Title
Using DER-CAM to Assess the Economic Competitiveness of Microturbines

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DER-CAM….  
• has been developed at Berkeley Lab to evaluate the DER potential at individual sites, and to address policy questions involving the attractiveness of on-site power generation.  
• takes a whole energy system approach and finds the cost minimizing option for meeting a site’s energy requirements.  
• finds the true global optimum solution over a test year.

A DER-CAM Case Study: U.S.P.S. San Bernardino Facility

• The U.S. Postal Service operates many processing centers like its (32,000 m²) San Bernardino facility.  
• The climate is hot (average 40°C summer max) and frosts are rare.  

Sorting equipment and cooling drive the annual electricity bill beyond a quarter million U.S. dollars, but natural gas use is minimal. Peak electricity use, 1500 kW, occurs at midnight when mail sorting is most active.

DER-CAM chooses two 500 kW gas engines and two 60 kW microturbines all with heat recovery for absorption cooling. Absorption cooling reduces the peak electricity load to 1150 kW, and residual electricity purchases are minimal.

Lessons Learned:
• reciprocating engines are the strongly incumbent technology  
• mixed technology systems are sometimes economically attractive  
• DER economics are driven more by electricity prices than fuel prices  
• optimal systems are larger than ones typically built today  
• systems tend to be sized to meet electricity and not heat loads  
• in warm climates, cooling loads can justify CHP systems  
• PV becomes economic with high subsidies and flat tariffs  
• demand charges encourage bigger systems
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**Assumptions**

- ICEs require selective catalytic reduction (SCR) to reduce NOx emissions, which adds 20% to the capital cost and $0.085/kWh to the variable O&M costs of ICEs.
- Microturbines do not require exhaust after-treatment, but are constrained to run at 90% or higher of capacity to maintain low NOx rates.
- Microturbines and ICEs are both 98% reliable.
- ICEs have a 20 year lifetime and microturbines have a 10 year lifetime.
- Unreliability affects only costs for the expected value of the demand charge.
- A 6 year simple payback period constraint is imposed.
- 5% interest rate
- Electricity and natural gas tariff prices are from 2003.

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**Hospital: New York City, New York**
- Prototypical small (90 beds) hospital loads based on Wyoming County Community Hospital in Warsaw, New York
- peak electricity load (including cooling): 1200 kW
- Heat loads comparable with electric loads year round
- Electric: ConEd tariff SC-9 (General Large), Rate 3 (Time-of-day, optional)
- Natural gas: ConEd tariff Rate 2 (General Finn Services) and Rider H, Rate 1 (distributed generation rate)
- 60% minimum DER system efficiency to avoid standby charges

**Key Findings:**

- Microturbines with lower reliability (93%) only increase annual energy costs by about 0.5%–1.5% compared to microturbines with higher reliability (98%). Perfectly reliable (100%) microturbines would lower costs less than 1% (considering demand charge effect only).
- Microturbines with a 50% higher lifetime (15 years) than the assumed current 10 year lifetime microturbines can reduce annual energy costs from 1% to 5%. A 20 year lifetime can reduce costs by up to 8%.
- Systems with double-effect chillers do not provide significantly lower cost solutions than single-effect chiller systems.

Cost reductions can be realized through economies of scale in production, streamlined installation, and packaged systems.