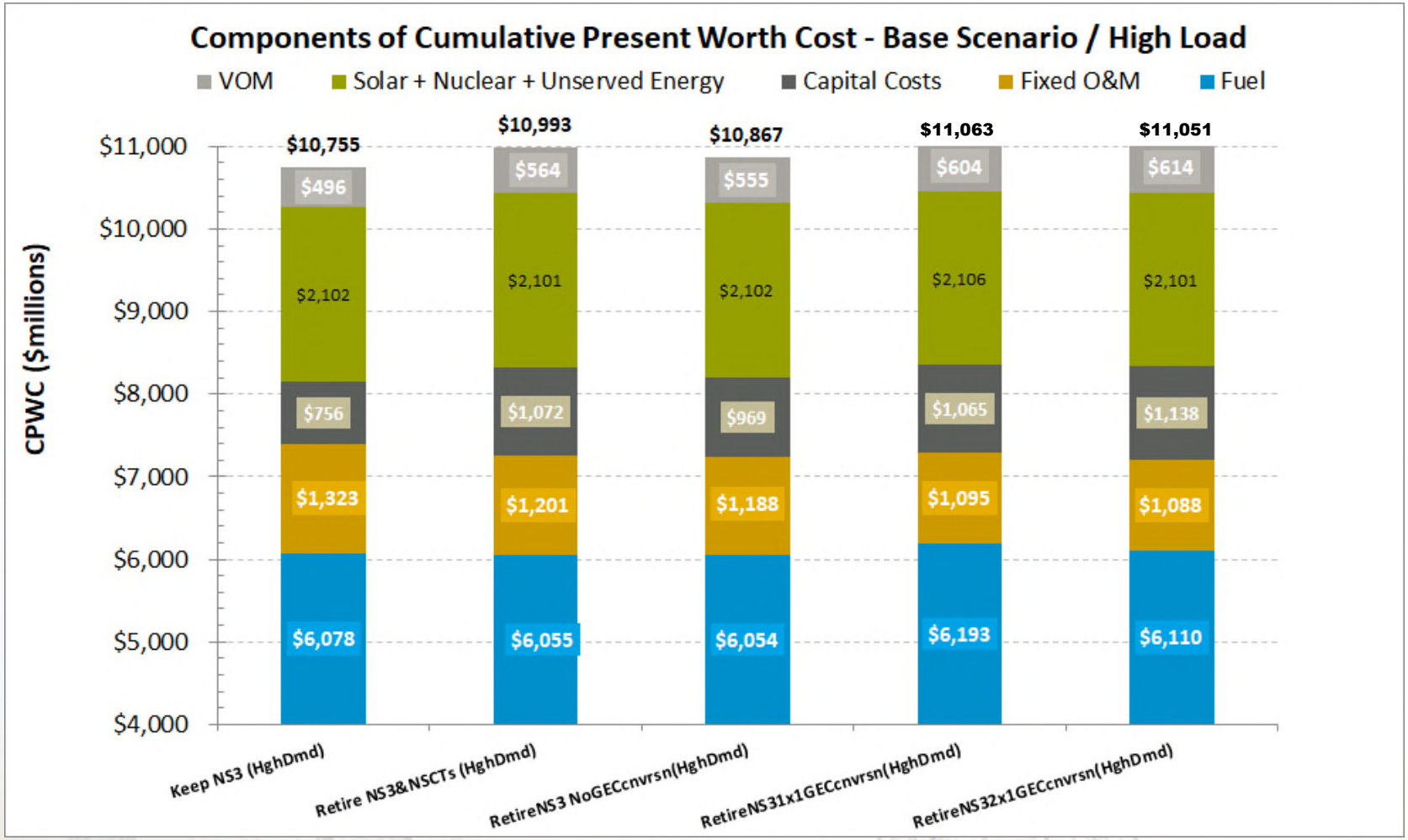


# Observations from Expansion Planning and Production Cost Modeling – Baseline Analysis

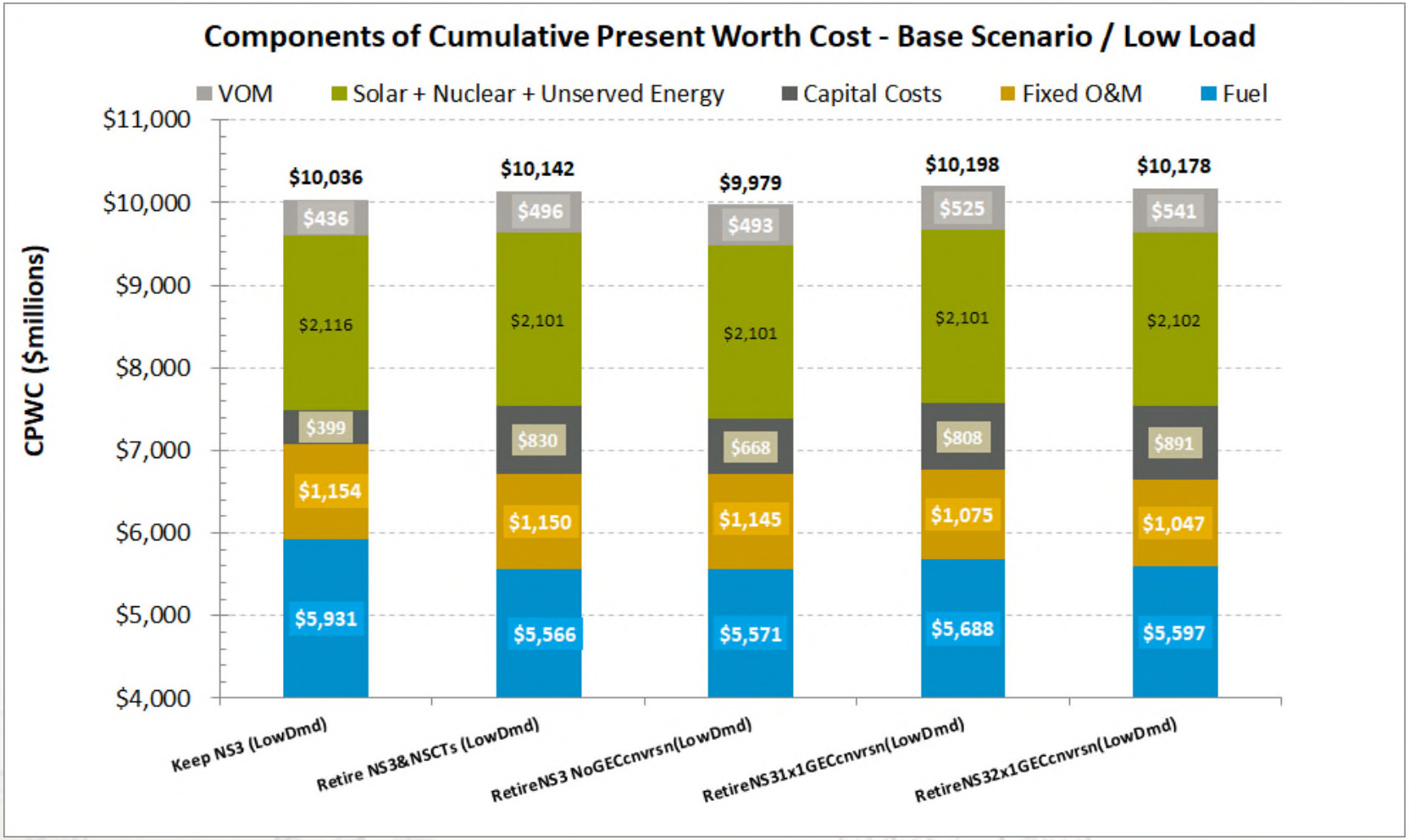
- Preliminary Results of Base Case/Baseline Scenario:
  - CPWC of case that includes retirement of Northside 3 (9/2025) and new 1x1 7HA.02 combined cycle in 2025 is least cost, but other cases are very close
    - CPWC of case with continued operation of Northside 3 (9/2025) is within 1% of CPWC of least cost case
    - CPWC of case with conversion of the existing simple cycle combustion turbines at Greenland Energy Center to combined cycle ("2x1 GEC CC Conversion") in 2025 is ~1.3% higher than least cost case
