At the Crossroads in GVEA Generation

the Financial Engineering Company

June 27, 2022
Where We Are

• Over the past year, GVEA has initiated a series of investigations into its power supply
• These investigations were initially commenced due to decisions that must be made regarding Healy 1 and GVEA’s Battery Energy Storage System (BESS)
• As worked progressed, it became apparent that recent advancements in renewable energy technologies could offer both short- and long-term benefits
• Tonight’s presentation summarizes these investigations and findings
Methodology - General

• Key to this analysis has been the use of GenTrader, a computer program that simulates the GVEA generation system
  • Hourly basis
  • 2023 – 2044 study period
• Approximately 120 scenarios have been evaluated using various assumptions regarding fuel prices, loads, unit availabilities and additional potential resources
• Economics and emissions of these scenarios have been projected while taking into account risk and opportunities
Resources Investigated

- Adding a new gas turbine to double the capacity of the existing combined cycle resource
- New solar installations of 15 and 30 MW
- New wind installations of 15 – 260 MW
- Six separate BESS configurations
- Upgrade to the Anchorage – Healy Intertie
- Purchase of gas-fired generation from the South
- Retirement of:
  - Healy 1
  - Healy 2
Resources Not Included

• Gas line, nuclear, and hydro units such as Susitna were not included due to the uncertainty and long lead time
Evaluation

• Economic
  • Monthly bill to the average Residential user was projected and comprised of:
    • Fuel costs
    • Purchased power costs
    • Capital and operating costs of the new resources being evaluated
    • Other GVEA system costs (admin, distribution, transmission, other production, etc.)

• Emissions
  • Total CO2 emissions over the study period
Immediate Decisions

- Air Quality Operating Permit for Healy 1 requires pollution control equipment to be installed by 1/1/2025
  - Should an SCR be installed at a cost of approximately $25 million or should the unit be retired?
- The existing Battery Energy Storage System (BESS) is aging and requires upgrades
  - Should the existing BESS be abandoned, upgraded, or replaced with newer technology that can be used for regulation of renewable resources?
A Snapshot of GVEA’s Thermal Resources

![Chart showing 2021 Operating Costs (\\$/MWh)]
Healy Units

- Healy 1
  - “Workhorse” of GVEA’s fleet
  - Very high reliability and proven track record

- Healy 2
  - Has not lived up to its expected reliability even with capital improvements
  - High operating costs and not expected to decrease
  - Implications must be worked through regarding GVEA equity if retired

### Annual Availability Factor

<table>
<thead>
<tr>
<th>Year</th>
<th>Healy 1</th>
<th>Healy 2</th>
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<tbody>
<tr>
<td>2021</td>
<td>89%</td>
<td>68%</td>
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<tr>
<td>2020</td>
<td>96%</td>
<td>65%</td>
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<tr>
<td>2019</td>
<td>85%</td>
<td>72%</td>
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<td>2018</td>
<td>93%</td>
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Summary of Findings
Existing Generation – No Retirements

Emissions (10^6 tons)
RF 4 22.9
Existing Generation – No Retirements

- Increasing the capability of the combined cycle can lower costs but only a small amount
  - Susceptible to fuel price volatility
Existing Generation – No Retirements

- Increasing the capability of the combined cycle can lower costs but only a small amount
  - Susceptible to fuel price volatility
- Any scenario with no Healy retirements results in high emissions

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<td>RF 44</td>
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Healy 1 Retirement

Emissions (10^6 tons)

RF 4 22.9

No Healy Retirements/No New Resources
Healy 1 Retirement

- Retirement with no replacement power adds significant costs to system
Healy 1 Retirement

- Retirement with no replacement power adds significant costs to system
- New combined cycle higher than no retirement

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Healy 1 Retirement

- Retirement with no replacement power adds significant costs to system
- New combined cycle higher than no retirement
- With just replacement power from south, a smaller purchase amount results in lower cost of power

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| RF 8  | 17.5 |
Healy 1 Retirement

