Distributed Energy Resources for Federal Facilities

DER Technologies and Applications

Atlanta Marriott Hotel
Atlanta, Georgia

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Keith Davidson

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Energy Nexus Group

- Professional services company focusing on distributed energy
- Subsidiary of Onsite Energy Corporation
- Company Origins in Co-generation and On-site Power
- Active in Distributed Generation and Combined Heat and Power

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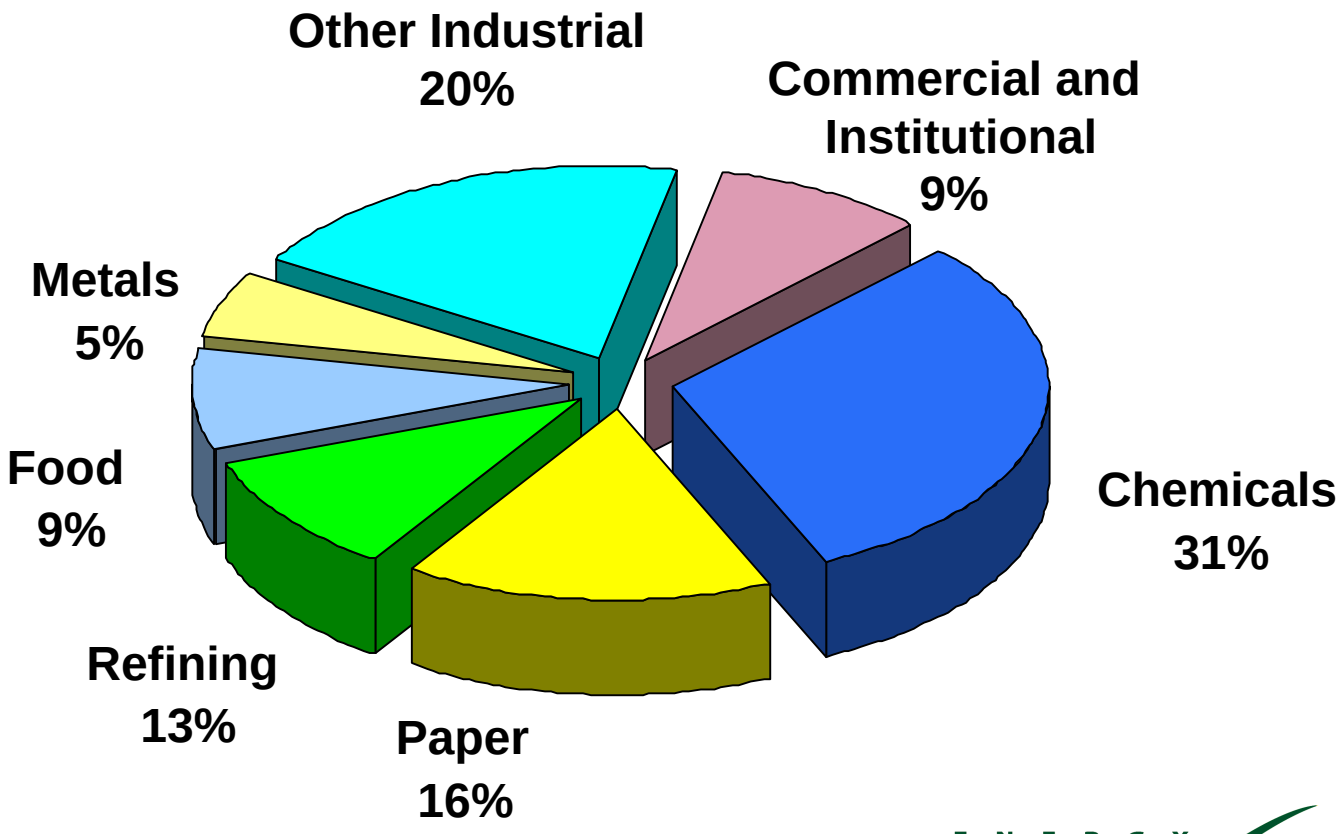
Industrials Represent 90% of Existing CHP