    - CPWC of case with conversion of one of the existing simple cycle combustion turbines at Greenland Energy Center to combined cycle ("1x1 GEC CC Conversion") in 2025 is ~1.9% higher than least cost case
    - CPWC of case with retirement of Northside 3 and Northside simple cycle CTs is ~3.4% higher than least cost case

# Analysis - Sensitivities and Scenarios

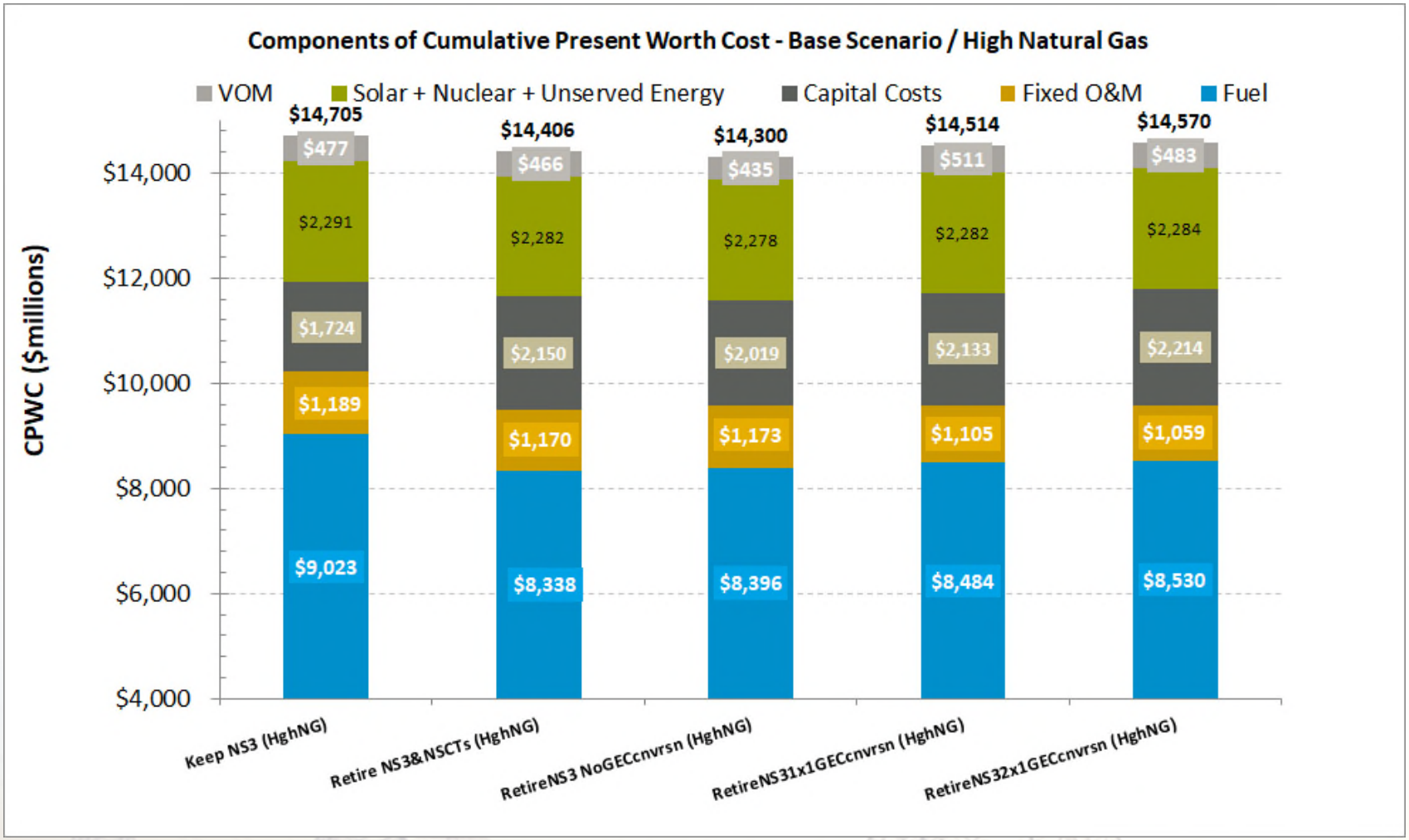
# Results of Expansion Planning and Production Cost Modeling – Baseline Scenario/High Load Sensitivity



