



Analysis of alternative Clean Energy Portfolios (CEPs) for the proposed Nemadji Trail Energy Center (NTEC)

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RMI's Clean Energy Portfolios Model (CEPM) outputs least-cost portfolios that can provide the same services as proposed gas-fired power plants

Our model creates least-cost “**clean energy portfolios**” (CEPs) to meet service assumptions, given a set of resource options:

- **Service requirements:** each portfolio is required provide the same **monthly energy (MWh)**, **peak capacity (in the top 50 hours expected)**, and **flexibility** that a proposed gas plant would provide if built at its presumed in-service date.
- **Resource options:** onshore wind, solar, battery storage, energy efficiency and demand response
- **Resource cost assumptions:** solar, wind, and storage costs are used from NREL's Annual Technology baseline. Energy efficiency and demand response costs from LBL's [Program Administrator Cost of Saved Energy for Utility Customer-Funded Energy Efficiency Programs](#) and EIA Form 861.

Inputs:

- Service requirements
- Resource options
- Resource cost assumptions

Optimization:

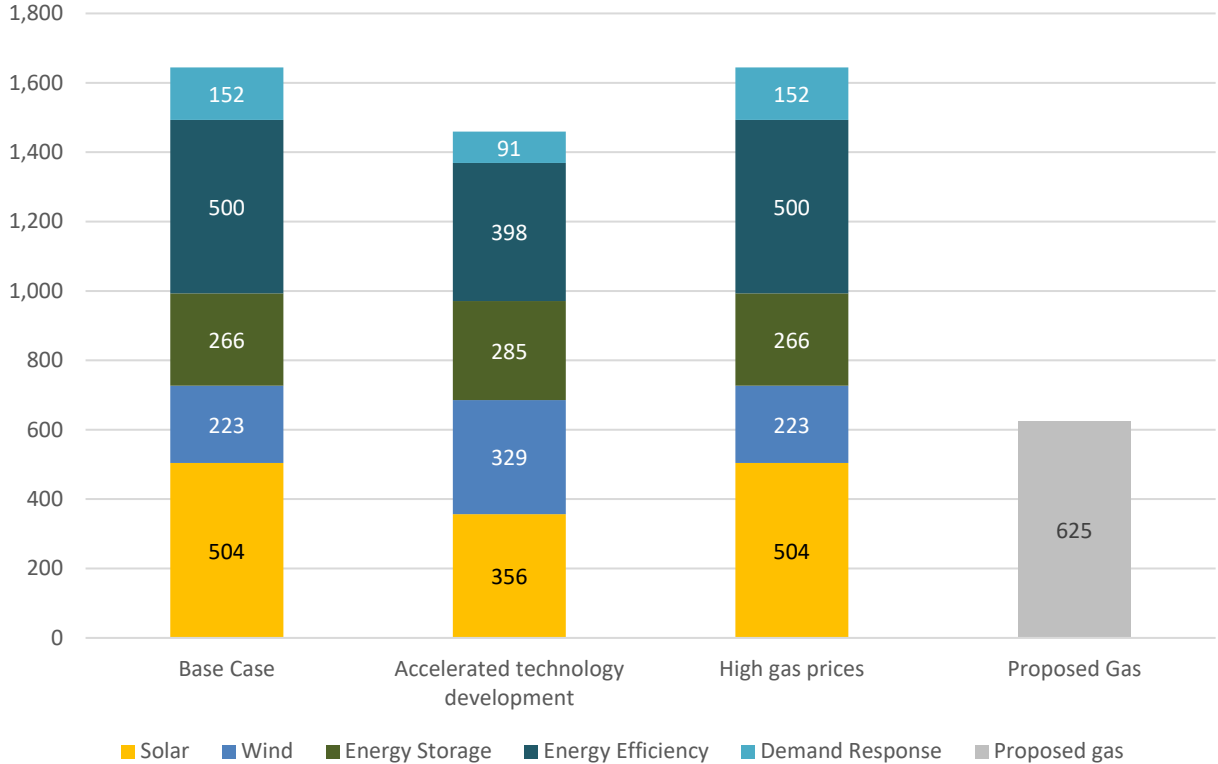
- Linear optimization that chooses the least-cost portfolio to meet the service requirements

Outputs:

- A least-cost CEP comprised of the allowed resource options that meets the service requirements of the proposed gas plant
- Total costs and LCOE that can be compared to the proposed gas plant