- *Existing CHP Capacity (1999) 52,800 MW*



Source

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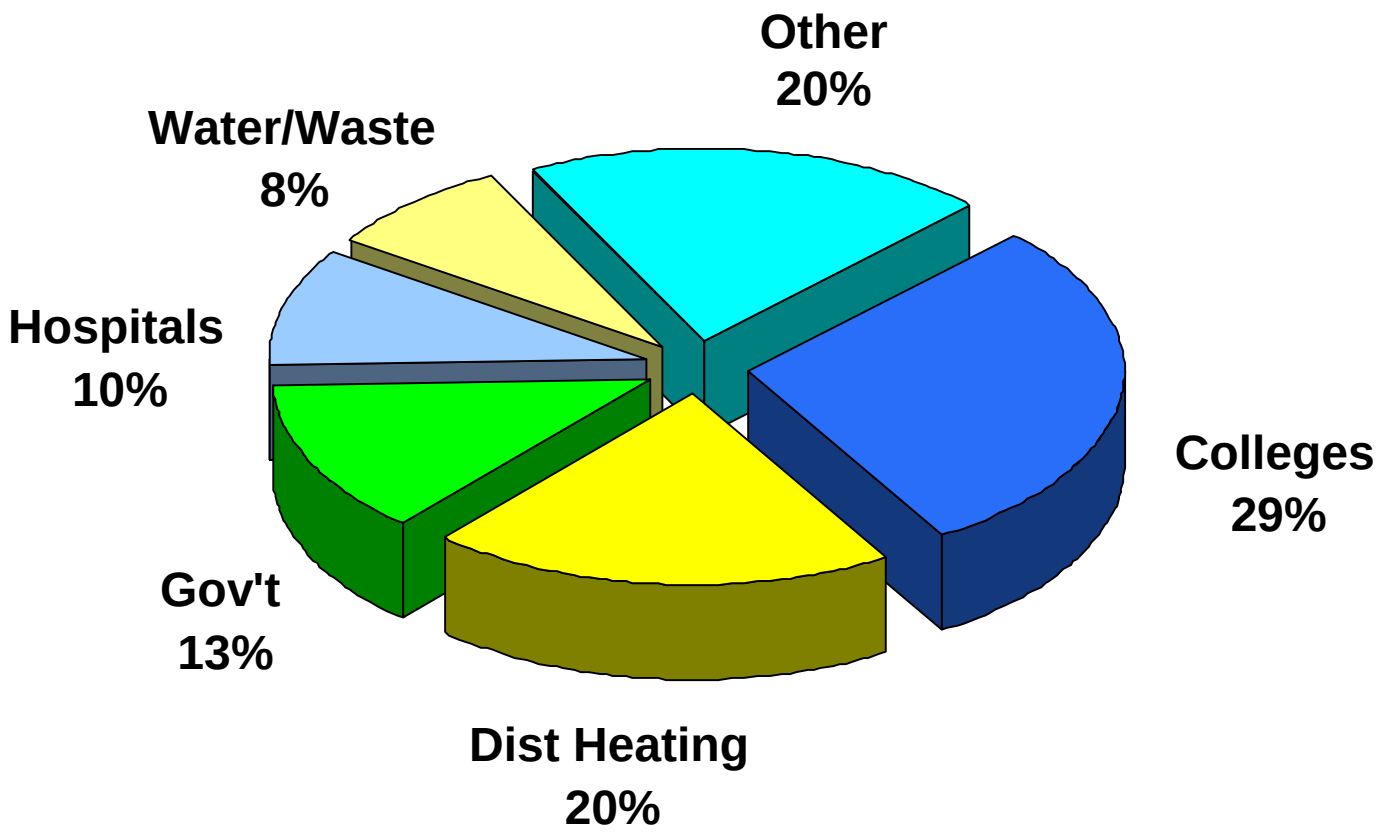
Existing Commercial CHP