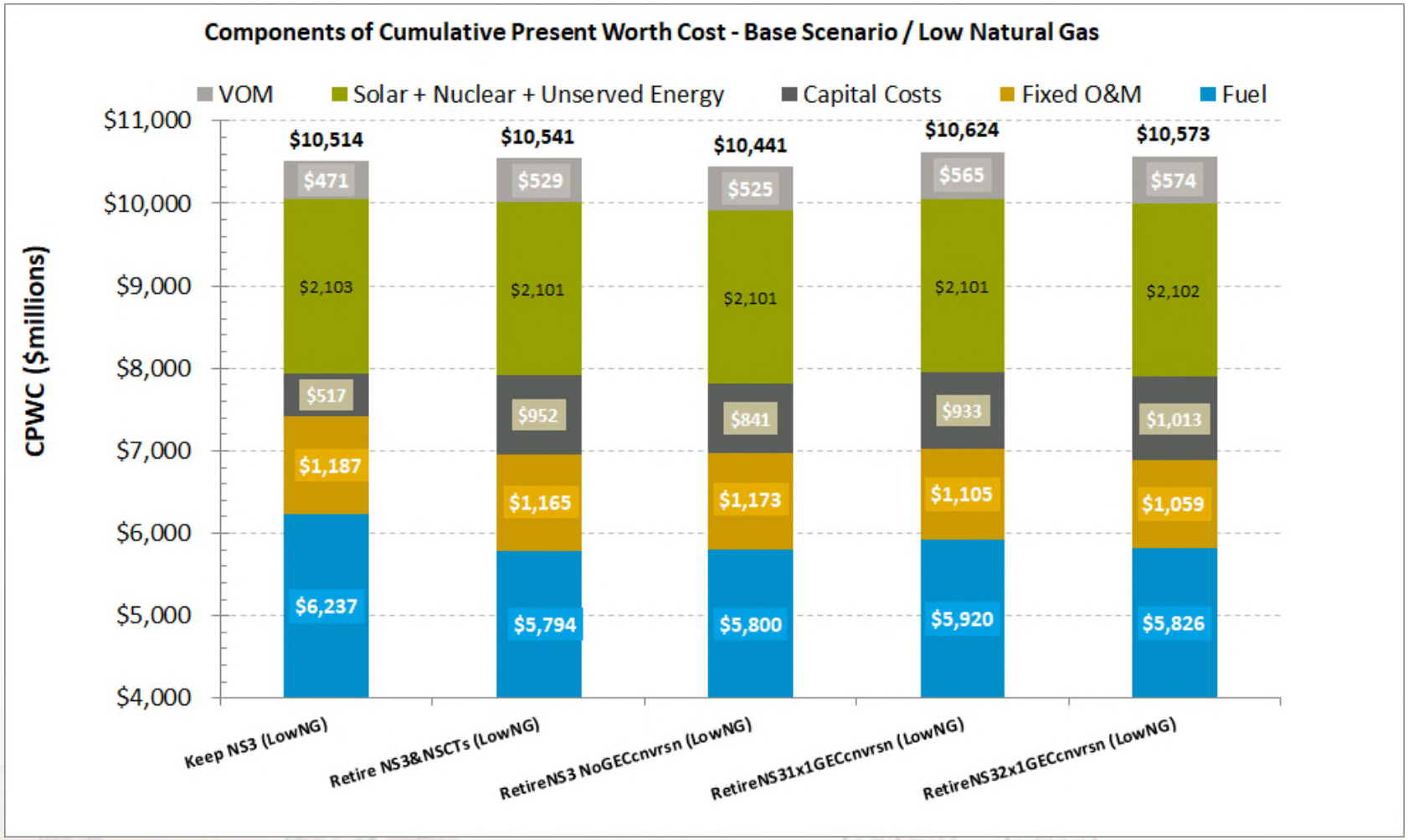
# Results of Expansion Planning and Production Cost Modeling – Baseline Scenario/Low Load Sensitivity



