CFSG

ENERGY & STRUCTURED FINANCE

On-Site Power Solutions:
The Benefits of Cogeneration

MDH2E Seminar

May 6, 2014

MD H2E
Hospitals for a Healthy Environment
MARYLAND

Agenda

- Highlights of CHP at Case Study of Upper Chesapeake Medical Center
- On-Site Power Technologies for Hospitals
- Factors Making CHP an Attractive Option
- Considerations When Evaluating a CHP Installation
- Benefits of Turnkey Delivery of On-Site Power Systems

Highlights of CHP At Upper Chesapeake Medical Center

ESF Solution for UCMC

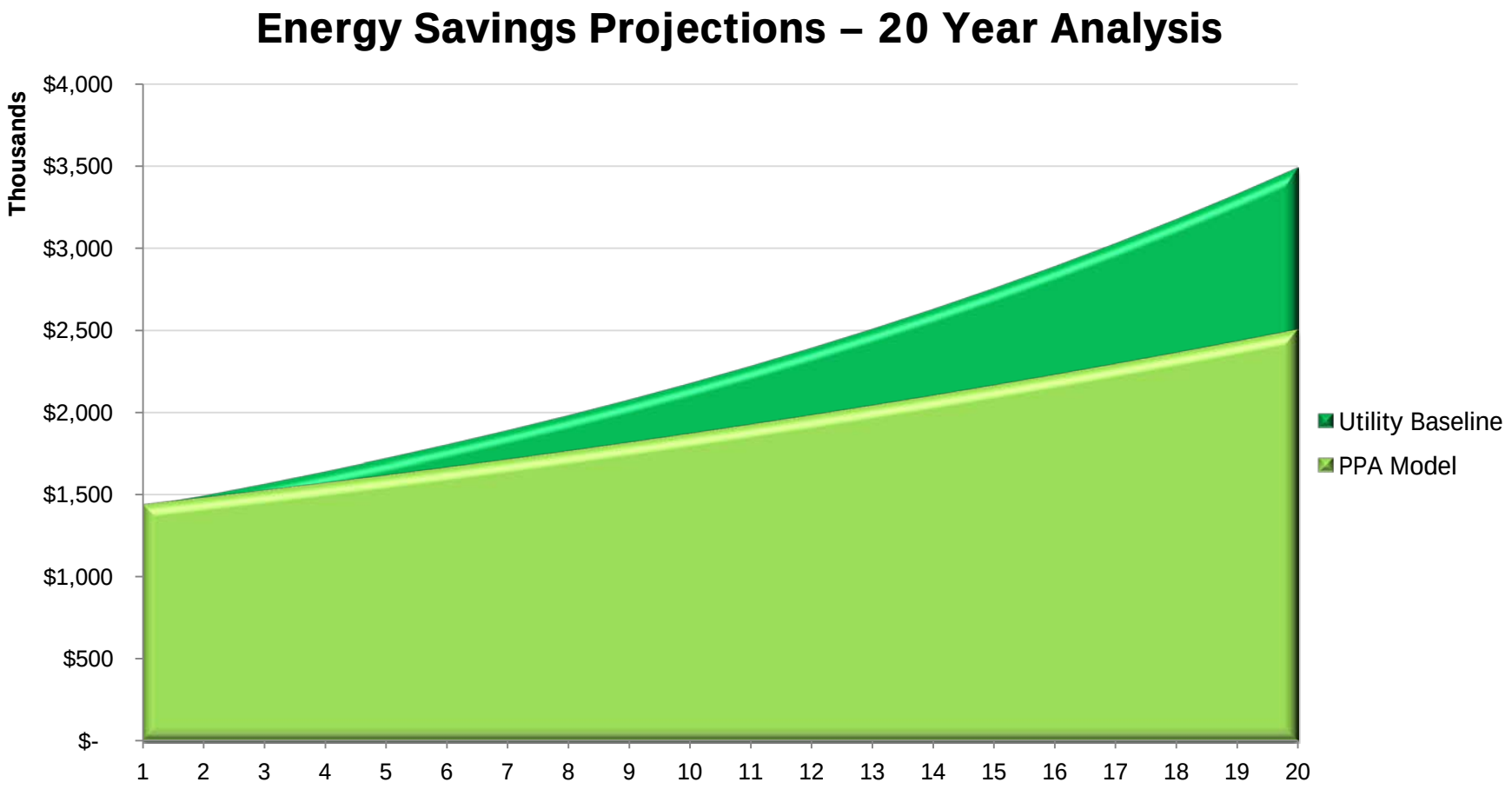
- 2.0 MW reciprocating engine system
  - Generates electricity, steam, chilled water and hot water
  - Parallels the utility and provides baseload power
- Client will purchase balance of electricity for normal operations from utility and when CHP is offline
  - Provides 45% of the existing electricity for the main interconnected loads
  - Supplies more than 60% of electricity with existing diesel generator
  - Qualified for over $1.5M in Empower Maryland
- ESF to sell power to UCMC over 20 year term with buyout options
- UCMC to save $9M+ over 20 year life cycle, net of buyout costs
- Project operational in June 2014

