Technology and Policy Developments Necessary for CHP to Prosper

COMBINED HEAT AND POWER CONFERENCE IN NEW YORK STATE

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Outline

- Recent history and lessons learned from 1980s CHP effort
- Recommendations for CHP success
- Conclusions

A Brief Recent and Selective History of CHP in the U.S.

- PURPA legislation in 1978
  - Buyback of power at very attractive prices (avoided cost; costly coal plant initially)
- Best thermal sites taken first (chemical and petroleum, pulp and paper, universities)
  - large, steady thermal load; typical refinery can support 100s to 1000+ of MW
- ~25% of power in California from QFs; ~22% of oil & gas generation nationwide is CHP
- Smaller CHP systems more challenging
  - many projects no longer operating--bought out of their contracts w/utilities in the 1990s

Lessons Learned from CHP Projects Developed in the '80-'90s

- Economics
  - Spark spreads often not favorable, nor stable; Low value for excess power sales
  - Financial stability/credit risk of small customers
  - Short paybacks required by customers
  - Few customers have ideal electric and thermal load profiles; Difficult to utilize all of the thermal output from CHP device
    - Thermal and electric site loads not steady, nor coincident (daily and seasonal variations)
    - Thermal energy not easily transported or stored
    - Dispatch on thermal load requires economic sale of unneeded electric output
  - Need for electric and heat backup
    - Peak thermal or electrical demand at site often greater than outputs of CHP device
    - CHP device not available 100% of time

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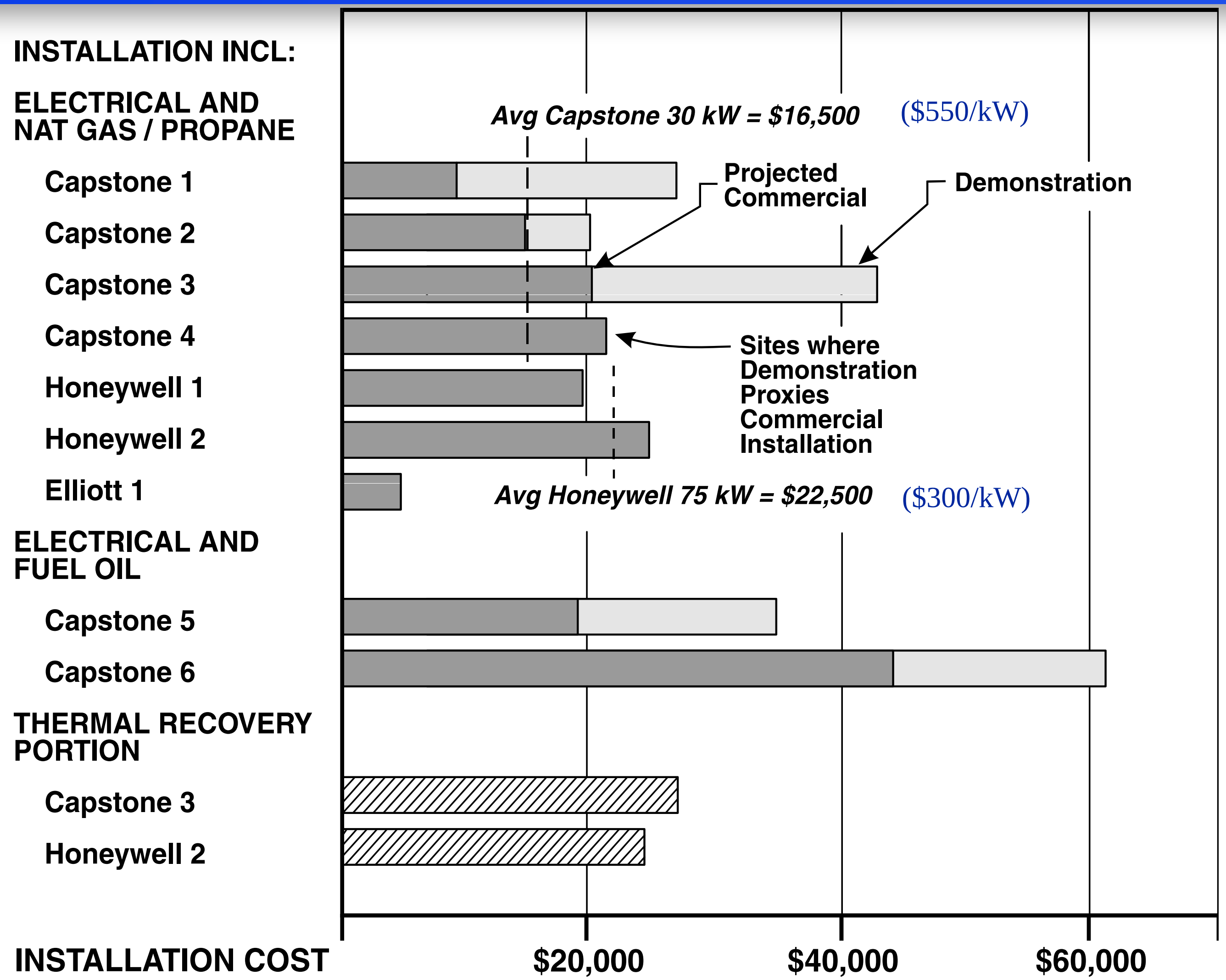
Lessons Learned from CHP Projects Developed in the '80-'90s