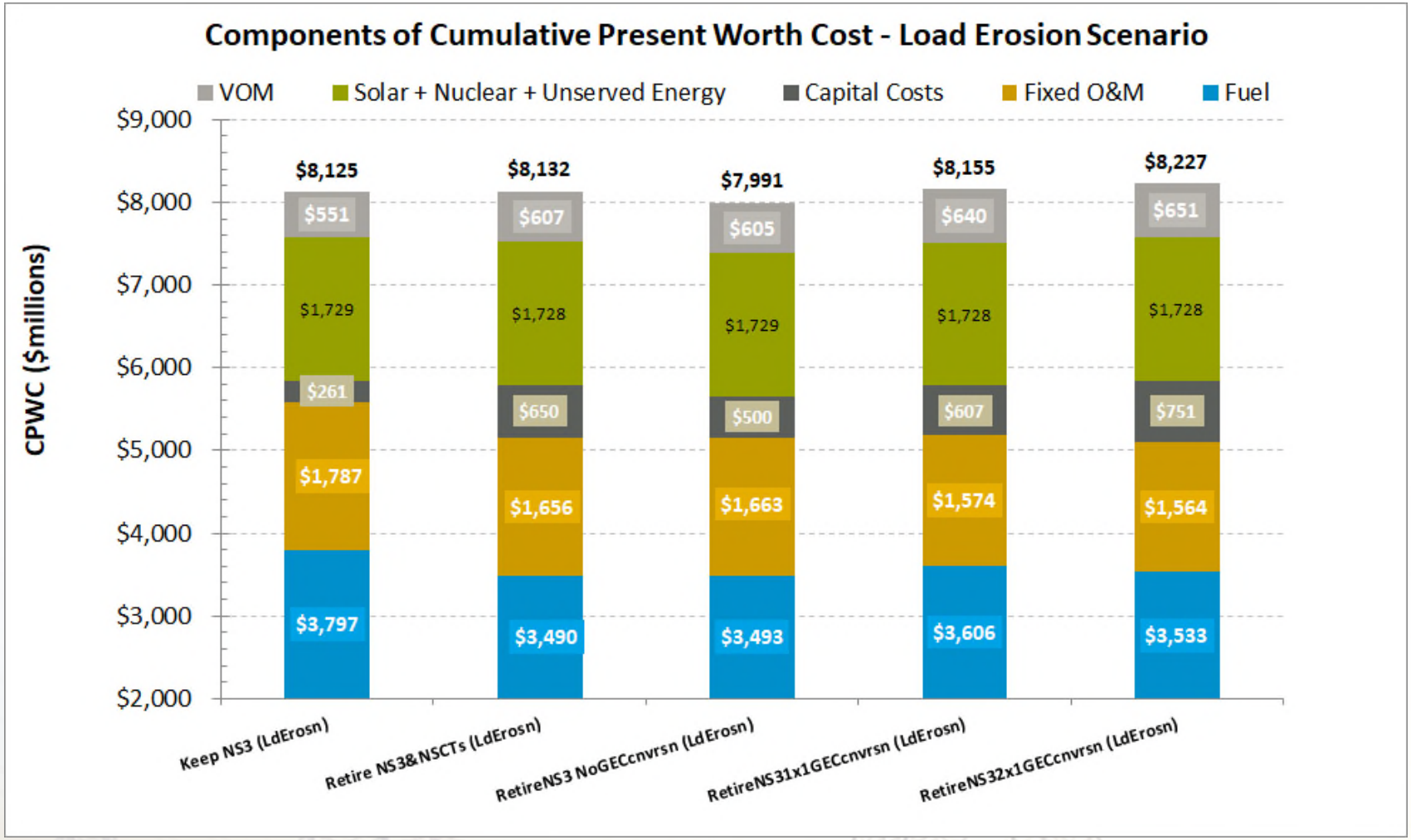
# Results of Expansion Planning and Production Cost Modeling – Baseline Scenario/High Natural Gas Sensitivity



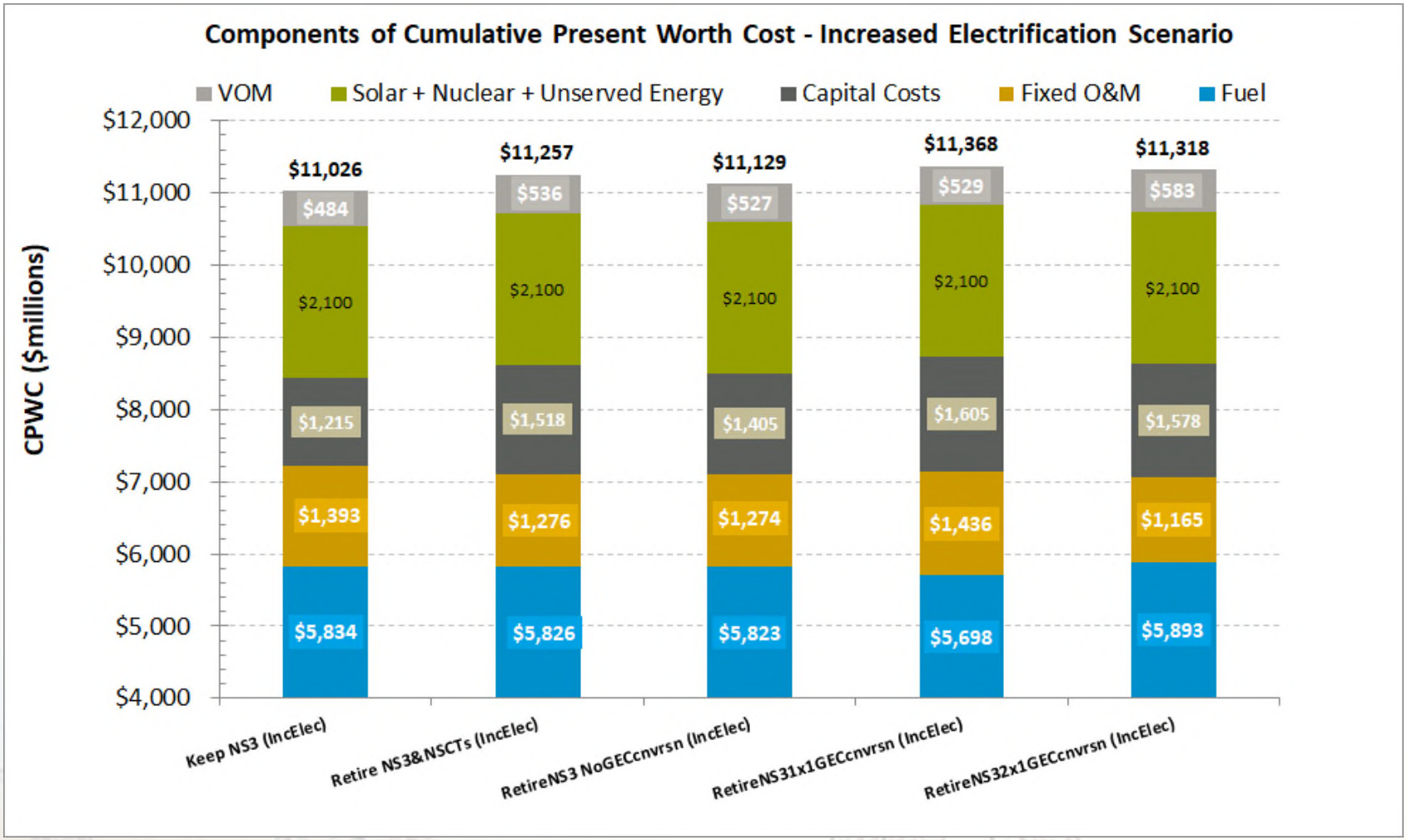
# Results of Expansion Planning and Production Cost Modeling – Baseline Scenario/Low Natural Gas Sensitivity