CFSG
ENERGY & STRUCTURED FINANCE

UCMC Uses a PPA

- Power Purchase Agreement (PPA) has private sector entity:
  - Owning system assets
  - Funding all project and life cycle costs
  - Managing all project risks
  - Selling electricity to hospital
  - Generating thermal capacity for heating / cooling
  - Supplying operations & maintenance and system rebuilds
  - Providing minimum performance guarantees
  - Transferring proven system to hospital at option points

UCMC Project Savings Analysis



On-Site Power Technologies for Hospitals

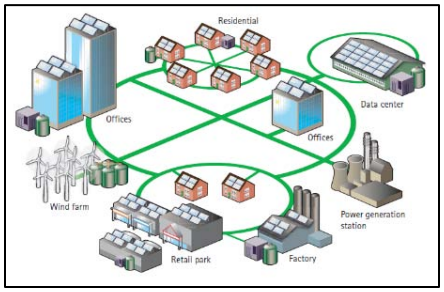
Key On-Site Power Technologies

Solar Photovoltaics

Biomass

Combined Heat & Power (CHP) Systems

Microturbines



District Energy/Microgrids

Most Relevant Technologies for Hospital Applications

- **Solar PV –** Addresses peak demands (from noon-5pm) and peak pricing
- **Microturbines –** Useful for smaller facilities where there is a limited use for the waste heat
- **CHP or CCHP –** Using reciprocating engines or gas turbines
  - High “base load” demand for electricity
  - Uses of waste heat for steam, hot water & chilled water

Solar Photovoltaics

- Converts solar radiation into electricity
- Helps offset peak energy demand charges (noon – 5pm)
- Generates no pollution / fully renewable
- Have improving economics:
  - Solar renewable energy credits
  - 30% investment tax credit
  - Declining panel pricing

Solar Array at FedEx Field Installed by Clark

- Are installed on ground, rooftops, car ports & garages
- Less applicable in Maryland due to :
  - Lower REC Value
  - Weather
  - Absence Utility Peak Pricing