- *Existing **Commercial** CHP Capacity (1999) 4,930 MW*



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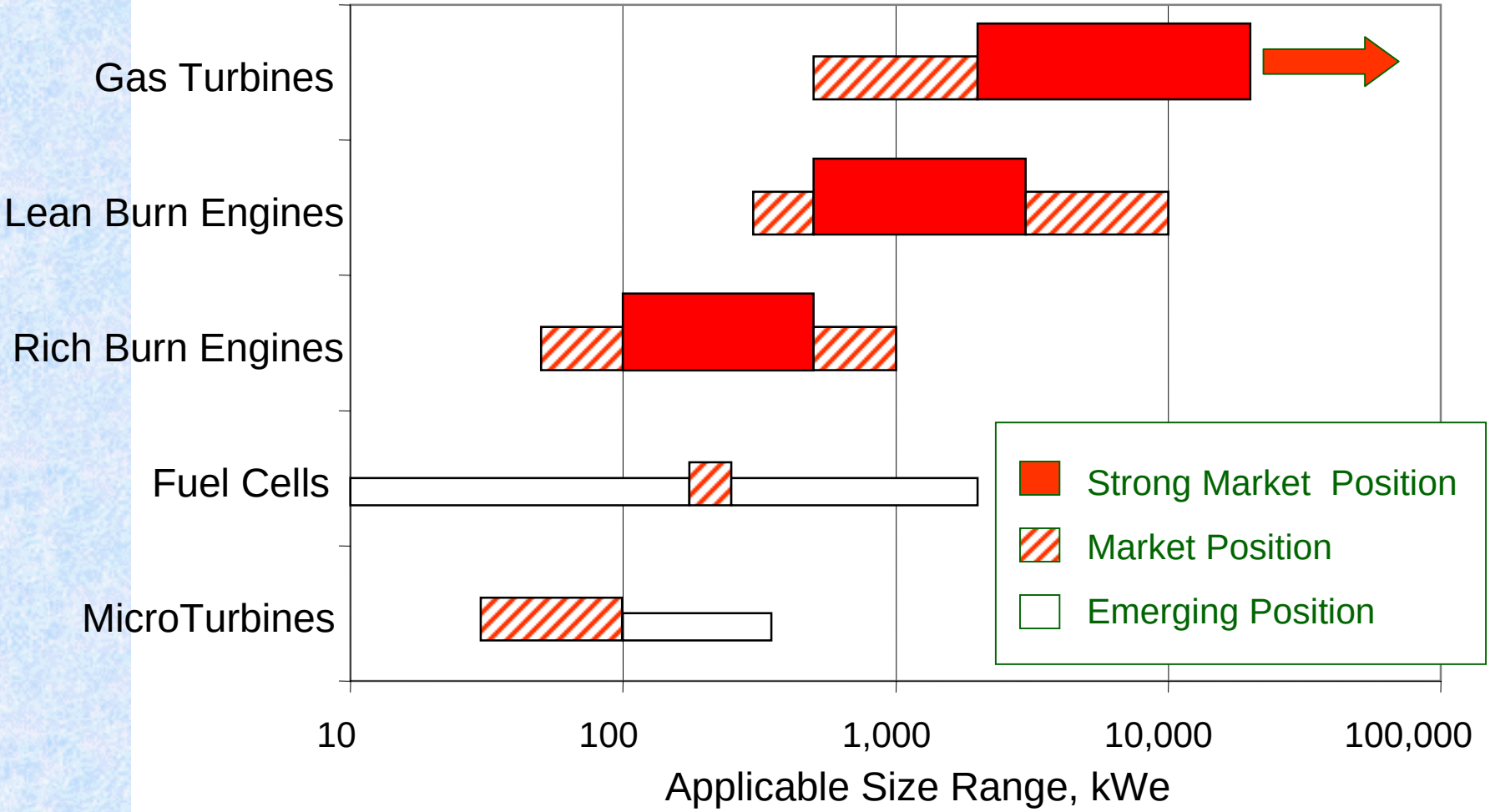
Technology vs Size Coverage