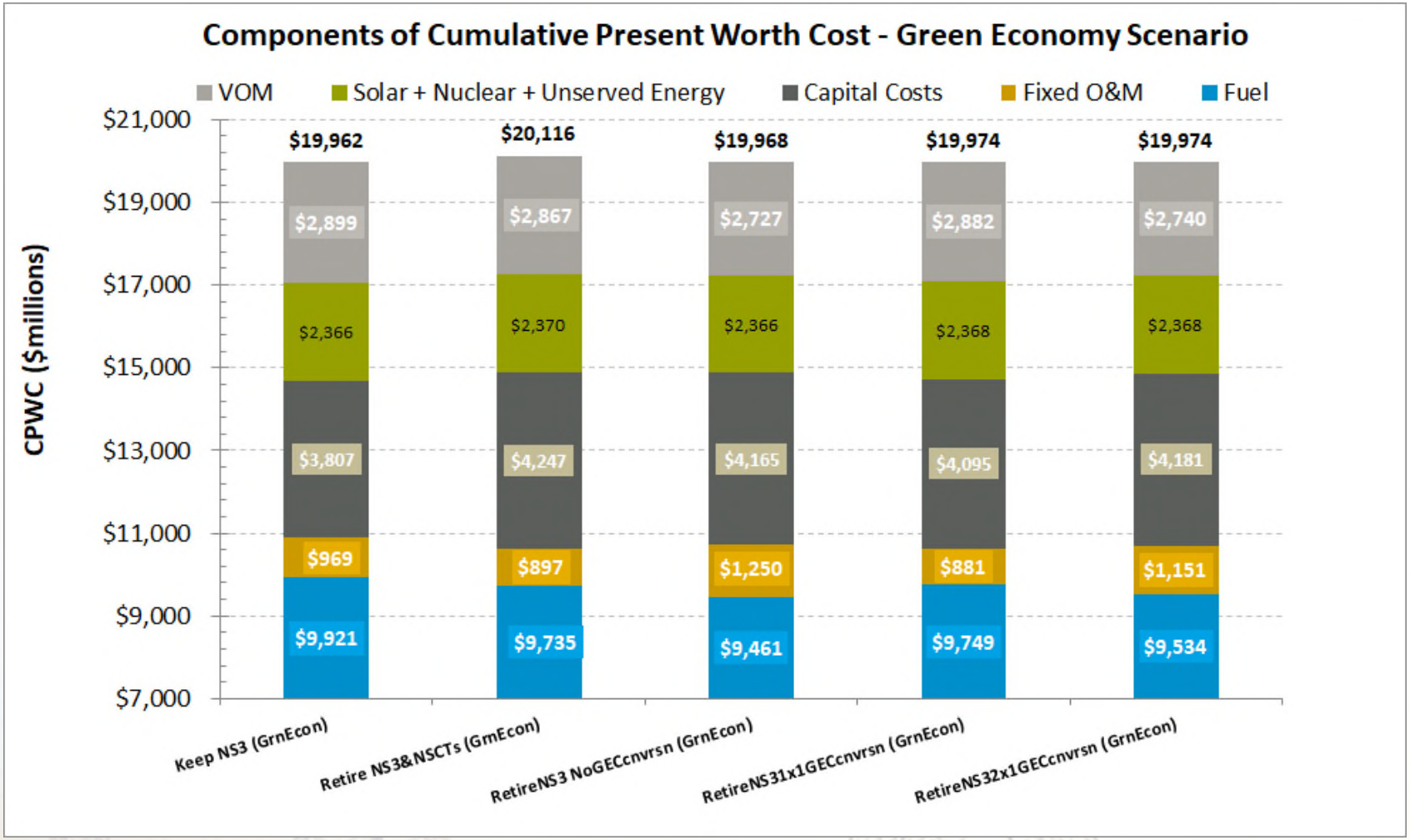
# Results of Expansion Planning and Production Cost Modeling – Load Erosion Scenario



# Results of Expansion Planning and Production Cost Modeling – Increased Electrification Scenario



# Results of Expansion Planning and Production Cost Modeling – Green Economy Scenario



# Observations and Next Steps

# Overall Observations from Expansion Planning and Production Cost Modeling

- In general, CPWCs of expansion plans are close to one another
  - When comparing plans including continued operation of Northside 3, retirement of Northside 3 (9/2025), and GEC combined cycle conversion:
    - Comparison of CPWCs within each scenario/sensitivity are within ~ 1% to 3% of one another
    - CPWCs are often less than 1% different between expansion plans
    - Plans with retirement of Northside 3 (9/2025) and new combined cycle in 2025 are generally lowest in CPWC; differentials in CPWC are small
- Other considerations beyond CPWC related to Northside 3 retirement and construction of new combined cycle:
  - Condition Assessment
  - Regulations beyond 316(b)
  - Reliability
  - Safety
  - Capital Investment
  - Efficiency
  - Operational Flexibility

# Next Steps

- Finalize IRP
- Northside 3 retirement decision
- If move forward with combined cycle (i.e. GEC 1x1 combined cycle or 2x1 combined cycle conversion or new combined cycle):
  - Consider issuing Request for Proposals (RFP) to compare to selected alternative (i.e. GEC CC conversion or new 1x1 combined cycle)
  - New or expansion of existing power plant with 75 MW or more of steam capacity falls under PPSA (see next slide)
  - Other environmental permitting required

# PPSA Considerations

- Statutory Criteria and Relevant Considerations:
  - Need for electric system reliability and integrity
    - How does addition of proposed unit help to improve reliability and integrity – for example, can transmission system benefits be quantified
  - Need for adequate electricity at a reasonable cost
    - Is there a "need" for the proposed unit – for example, to maintain reserve margin
  - Need for fuel diversity and supply reliability
    - Would need to demonstrate reliable supply of fuel for proposed unit
  - Whether the proposed plant is the most cost-effective alternative available
    - Consider power supply request for proposals (RFP) to demonstrate cost-effectiveness
  - Whether renewable energy sources and technologies, as well as conservation measures, are utilized to the extent reasonably available
  - Consideration of the conservation measures taken by or reasonably available to the applicant or its members which might mitigate the need for the proposed plant