Microturbines

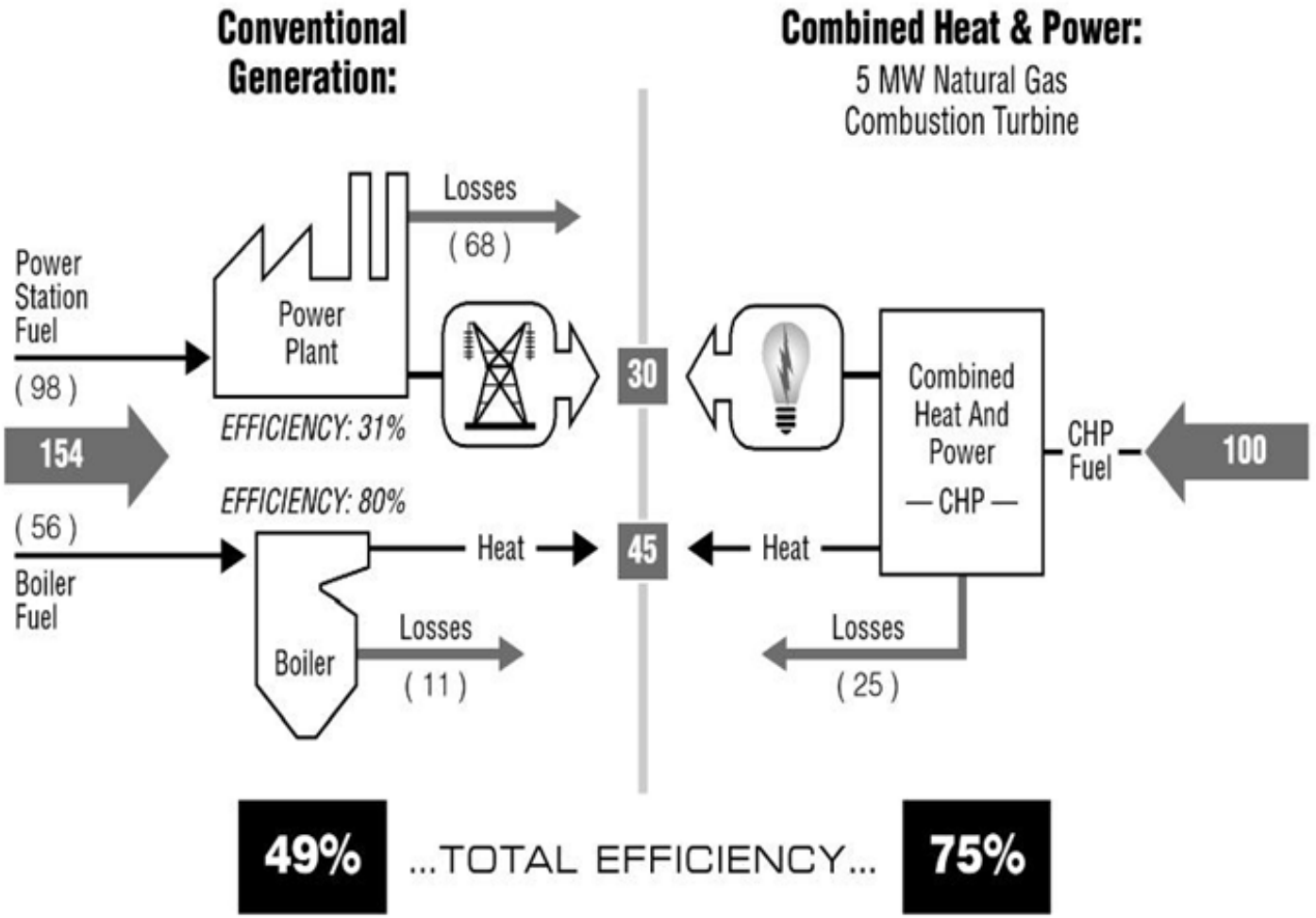
- Small combustion turbines which operate similarly to large CHP systems, but are typically constructed in modular units
- Known for high uptime and reliability
- Utilized to capture waste heat but more commonly used solely to produce electricity
- Microturbine systems are proportionately more expensive (on a per kW basis) than reciprocating engines or gas turbines