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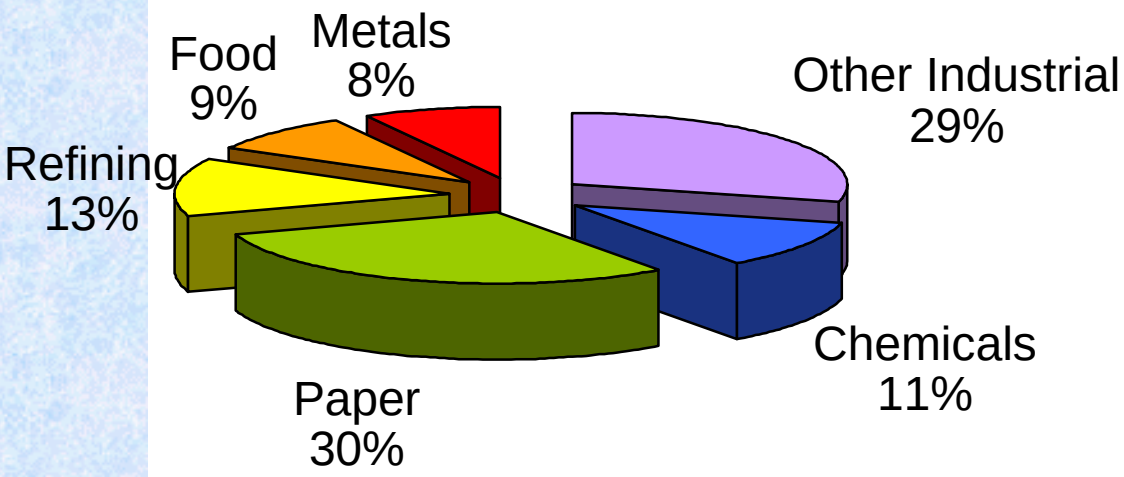
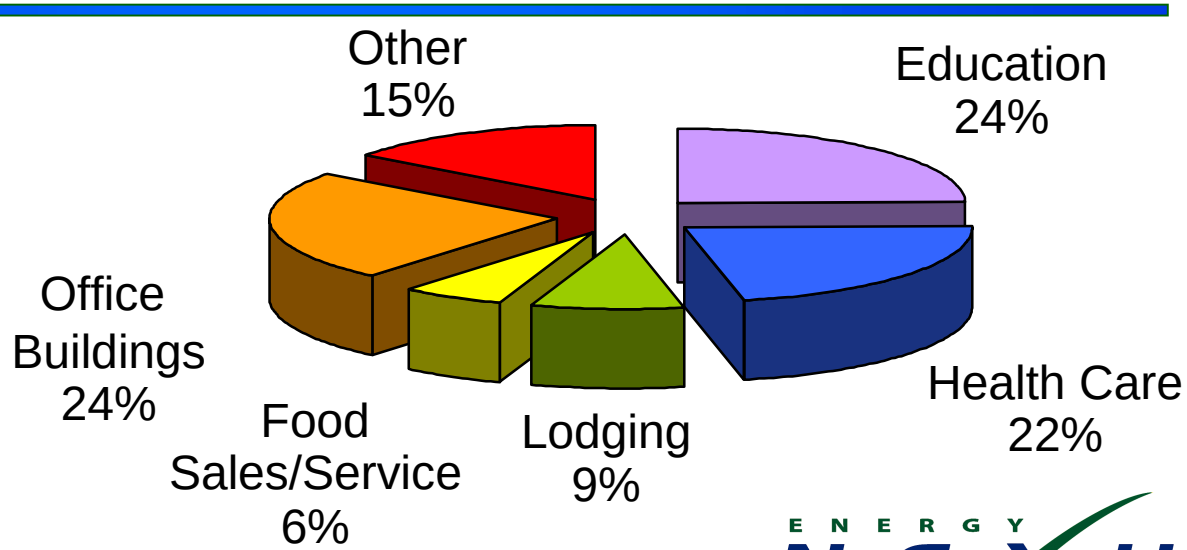
Broad CHP Opportunities Remain