# Reference Material

# Levelized Cost of Energy and Expansion Planning/Production Cost Modeling

# Levelized Cost of Energy (LCOE)

- The LCOE analysis was developed based on the estimated cost and performance characteristics for the various alternatives
- LCOE provides a single, levelized cost per MWh (or kWh) lifecycle operating cost estimate for each of the supply-side options
- The LCOE analysis was performed at various assumed levels of annual operation (i.e. capacity factor, or amount of energy generated each year) for each supply-side option
- The LCOE analysis considered (as appropriate for each supply-side option) capital costs, operating costs, and fuel costs and expressed the total annual cost and corresponding energy generation on a nominal (current year) and present value basis

# Levelized Cost of Energy (LCOE)

- The cumulative present value costs were then divided by the sum of the annual present worth factors to calculate the lifecycle levelized cost of energy for each option
- Such an approach is widely used in comparing the relative economics of various supply-side options to determine if one (or more) option may be consistently more costly than the others across a range of possible capacity factors, allowing an initial list of supply-side options to be reduced to a smaller number to be considered in subsequent evaluations

# Expansion Planning and Production Cost Modeling

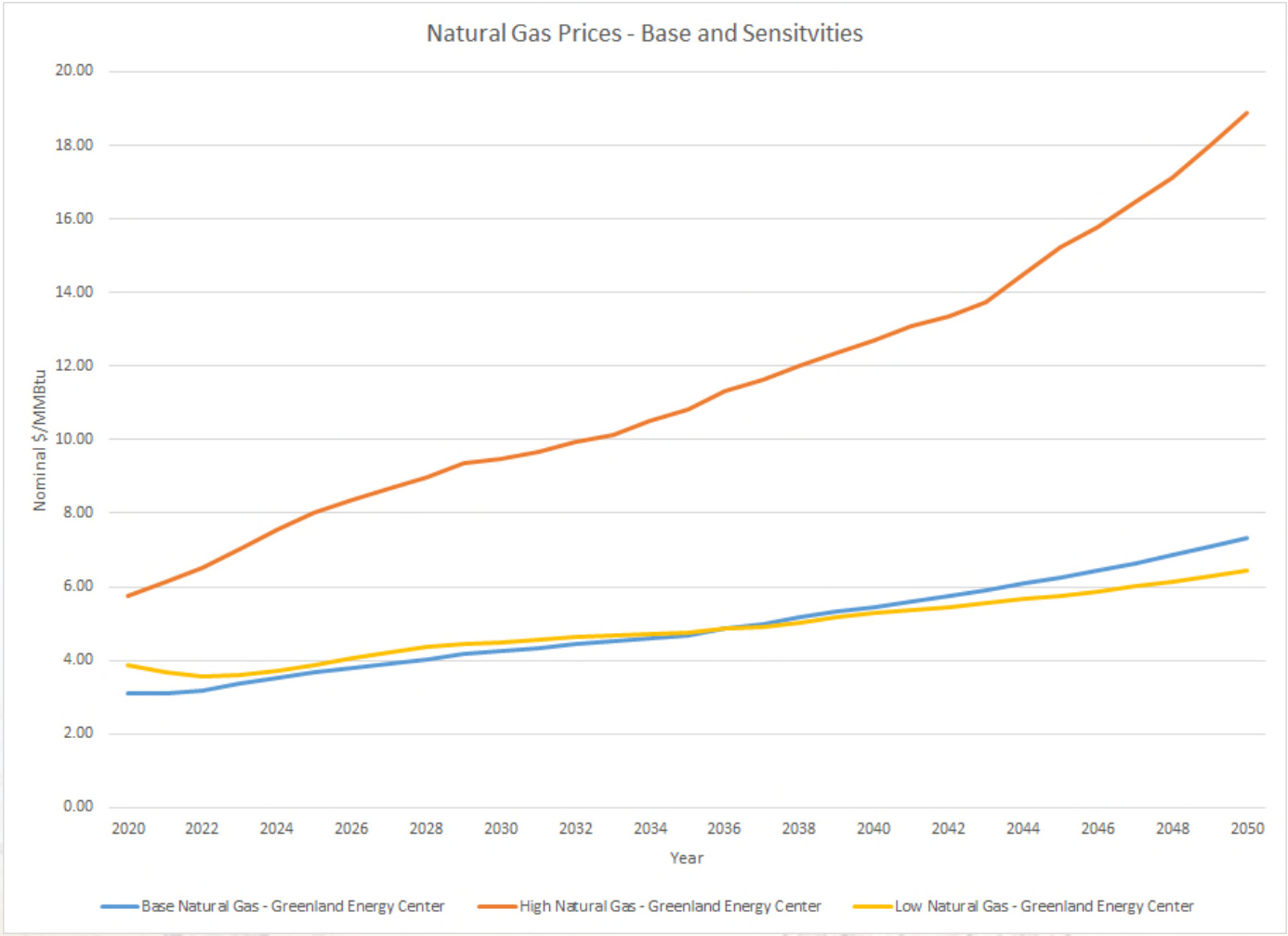
- Expansion planning and production cost modeling was performed to evaluate various resource plans under numerous sensitivities/scenarios
- Used Strategist™ and ProMod™, industry-accepted expansion planning and production cost models licensed by ABB (formerly Ventyx)
- Analyzed cumulative present worth costs (CPWCs), which represent the present value of JEA's system costs over the study period, including variable and fixed O&M costs, capital costs for new unit additions, costs for nuclear and solar purchases, fuel costs, and CO2 emissions costs (for evaluations in which emissions of CO2 are assumed to be regulated)
- Results are presented in subsequent slides