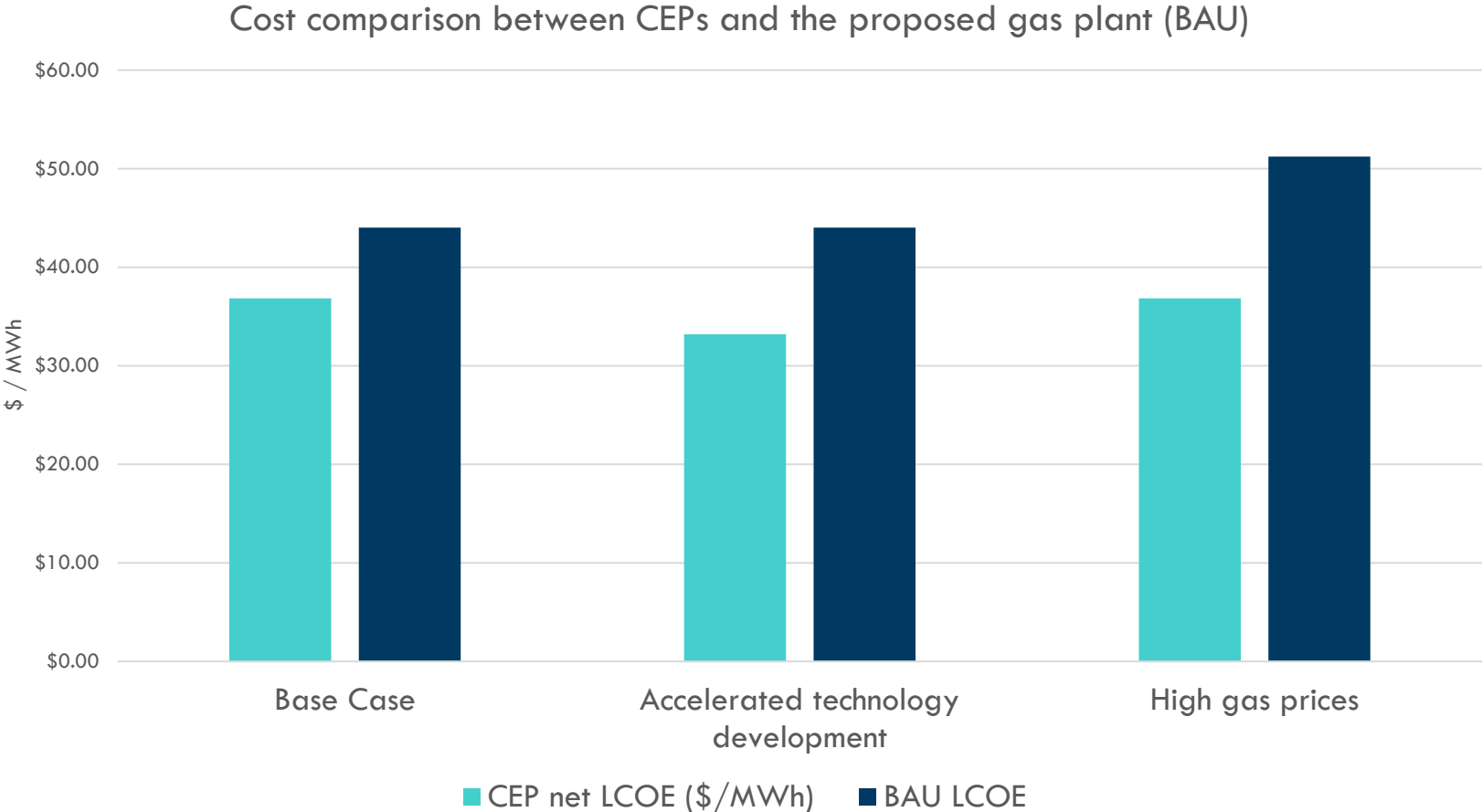
RMI analyzed several options for clean resource mixes that can serve NTEC's need

Clean Energy Portfolio compositions that can provide NTEC's estimated services



Portfolio	Scenario Definition
Base Case	<ul style="list-style-type: none"> Resource costs from NREL ATB's 2021 moderate scenario Gas prices from EIA AEO 2021
Accelerated technology development	<ul style="list-style-type: none"> Resource costs from NREL ATB's 2021 advanced scenario Gas prices from EIA AEO 2021
High Gas Prices	<ul style="list-style-type: none"> Resource costs from NREL ATB's 2021 moderate scenario Gas prices from EIA AEO 2019 (see appendix)

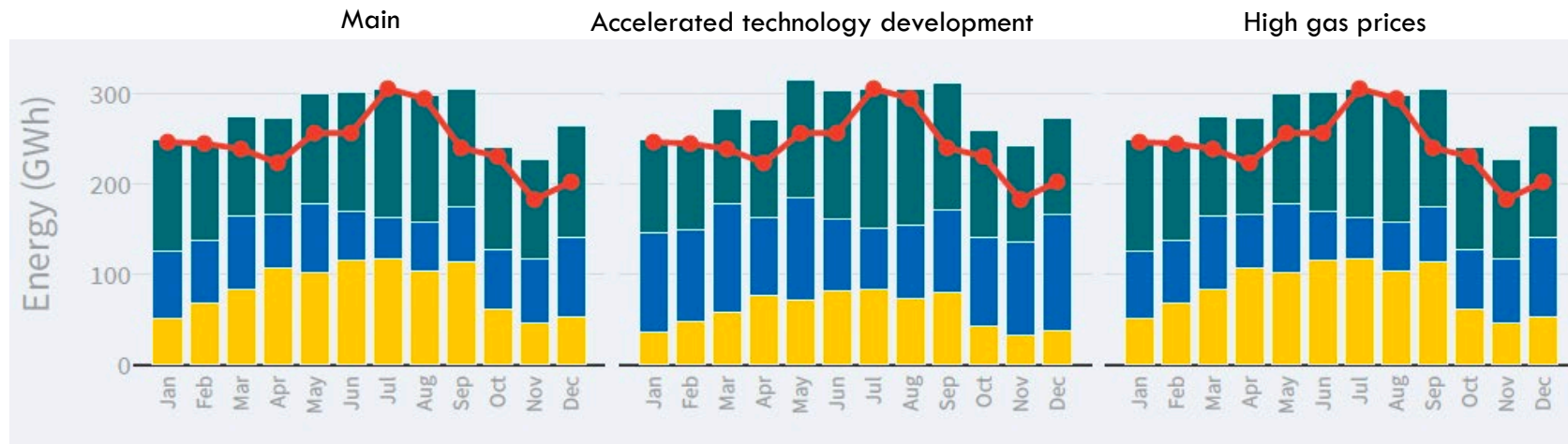
Clean energy portfolios are cheaper on a levelized cost basis



