What is the most energy efficient and economic solution to ensure the integrity of Corning's manufacturing plants in the event of an electrical outage?

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Introduction

ABOUT CORNING:

- Started in 1851 and became one of world's leading innovator in materials science
- Focuses on 3 core technologies, which are glass science, optical physics, and ceramic science that deliver market-access platforms from optical communications to mobile consumer electronics

Corning Inc. is an energy-intensive, optical fiber manufacturing company whose current asset protection strategy relies on diesel back-up generators to provide emergency power when the grid power is interrupted. This expensive asset must have power restored within 1 hour to assure the integrity of their product, which makes reliability of power a critical factor to keep their assets protected. This leads to our question: Are their current back-up generators the most reliable and cost-effective solution?

Methods

Quantifying Risk-Benefits of Mitigation Techniques

- **NERC:** Power event logs to quantify the various threats to generate probabilistic distributions for calculating downtime losses
- **Standardizing Reporting:** Improvement in current survey format of data collection in a uniform fashion for analysis
- **Estimating Downtime:** Estimation of the baseline cost of loss wares and the opportunity cost per hour of downtime by integrating event frequency data for risk assessment
- **Financial Modeling:** Generated a model that can be used to assess the total cost of an alternative solution

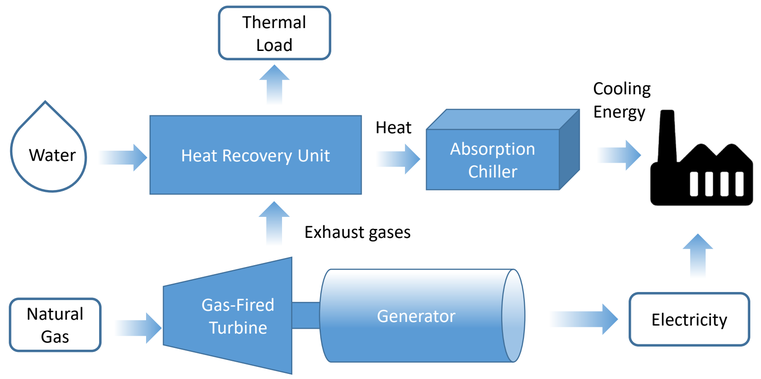
Mitigation Approaches-Cost of Alternatives

- **CHP:** Research into steam/gas turbines as the most viable and cost-effective solution
- **Syracuse Data Center:** Research on reliability options and background knowledge of microturbines and absorption chillers
- **Case Study:** Preliminary feasibility study of the installation of a CHP system with absorption chillers

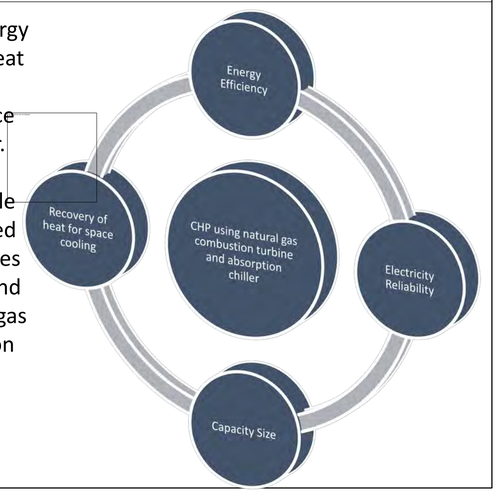
Combined Theory

- **Net Present Value:** Method used to compare alternative power generation options by incorporating initial investment, fuel and O&M costs, risk assessment, and design cost.

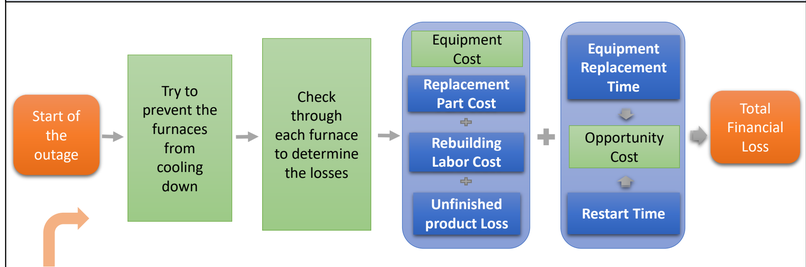
Specific Aim 1: Combined Heat & Power (CHP)



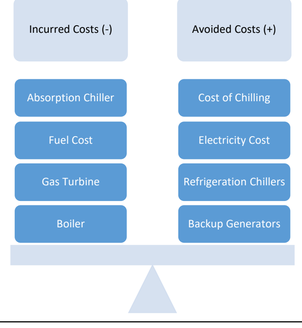
CHP technology increases energy efficiency by recovering the heat exhausted from power generation to be used for space cooling with absorption chiller. From the range of CHP technologies currently available in the market, we have selected natural gas combustion turbines due to its relatively low cost and the existing source of natural gas at the Corning sites. Absorption chillers eliminates electricity consumption that would otherwise be required to produce chilling energy.



Specific Aim 2: Economics & Risk Mitigation

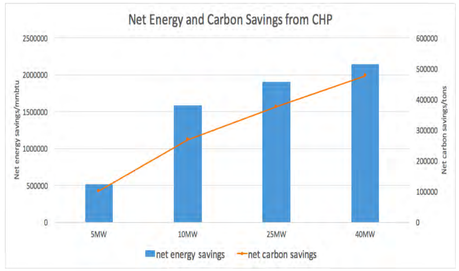


The duration of the outage positively correlates with the likelihood of damaging the furnace. The financial model calculates the total financial losses associated with an outage

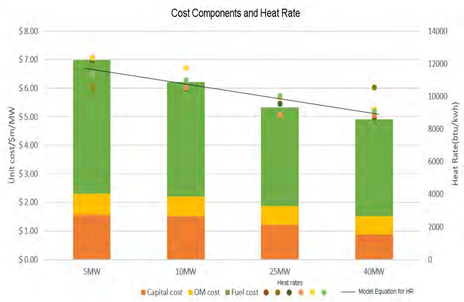


The figure compares the cost and benefit variables taken into account for NPV calculation

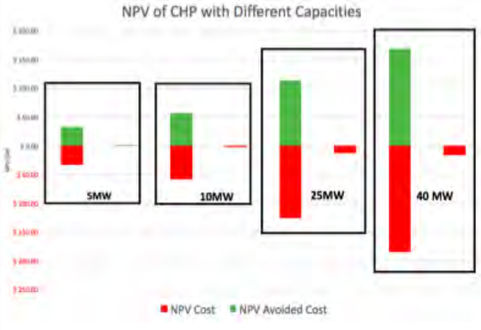
Conclusions



Energy and carbon savings increase with CHP capacity



Capital cost per MW generated gets cheaper with at larger scales. The large systems also have more efficient heat rates.



NPV values for 10-40MW are negative based off our NPV analysis, but can the savings in reliability make up the difference?

In many industries, back-up generators are employed as the back up power generation solution. From our research, energy savings and carbon emission reductions from using CHP, instead of running a backup diesel generator, result in a positive solution and benefits increase with larger capacity. Also, the costs of CHP and heat rate decrease with larger-scale CHPs. For Corning, 10MW CHP system with absorption chillers is recommended as the most energy efficient and economic solution to strengthen their current asset protection strategy. Therefore, combined heat and power (CHP) system in combination with the installment of absorption chillers reap greater energy savings, increase reliability, and reduce carbon emission.

References & Acknowledgements

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