Small-Scale Cogeneration: Benefits and Barriers

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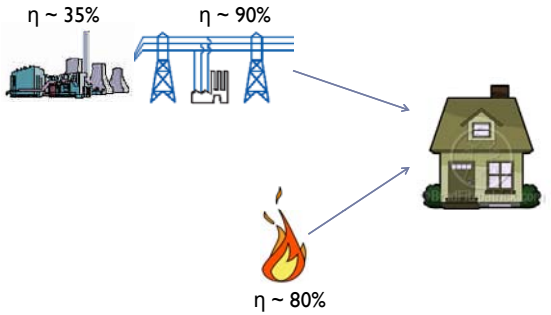
The Current System…



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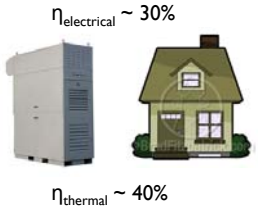
Cogeneration is ~30% more efficient



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Emissions Benefits

- **1% penetration of cogeneration:**
  - ~0.5% reduction in CO_2 emissions.
  - ~1 to 1.5% reduction in SO_2 emissions.
  - Likely to reduce overall NO_x emissions, but may increase NO_x near population centers.

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Adoption of Cogeneration

- Switzerland: 77%
- Denmark: 44%
- United States: 9%

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Slow Adoption of Small-Scale Cogeneration

- Cogeneration is a high risk, low return investment.
  - Large capital expense
  - Low capacity factor for meeting thermal demand
  - Huge uncertainties in future fuel and electricity prices

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Limit Analysis To…

- Retail commercial buildings in the mid-Atlantic region.
- Natural gas-fired generators
  - Turbines from 1 to 40 MW
  - Micro-turbines from 30 to 250 kW
  - Reciprocating engines from 100 kW to 5 MW

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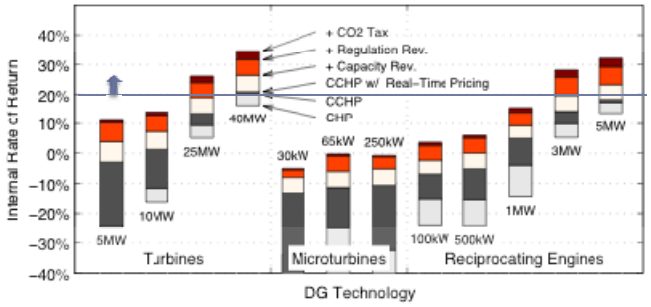
Increasing Revenue for Cogeneration



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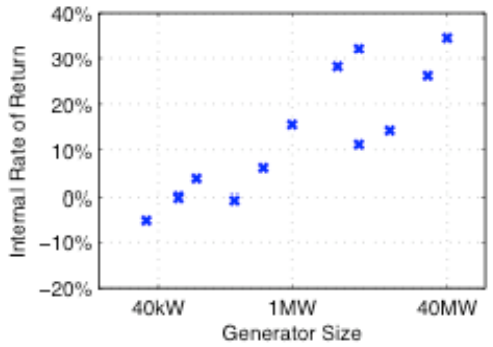
Economies of Scale



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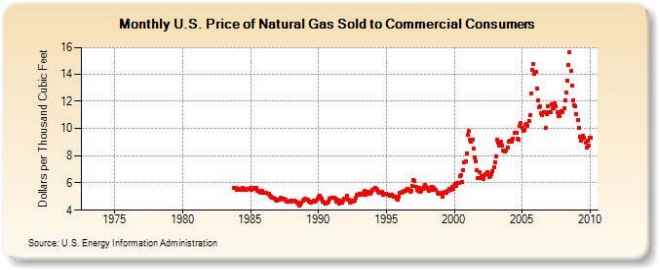
Uncertainty in Future Energy Prices



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Solutions

- "Clean Energy Standard Offer Programs" (CESOP)
- Micro-grids
- Standardized smart meters
- Reevaluate policies that are aimed at clean energy but limited to renewable energy.

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European vs. American Experience

Europe	U.S.
District Heating	Nope
Utility Owned	End-User Owned
Generous Net-Metering Rates	Nope

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Acknowledgments

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Thank You

Questions?

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