# Scenarios and Sensitivities

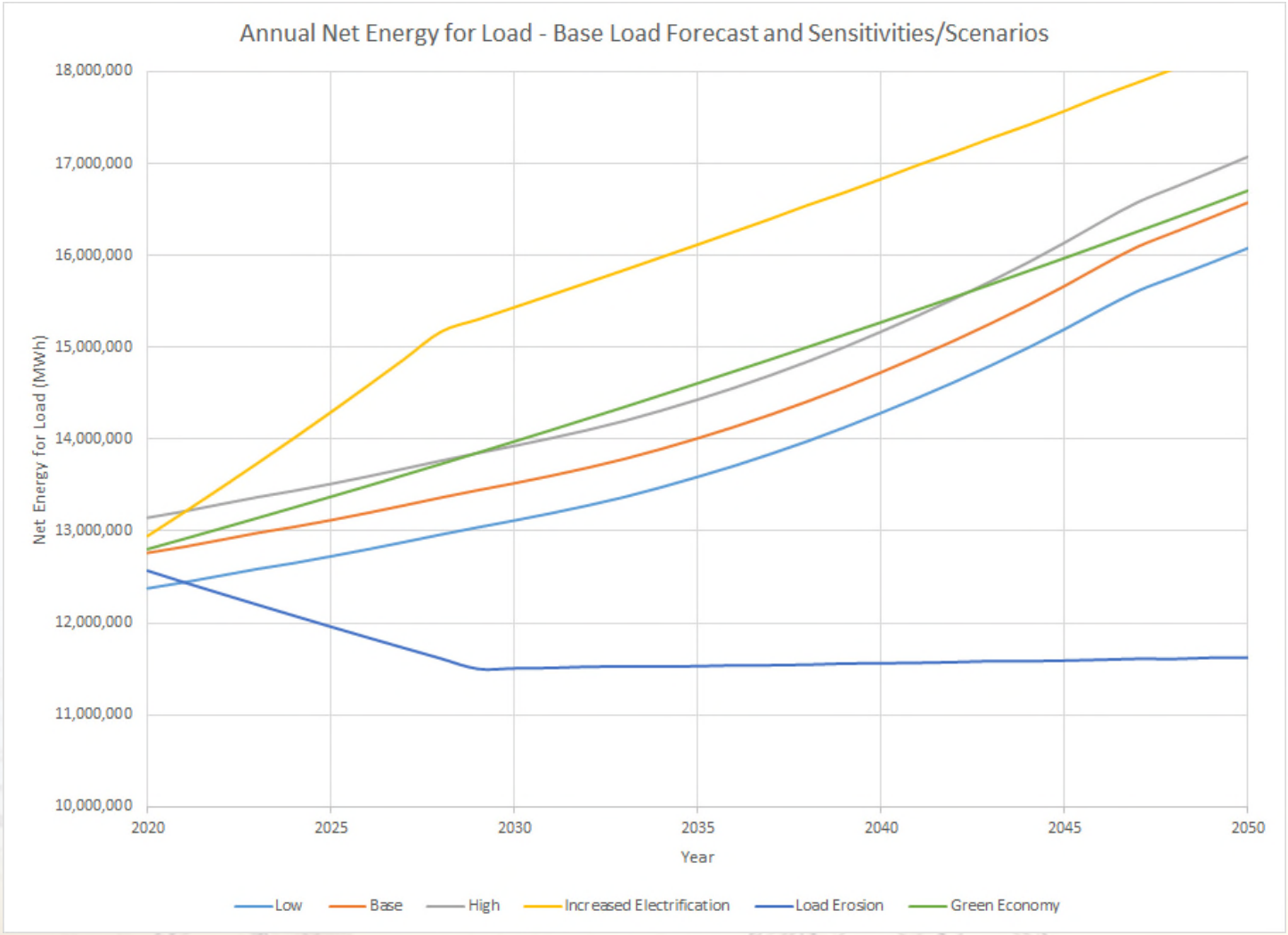
# Scenarios and Sensitivities

- Baseline Scenario:
  - Retirement of Northside 3 in 9/2025
  - No carbon dioxide emissions regulations
  - No clean energy/renewable energy standards
  - Baseline load forecast, fuel price projections, capital costs for new construction
- Considerations and Sensitivities under Baseline Scenario:
  - No Northside 3 retirement (analyzed for all sensitivities)
  - Retirement of Northside simple cycles (analyzed for all sensitivities)
  - High and low load sensitivities
  - Natural gas price sensitivities
- Additional Scenarios:
  - Load Erosion
  - Increased Electrification
  - Green Economy

