The Benefits of Cogeneration:
A Case Study of Upper Chesapeake Medical Center
May 6, 2014
Upper Chesapeake Medical Center

• Located in Bel Air, Maryland, part of University of Maryland Medical System
• Contains a 200 bed state-of-the-art general medical, surgical hospital and medical complex including:
  – Hospital
  – Two medical office buildings (MOB) Pavilion I and II
  – Parking garage
  – Klein Ambulatory Care Center of Harford County
  – Administrative offices
  – Cancer Center
• Serves the residents of northeastern Maryland
Hospital Facility Challenges

• Single point of failure in backup power system design
  – One existing 1.5MW diesel generator

• Minimal to no upfront capital available for system upgrades
  – Capital budgets favored other revenue generating investments
  – Previous CHP capital budget requests denied

• Need for additional cooling capacity and backup power

• Limited space to install new CHP system components

• Increase electrical/steam/cooling/hot water availability during utility outages and emergencies

• Resources to oversee the design/construction/permitting and operation and maintenance of the CHP system
Electrical Distribution Hurdles

• Electrical service to the campus is delivered to a service station via a pair of 33KV feeders:
  – Fed to six (6) substations
  – Three (3) of the six (6) substations feed the “healthcare” uses
• Cancer Center is serviced by a separate feeder
• 1,500KW diesel generator insufficient to provide power to greater than the critical care and a few other connected loads
Solution Development

• Worked with ESF team to evaluate system sizing, location and options

• Considered various options including:
  − Two (2) smaller cogeneration totaling 2MW
  − Upsizing the absorption chiller
  − Increasing loads on existing electrical buses

• Derived optimal solution after considering:
  − Physical space
  − Total system cost
  − Seasonality of existing building loads
  − Thermal loads balance with electrical production
  − Noise mitigation to meet local ordinance db levels
  − Environmental impacts
  − BGE incentive requirements
UCMC CHP System Components

- 2 MW Caterpillar Natural Gas Reciprocating Engine
- 350 ton Broad Absorption Chiller
- 500 ton Heat Rejection Cooling Tower
- 2,245 lbs/hour Heat Recovery Steam Generator (HRSG)
- Two heat rejection radiators
- Two Plate and Frame Heat Exchangers
- Power Monitoring Control System (PMCS)
- Energy Management Control System (EMCS)
Other Key CHP Major Components

- Sump pump station
- Switchboard/circuit breakers
- Upgraded electrical breakers, panels and control systems
- Field devices:
  - Natural Gas meters
  - Heating & cooling system flow meters
  - Valves, actuators, temperature, and pressure sensors
2MW Natural Gas Fed Generator Set
Chiller & HRSG Make Tri-Gen System

350 Ton Absorption Chiller

2,245 lbs/hour HRSG
System Layout

- The CHP is located within a single story, 705 sq ft building in existing mechanical pit
- The building houses:
  - Generator
  - HRSG
  - Feed water pumps
  - HT heat exchanger
  - LT and HT radiators
- Other components located in or adjacent to the existing central plant include:
  - Absorption chiller
  - Cooling tower
  - Electrical gear
  - Control panels
PPA Structure Highlights

- Hospital buys all electricity generated by system from ESF
- Byproduct of waste heat is “free” and used to calculate “effective price of power”
- Minimum monthly payments from hospital
- Minimum performance guarantees by ESF
- 20 year contract with fixed escalation, allows for budgeting of utility expense
- Operations and maintenance cost of system including all rebuilds incorporated into cost for 20 years
- Buy-out options for hospital to purchase system early
- Hospital supplies natural gas – cost of this embedded into economic analysis and savings
Rationale to Use PPA from Hospital Perspective

- Use of Federal tax credits and depreciation cannot access as non-profit hospital
- Ability to lock in future electric rates
- Access to funding source
- Ability to have turnkey delivery of all aspects system
  - Development
  - Permitting
  - Design
  - Construction
  - O&M
  - Financing
  - Incentive management
- Risk transference from hospital
- Complexity of project coordination
- Any cost overages borne by ESF
Some CHP and PPA Considerations

- Legal expense to negotiate PPA
- Town/County willingness to abate certain personal property tax
- Balance sheet treatment by auditors
- Potential of ongoing Title V compliance reporting costs
- Preparation for potential DHHS standards
Summary

- CHP system a “home run” for UCMC
- PPA structure facilitated delivery of vital infrastructure which would not have otherwise received funding
- Hospital able to operate during storm/prolonged outage
  - Improved reliability when combined with diesel generator (approximately 65% of hospital electrical load)
  - Serve as a vital community resource during emergencies
- Environmentally friendly solution
  - 2.0MW system equivalent of taking 2,200 cars permanently off our roads!