Industrial Sector
90 - 100 GW
of Additional
DG Potential

Commercial Sector
75 to 100 GW
of New
DG Potential



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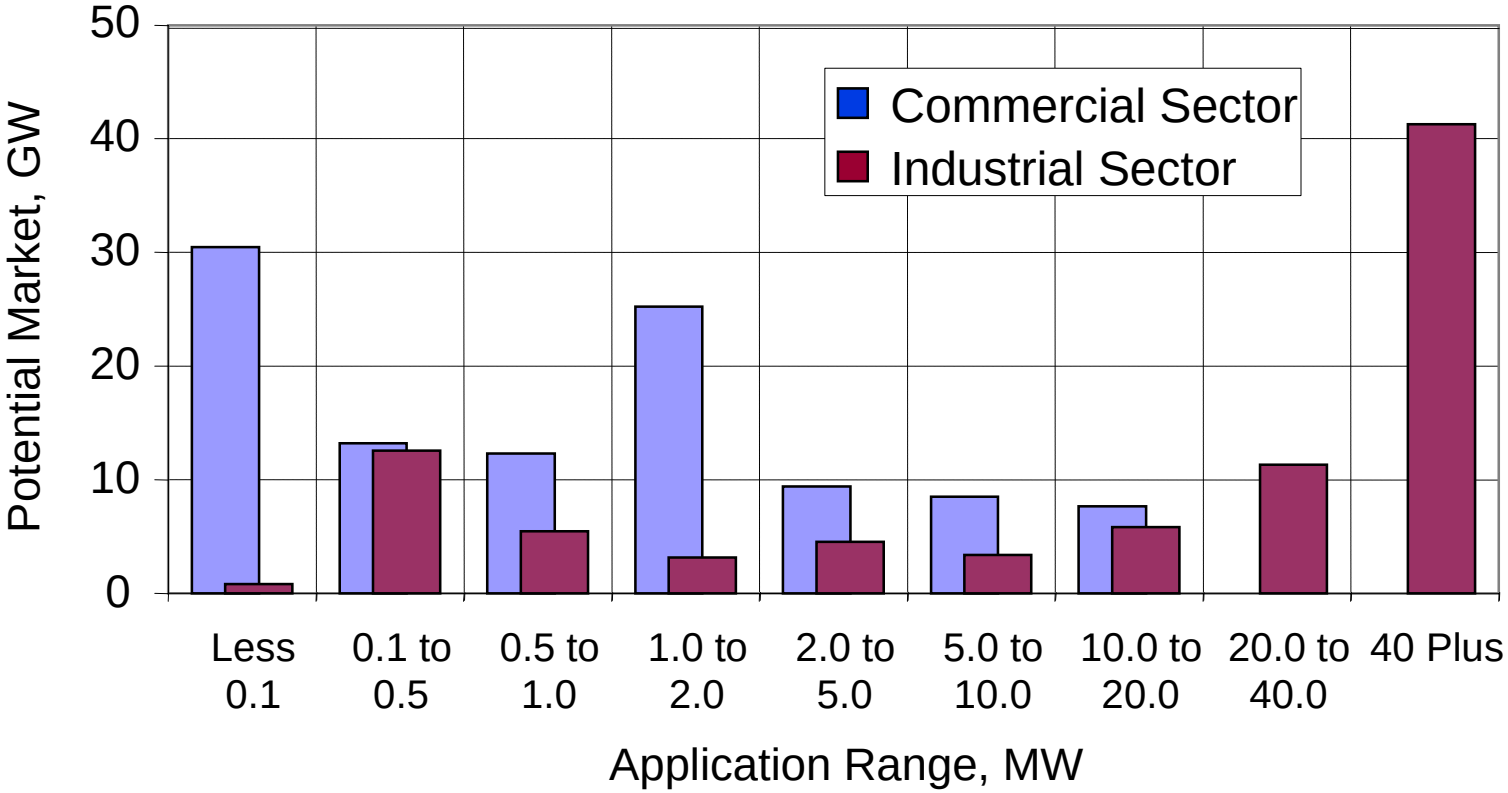
US CHP Market Opportunities