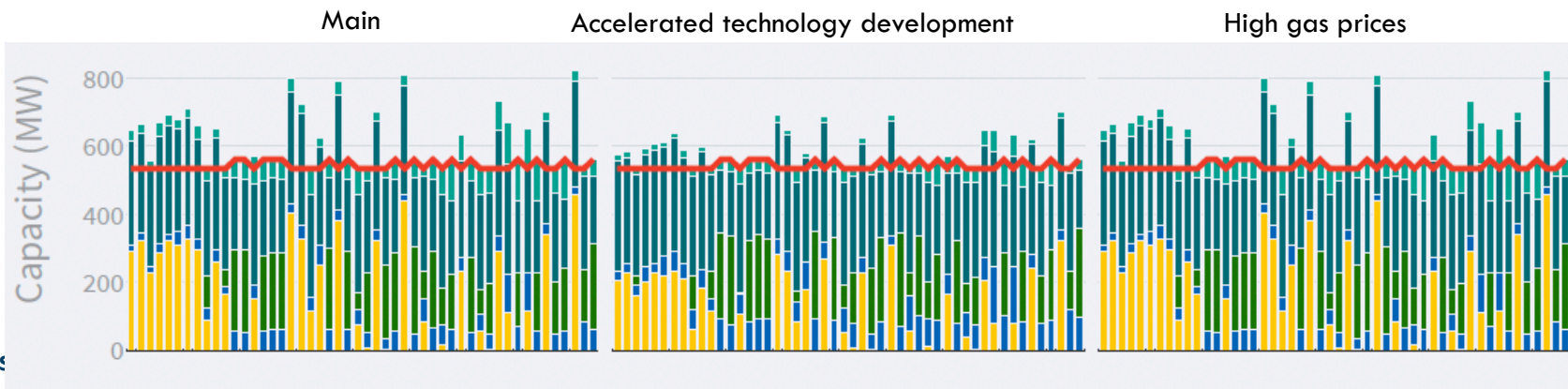
- **Proposed gas levelized cost of energy (LCOE) (\$/megawatt-hour [MWh]):** calculated as the present value of all costs divided by the lifetime energy of the proposed gas plant discounted to its present value
- **CEP net LCOE (\$/MWh):** calculated as the present value of all CEP costs minus the present value of all revenues from energy produced in excess of the gas plant (CEP lifetime energy minus proposed gas lifetime energy), valued at the assumed additional energy price, divided by the present value of the lifetime energy of the proposed gas plant

Each of these clean energy portfolios can provide the same services as the proposed CC

All portfolios meet or exceed the expected monthly generation from a 625 MW CC in the region



All portfolios can replace the CC's expected maximum output during the top 50 peak hours of the year



Conclusions based on this analysis:

- **Gas may not be the least-cost option for meeting the need NTEC is proposed to meet**
- **Several portfolios of clean energy resources may be capable of providing the same services as the proposed gas plant**
- **The utilities should consider more comprehensively assessing cost-competitive options by issuing a technology-agnostic all-source solicitation for the capacity need and analyzing portfolios of returned bids**

Limitations of this analysis:

- Does not model local reliability or transmission constraints
- Does not account for actual expected operations of the specific plant – assumptions are based on regional, historic data
- Does not model long duration storage, hydrogen conversion, or other emerging technologies

APPENDIX

Analysis Approach Details



Assumptions in the CEPM and how they impact portfolio selection

Assumptions in the CEPM that favor gas

- We make CEPs act like a gas plant
- We use pessimistic cost trajectories
- We don't account for the cost impact of decarbonization policies

Assumption in the CEPM that favor CEPs

- We don't account for how transmission may limit regional reliability needs (but do account for transmission cost)
- Results not applicable to a very high renewables (i.e., >50%) grid

Gas price assumptions

Comparison of 2023–2033 levelized prices, the period that most affects CEP competitiveness

Base case (power sector AEO 2021 reference case)	\$3.44
High gas prices (power sector AEO 2019 reference case)	\$4.21
October/November Henry Hub curve + AEO 2021 power sector delivery	\$3.59