

Distributed Cogeneration for Commercial Buildings: Can We Make The Economics Work?

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2011 CEDM Advisory Board Meeting

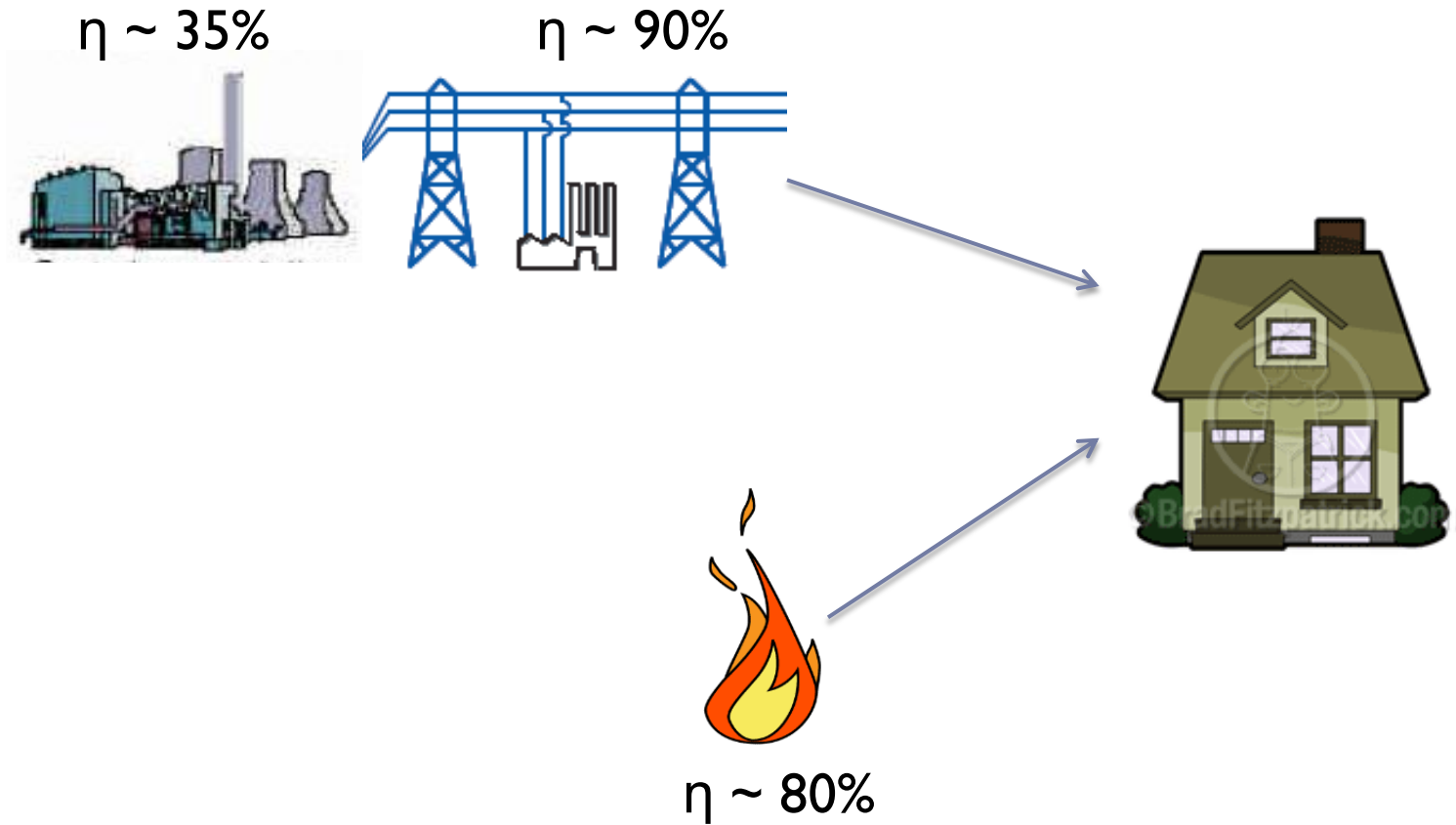
Areas of Research

Marginal emissions rates of the US electricity system

Comparison of emissions benefits from various demand- and supply-side interventions in the electricity industry

Strategies for improving the economics of cogeneration

The Current System...