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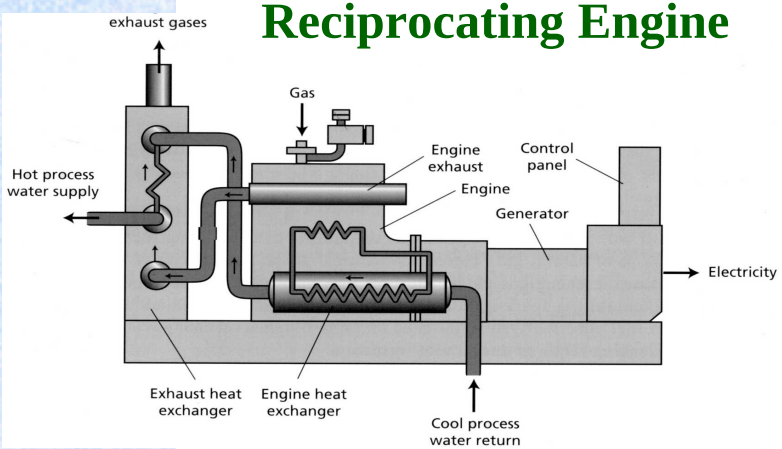
DG Technology Options

Reciprocating Engine

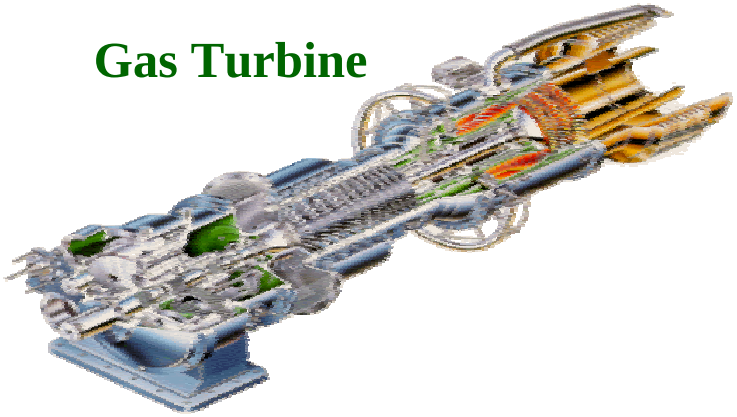


Microturbine

Photovoltaic

Fuel Cell

Gas Turbine



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Technology is a Key Driver for DG

- The cost of small generation technologies has declined
- The performance of small generation technologies has increased
- Controls, sensors and communications have advanced

On-site generation is becoming a viable option for more users

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What Affects Technology Choice and System Design?

- Energy costs and fuel availability
- Electrical load size/factor/shape
- Load criticality
- Thermal load size/shape
- Special load considerations
- Regulatory requirements

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What Differentiates Technologies?

- Size
- Fuels
- Efficiency
- Capital costs
- O&M costs
- Amount and quality of thermal energy
- Emissions
- Risk