- Many customers burned by "fly by night" companies
- Economy of scale (fixed costs per kW lower for big projects)
  - Specialized engineering to design and evaluate heat recovery options; engine/generator set distributors not staffed w/these skills
  - Capital and operating costs, especially for steam systems, absorption chillers, and emission controls
  - Startup and debugging time in field
  - Permitting delays and costs
  - Customer sales process very involved
  - Contract negotiations (finance, site access, power and thermal sales, insurance, etc.)
- Electric utility opposition
  - Lack of uniform and costly utility grade interconnection requirements
  - Revised retail rate design (demand, standby charges, competitive cogen rates)
  - Lengthy review and approval process
  - Utility position: Unneeded, expensive power; loss of contribution to fixed costs

Lessons Learned from CHP Projects Developed in the ‘80-’90s

- Operations and maintenance higher than expected / risks of long term performance contracts
  - Unplanned outages
  - Manufacturer /distributors did not support well; some customers took over O&M, disastrous
  - Poorly designed facilities
  - Underestimated costs for parts and labor
- Summary
  - “Plug and play” is necessary and does not yet exist
  - Only larger projects are currently viable
  - Best strategies for current technologies: size CHP unit to match site thermal base load and sell any excess power
  - Technology not a barrier; however, high electric efficiency CHP devices are desirable so that 100% heat utilization not necessary for project economics

Installation Costs for Small DG / CHP



Recommendations for CHP Success

- Operations and Maintenance
  - Unattended, remote monitored and controlled
  - Low cost sensors on all equipment (switchgear, generator, prime mover, gas compressor, heat recovery, environmental etc.) to allow preventive maintenance by specialists, high availability
- Electrical Interconnection and Excess Power Sales
  - Disco and PUC/stakeholders agree on value of power by time and location, then:
    - Disco specifies where (planning area/substation/feeder), and when (time of day/season/year) DG/CHP is best choice
  - Disco and interconnection hardware vendors approve low cost protection equipment
  - R&D Need: Low cost solid state transfer switches and reverse power relays

Recommendations for CHP Success

- Installation and Sales Costs
  - Get end users out of sales process
  - Packaged CHP units
  - Focus on new facilities (50 year plan)
- Siting and Environmental Permitting
  - Air Boards support methodology for comparing impacts of DG/CHP vs. conventional power and heat generation, then:
    - Develop long term policy: specify acceptability (or emission taxes) for types of DG devices by size, location, emission control equipment, time of day/season/year, etc.

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Conclusions

- Near term CHP opportunities: large, industrial scale CHP, e.g., chemical & petroleum, paper, etc. Size for max electric output for given thermal load.
- Create clear and lasting public policy rules of the game on interconnection, power sales, siting and permitting
- Long-term, encourage development of clean, high electric efficiency options to reduce dependency on thermal to electric load matching