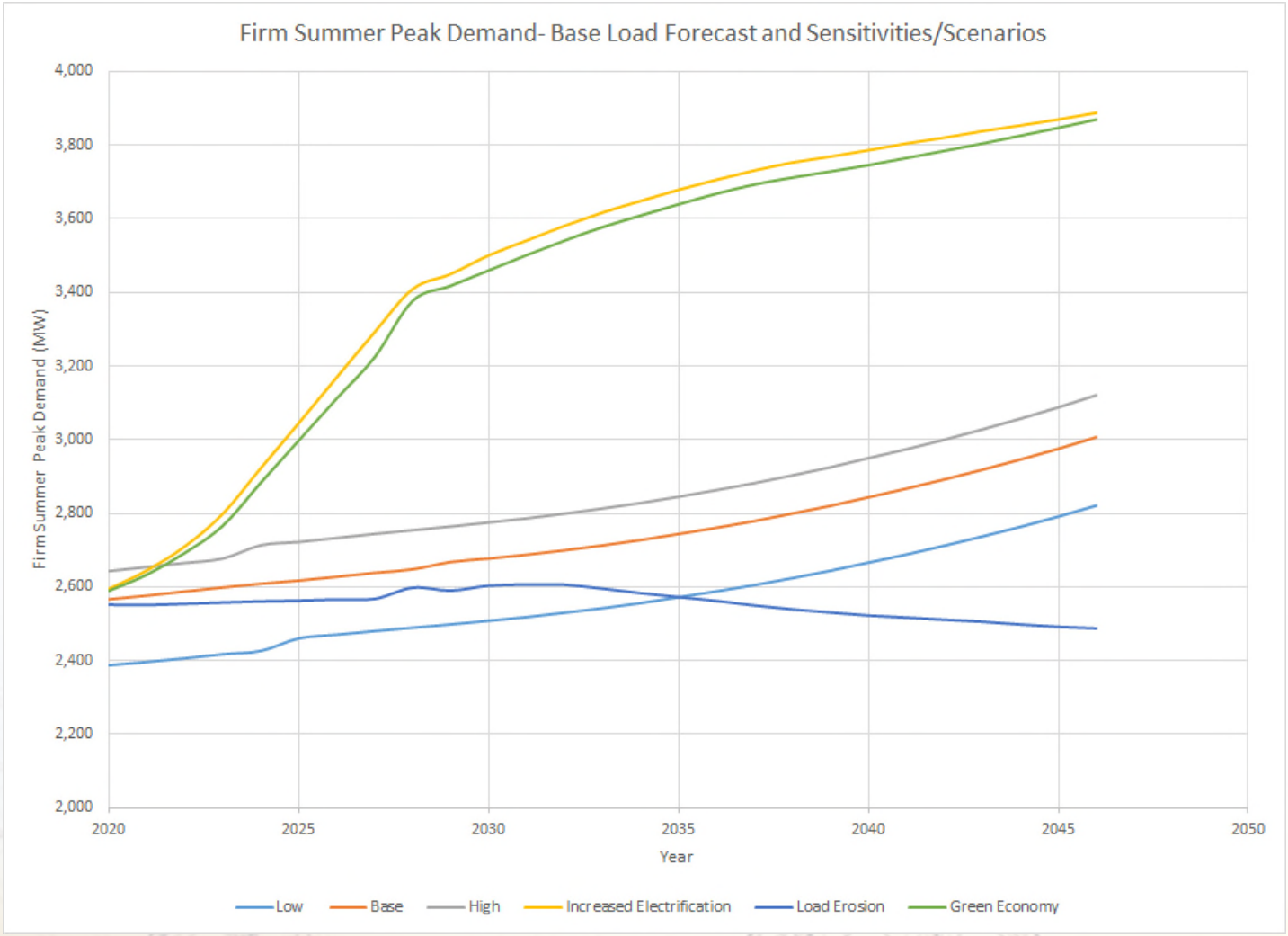
# Natural Gas Price Sensitivities



# Load Sensitivities and Scenarios



# Load Sensitivities and Scenarios



# Observations and Next Steps

# Observations from Expansion Planning and Production Cost Modeling – Sensitivity and Scenario Analyses

- High Load Sensitivity
  - Least cost plan includes continued operation of Northside 3 and new 1x1 7HA.02 combined cycle in 2025
  - Plan with retirement of Northside 3 (9/2025) includes new 1x1 7HA.02 combined cycle in 2025; ~ 1% higher in CPWC than least cost plan
  - Plans with retirement of Northside 3 (9/2025) and either 1x1 GEC CC Conversion or 2x1 GEC CC Conversion are ~ 2.7% to 2.8% higher in CPWC than least cost plan
- Low Load Sensitivity
  - Least cost plan includes retirement of Northside 3 (9/2025) and new 1x1 7HA.02 combined cycle in 2025
  - Plan with continued operation of Northside 3 is ~ 0.6% higher in CPWC than least cost plan
  - Plans with retirement of Northside 3 (9/2025) and either 1x1 GEC CC Conversion or 2x1 GEC CC Conversion are ~ 2.0% to 2.2% higher in CPWC than least cost plan

# Observations from Expansion Planning and Production Cost Modeling – Sensitivity and Scenario Analyses

- High Natural Gas Sensitivity
  - Least cost plan includes retirement of Northside 3 (9/2025) and new 1x1 7HA.02 combined cycle in 2025
  - Plan with continued operation of Northside 3 is ~ 2.8% higher in CPWC than least cost plan
  - Plans with retirement of Northside 3 (9/2025) and either 1x1 GEC CC Conversion or 2x1 GEC CC Conversion are ~ 1.5% to 1.9% higher in CPWC than least cost plan
- Low Natural Gas Sensitivity
  - Least cost plan includes retirement of Northside 3 (9/2025) and new 1x1 7HA.02 combined cycle in 2025
  - Plan with continued operation of Northside 3 is ~ 0.7% higher in CPWC than least cost plan
  - Plans with retirement of Northside 3 (9/2025) and either 1x1 GEC CC Conversion or 2x1 GEC CC Conversion are ~ 1.3% to 1.8% higher in CPWC than least cost plan

# Observations from Expansion Planning and Production Cost Modeling – Sensitivity and Scenario Analyses

- Load Erosion Scenario
  - Least cost plan includes retirement of Northside 3 (9/2025) and new 1x1 7HA.02 combined cycle in 2026
  - Plan with continued operation of Northside 3 is ~ 1.7% higher in CPWC than least cost plan
  - Plans with retirement of Northside 3 (9/2025) and either 1x1 GEC CC Conversion or 2x1 GEC CC Conversion are ~ 2.1% to 3% higher in CPWC than least cost plan
- Increased Electrification Scenario
  - Least cost plan includes continued operation of Northside 3 and new 1x1 7HA.02 combined cycle in 2025
  - Plan with retirement of Northside 3 (9/2025) includes new 1x1 7HA.02 combined cycle in 2025; ~ 1% higher in CPWC than least cost plan
  - Plans with retirement of Northside 3 (9/2025) and either 1x1 GEC CC Conversion or 2x1 GEC CC Conversion are ~ 2.7% to 3.1% higher in CPWC than least cost plan

# Observations from Expansion Planning and Production Cost Modeling – Sensitivity and Scenario Analyses

- Green Economy Scenario
  - Least cost plan includes continued operation of Northside 3 and GEC 1x1 combined cycle conversion in 2025
  - Plan with retirement of Northside 3 (9/2025) includes new 1x1 7HA.02 combined cycle in 2025; CPWC is essentially a "break-even" with least cost plan
  - Plans with retirement of Northside 3 (9/2025) and either 1x1 GEC CC Conversion or 2x1 GEC CC Conversion essentially "break-even" with least cost plan

# Generation Planning Flow Chart