Cogeneration is ~30% More Efficient

$\eta_{\text{electrical}} \sim 35\%$



$\eta_{\text{thermal}} \sim 45\%$

Slow Adoption of Small-Scale Cogeneration

- ▶ **Cogeneration is a high risk, low return investment.**
 - ▶ Large capital expense
 - ▶ Huge uncertainties in future fuel and electricity prices

Case Study: Large Hospital In Newark, NJ

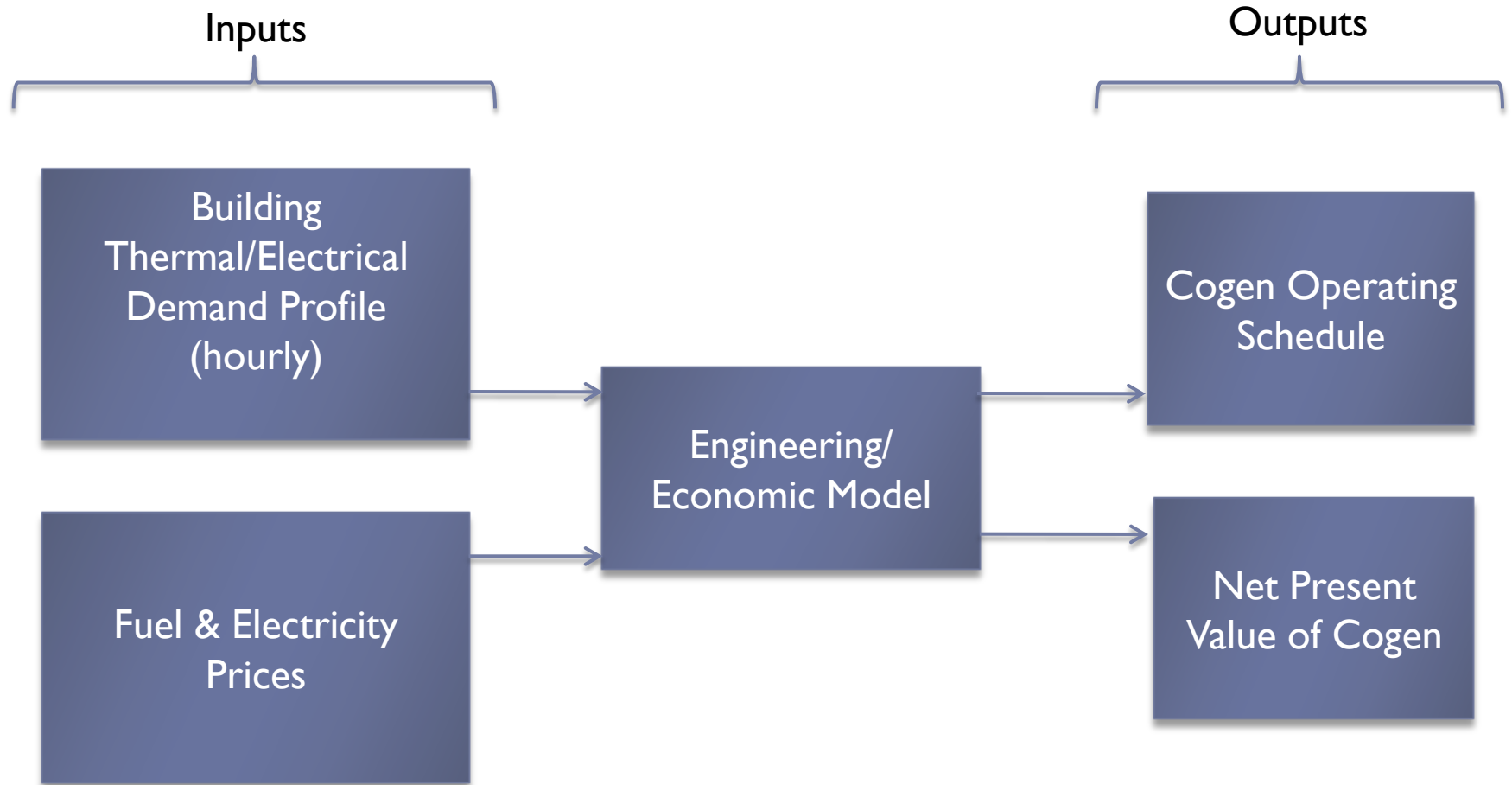
Case Study Building

- ▶ 150,000 sq. ft. hospital
- ▶ \$850,000 annually for heating and electricity

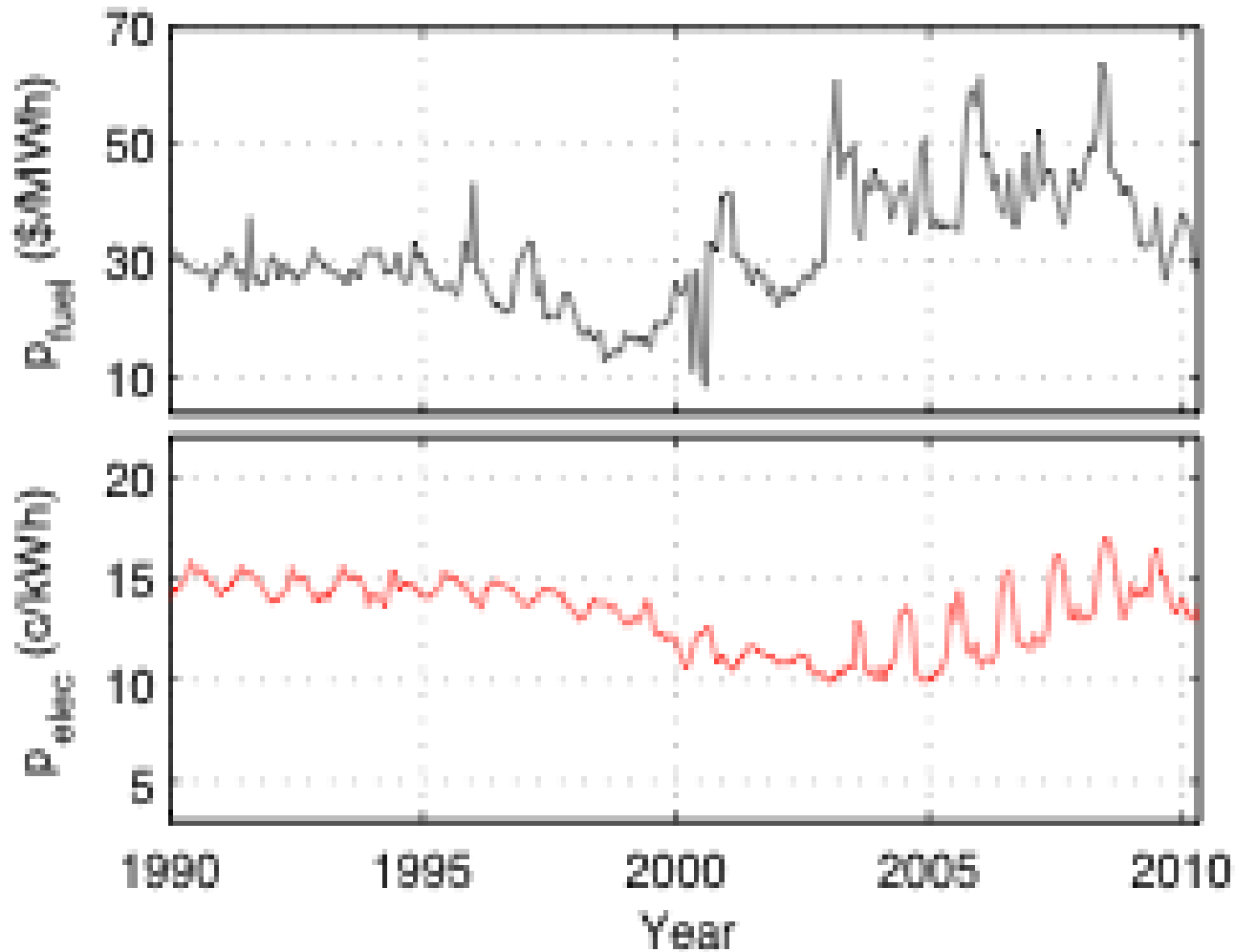
Cogeneration Unit

- ▶ 300 kW_e reciprocating engine (natural gas-fired)
- ▶ Capital Cost: \$600,000
- ▶ Net Efficiency=79%
- ▶ Discount rate=12%