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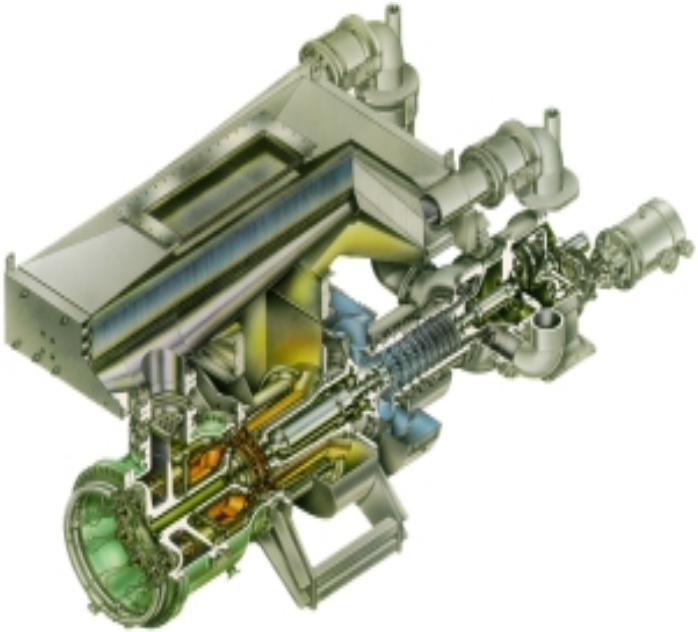
Potential DG Applications

- ***Combined Heat and Power*** - common practice by large industrials; large untapped potential in small industrial and commercial
- ***Peaking*** - potential growth market for customer peak shaving (500 to 2000 hours/year) by light industrial and commercial
- ***Premium Power*** - emerging market to provide quality power to sensitive customers
- ***Niche Applications*** - providing power in remote

Industrial Gas Turbines

- Size range: 500 kW - 50 MW
- Electric efficiency (22-40%)
- Start-up time: 10min - 1hr
- High pressure steam or high temperature direct heat
- Established technology for many power and direct drive applications
- Multi-fuel capable, but economics and emissions favor natural gas



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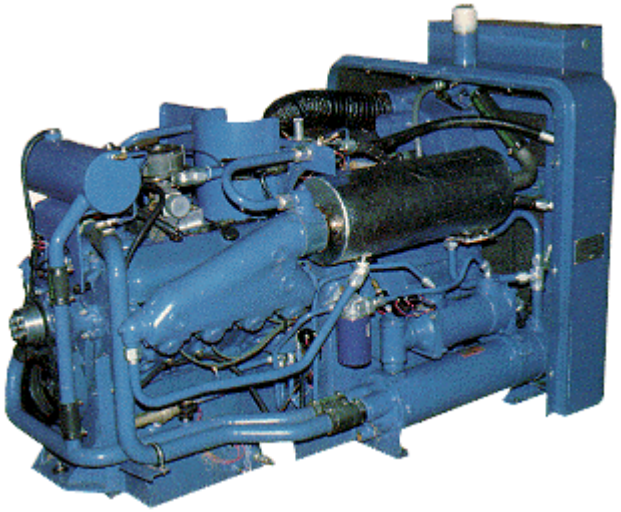
Reciprocating Engines



- Size Range: 30 - 6,000 kW
- Electric efficiency: 28 - 38%
- Fast startup (10 secs) capability allows for use as standby
- Thermal energy in the form of hot water or low pressure steam
- High maintenance requirements (lots of moving parts)
- Emissions can be an issue

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Microturbines

- Size range: 25 - 300 kW
- Electric efficiency: 20 - 30%
- Start-up time: >1 min.
- Fuel compressor usually required
- Small CHP, Power only and Peaking
- Commercial introduction underway

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Fuel Cells

- Size range: 3 - 3,000 kW
- Start-up time: 3hrs -
- Electric efficiency: 36-65%
- Low emissions - exempt in some areas
- Only PAFC is commercially available

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Solar Photovoltaic Cell

- Size range: 10-1,000 kW
- Start-up time: n/a
- Electric efficiency: 10-15%
- Quiet operation - no sound attenuating enclosure
- Costs are dropping and
- Performance is improving

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Summary

- Wide range in technology performance in terms of cost, efficiency and emissions
- New technologies being tested in niche markets
- All technologies are improving
- Match to cost, performance, regulatory and risk requirements of the user

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The DER Panel

Microturbines	Andrew Wang	Capstone
Recip Engines	Keith Luomala	GE
Turbines	Jack Hawley	Solar Turbines
Renewables	Kurt Creamer	N.C. Solar Center
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