- Retirement with no replacement power adds significant costs to system
- New combined cycle higher than no retirement
- With just replacement power from south, a smaller purchase amount results in lower cost of power – difficult to fit 50 MW in with loss of only 25 MW (Healy 1)
- Replacement power commensurate with loss of Healy 1 and wind is most economic of scenarios options investigated
- Wind scenario includes the capital and operating costs of a BESS sufficient in capacity (MW) and energy (MWh) to regulate the wind resource

Emissions (10^6 tons)

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• Initial analyses investigated whether to implement the SCR on Healy 1
  • Should Healy 1 be retired?
• But, all options should be on the table
• What about retirement of other GVEA resources?
  • North Pole 1 and 2 and Zehnder units expensive to operate but are there only to fill in the peaks
  • North Pole Combined Cycle is very efficient, can fluctuate with load, and can provide regulation for Eva Creek
• Would retiring Healy 2 provide benefits to GVEA?
What if Healy 2 was retired instead of Healy 1?
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• With no replacement power, retirement of Healy 2 results in very high cost of power

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*Monthly Residential Cost Utility Charge + COPA*

- Healy 2 Retirement – No Replacement
- No Healy Retirements
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What if Healy 2 was retired instead of Healy 1?

- With no replacement power, retirement of Healy 2 results in very high cost of power
- Retirement of Healy 2 instead of Healy 1 results in lower costs

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Healy 2 Retirement – No Replacement
No Healy Retirements
Healy 2 retired with 40 MW Power Purchase/40 MW Wind
Healy 1 Retirement: 20 MW Power Purchase/40 MW Wind (from previous slide)
Healy 2 Availability

- Maintaining Healy 2 in operating fleet and retiring Healy 1 is based on capital expenditures to Healy 2 improving Availability Factor to approximately 88%

- Even with this high availability factor, retirement of Healy 2 is favored

- If expenditures do not work and Healy 2 has a lower availability factor, retirement of Healy 2 instead of Healy 1 is favored even more
Can both Healy units be retired?

- Retiring both units leads to much higher costs without firm replacement power
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Can both Healy units be retired?

- Retiring both units leads to much higher costs without firm replacement power
- Wind might further lower costs but needs to fit in with power purchase
- Can lower costs from retiring Healy 2 only, but only small amount
  - Requires intertie upgrade for replacement power
  - Can upgrade be accomplished in 2½ years?
- Retirement of both Healy units further reduces fuel diversity

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Summary

• Analysis performed over the past several months indicates that the retirement of a Healy unit can lead to lower costs if sufficient replacement power is available

• Of the two Healy units, it is more economic to retire Healy 2

• Retirement of both Healy units right away provides only a small long-term gain over retiring Healy 2 while imposing certain risk factors
  • Sufficient replacement power from the southern utilities requires the upgrade of the Anchorage – Healy intertie
  • Can this upgrade be accomplished before the Healy units are retired (2 ½ years)?
  • Increases reliance on oil-fired generation during times of intertie outages
Summary (continued)

• Adding wind resources to the system can provide both economic and environmental benefits if:
  • Prices are within the range assumed
  • A BESS of sufficient size (capacity and energy) is added to the system for regulation
  • Minimum focusing on a 46 MW / 184 MWh system
  • Should be capable of expansion

• All scenarios run with wind included the capital and operating costs of a BESS
Going Forward

• Continue operation of Healy 1 (implement SCR on Healy 1)
• Initiate steps to retire Healy 2
  • Work with RCA regarding retirement of Healy 2
• Secure firm power replacement / gas commensurate in size with lost power
• Wind
  • Secure wind resource of approximately 40 MW
  • Investigate possibilities to implement interruptible loads (heat/thermal storage, etc.) that could increase the amount of wind that could be accommodated into the system
  • Investigate wind forecasting models
• Install a BESS commensurate in size (MW and MWh) with wind and need to regulate
  • Interruptible loads would reduce need for Regulation Down