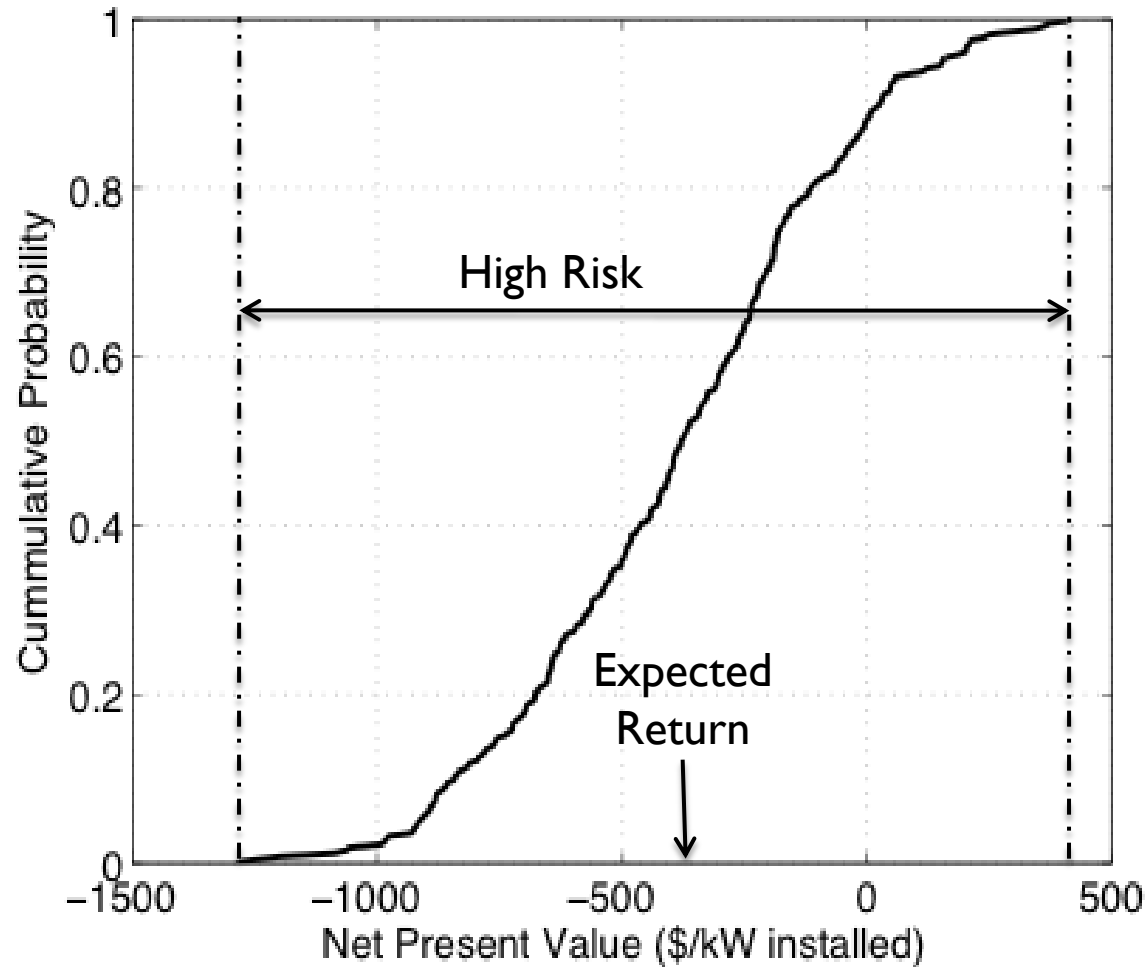
Model Overview



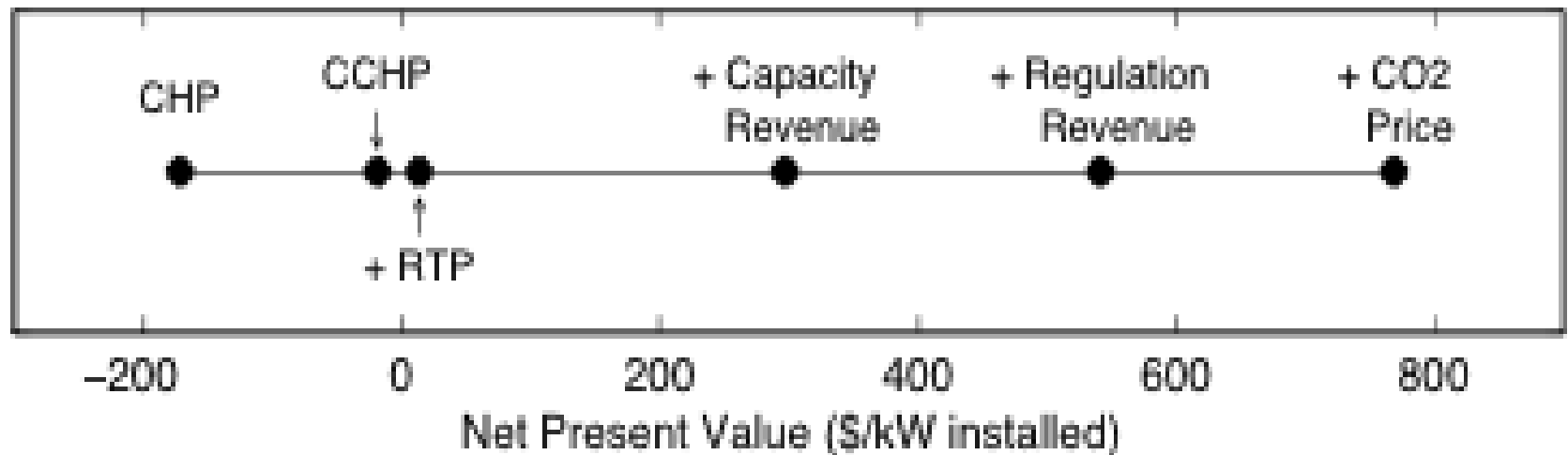
Historic Fuel & Electricity Prices



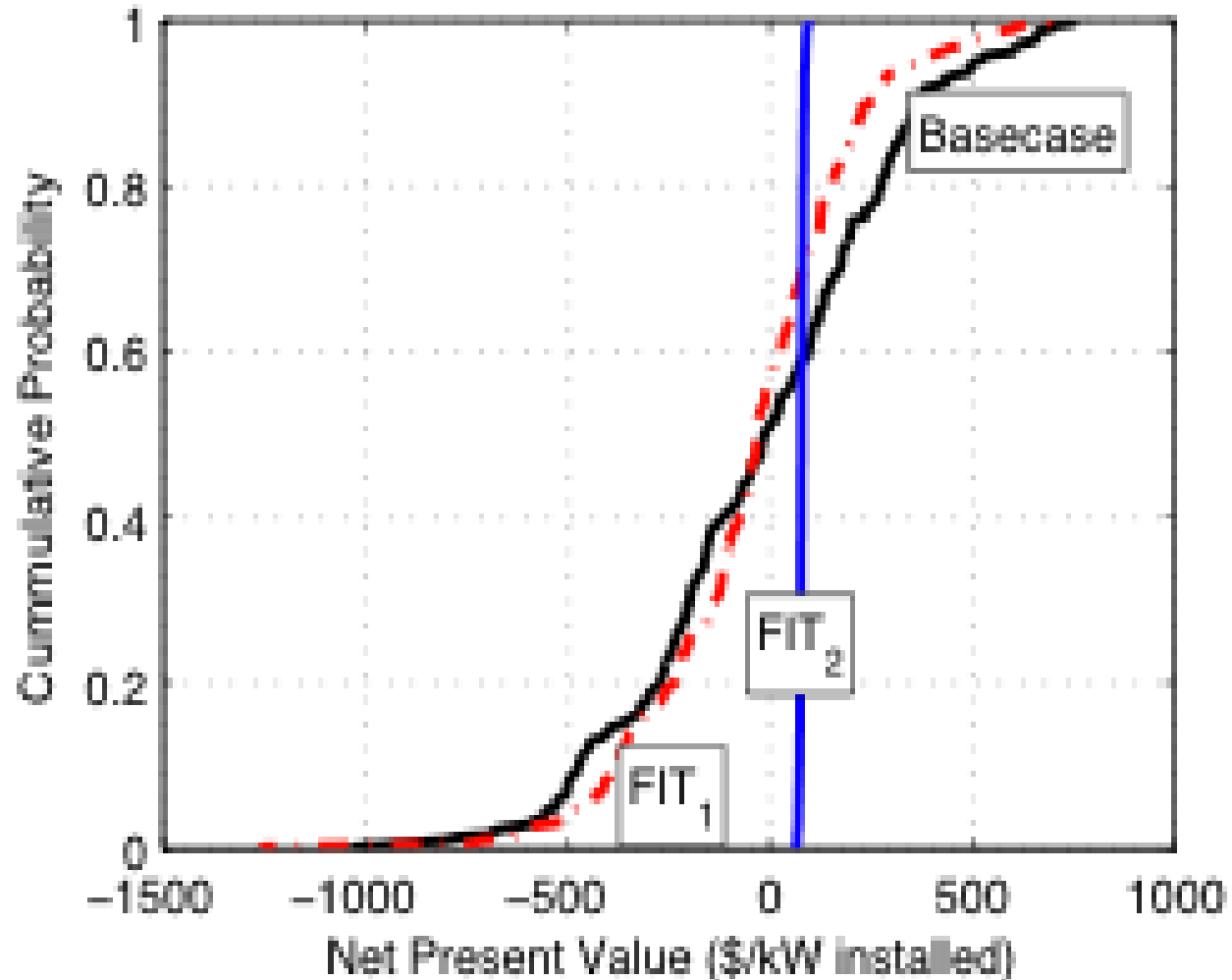
Cogen: High Risk, Low Return



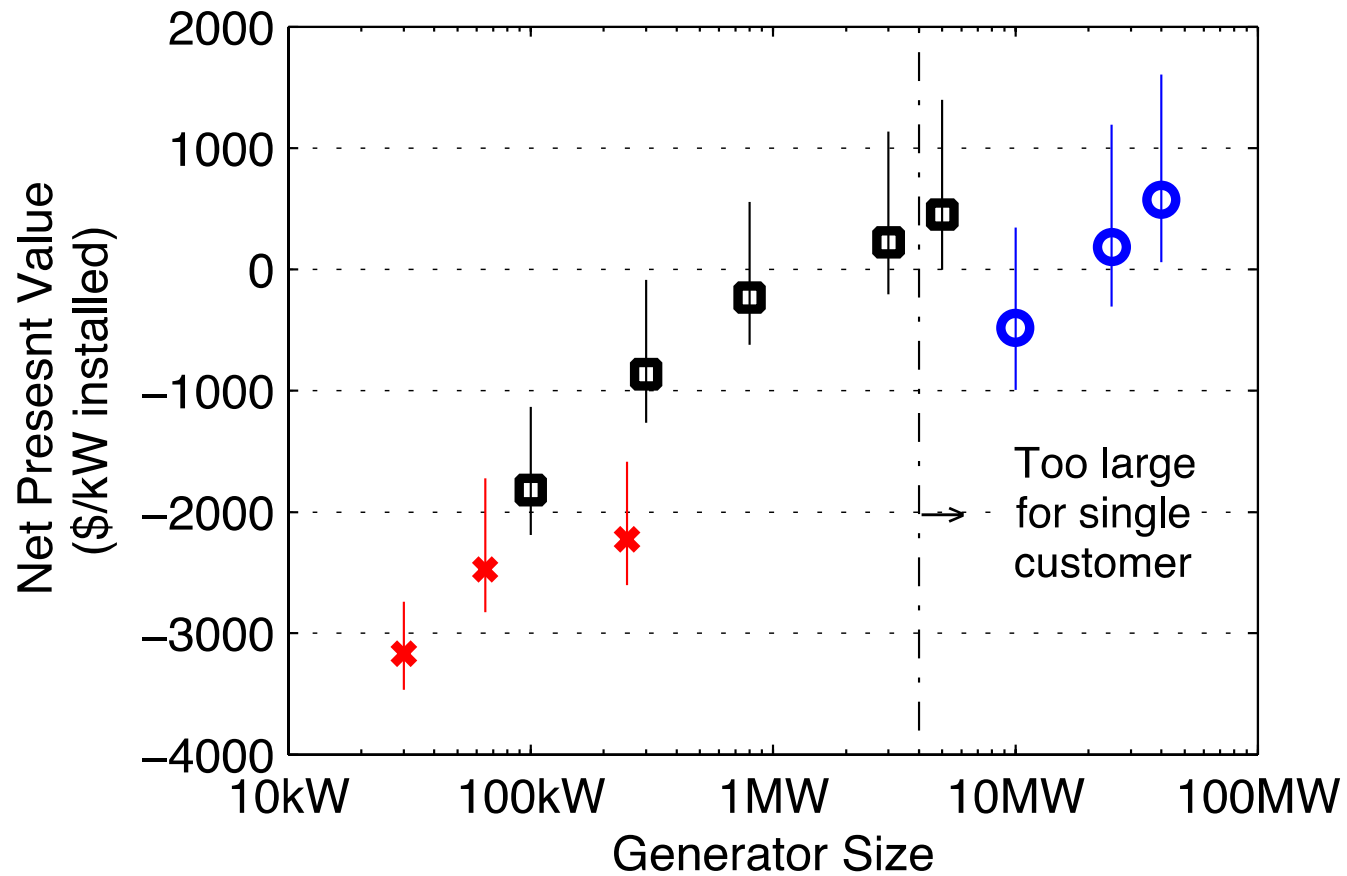
Increasing Revenue to Cogen



Decreasing risks



Economies of Scale



Insights / Conclusions

- ▶ We can design mechanisms to increase the revenue and decrease the risks to a cogeneration project.
- ▶ Improving the economics of cogeneration may mean decreasing the efficiency.

Decision Makers

- ▶ Clarifying the legal status of microgrids will require action from state legislatures
 - ▶ FERC and state PUCs should play an active role in designing rules and regulations for microgrids
- ▶ Depending on the region, small-scale DG may or may not be able to earn revenue through ancillary services
 - ▶ FERC, state PUCs, and electricity system operators all have a role in creating or removing barriers to entry
- ▶ Enacting a national program to price CO₂ emissions requires federal legislation

Acknowledgments

- ▶ Advisors: Granger Morgan and Inês Lima Azevedo

- ▶ This research was supported by a grant from the Gordon Moore Foundation and by the Center for Climate and Energy Decision Making (CEDM), which is supported under a cooperative agreement between the National Science Foundation (SES-0949710) and Carnegie Mellon University.

Thank You

Questions?