John Muir Medical Center, Walnut Creek, CA

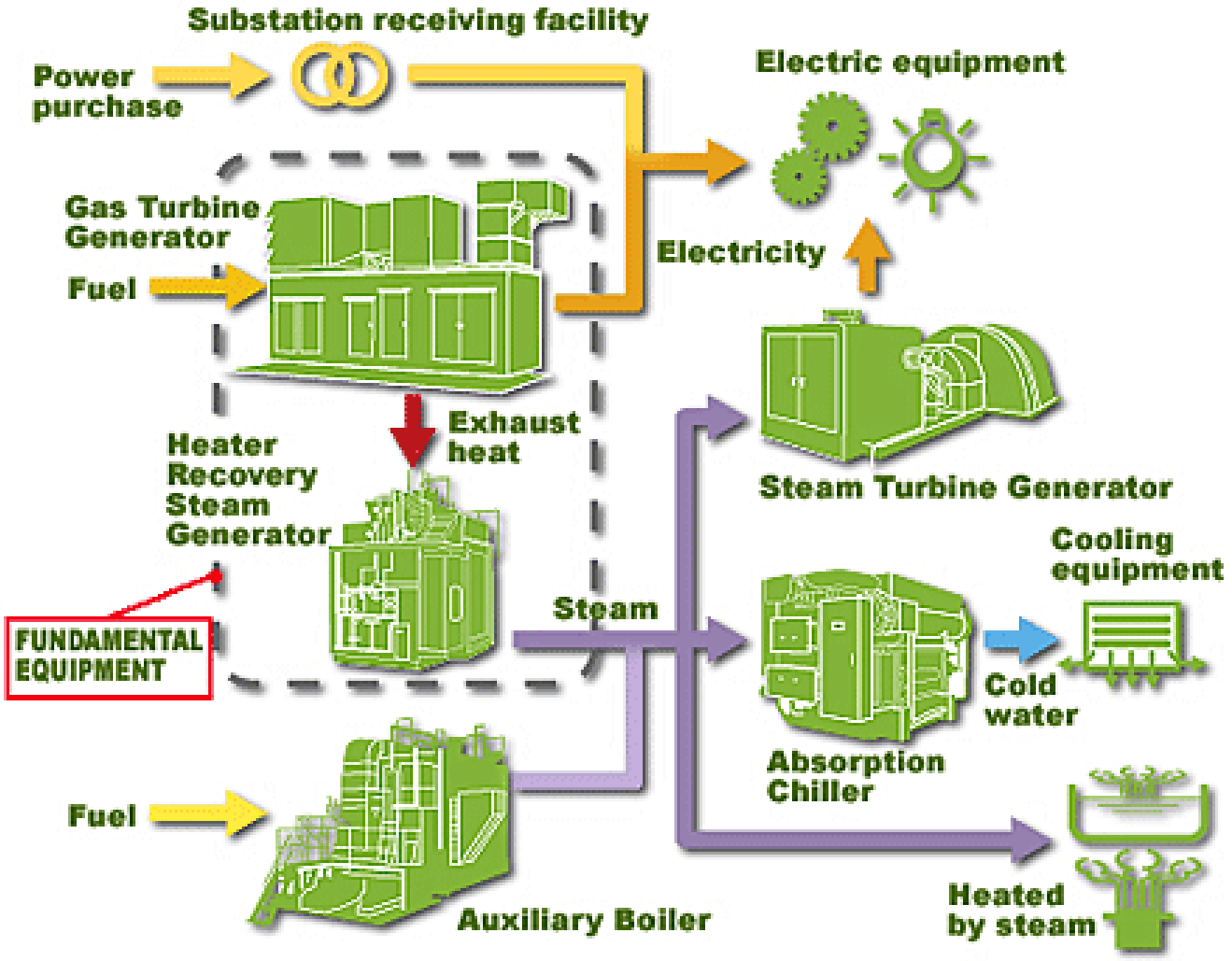
Overview of Combined Heat and Power (CHP)

- Use fossil fuel (typically natural gas) to simultaneously generate electricity and useful heat
- Typically use reciprocating engine or gas turbine as prime mover
- Capture useful heat for many purposes:
  - Steam
  - Hot water
  - Chilled Water
  - Deaeration
- Reduce environmental footprint (CO2, NOX, SOX) of facility compared with using utility energy
- Can be designed to run in “island mode” in event of grid failure, providing power, heating and cooling to facility
- Provide back-up power generally to non-critical care needs of hospitals, complementing use of diesel generators

CHP Systems Are Very Efficient

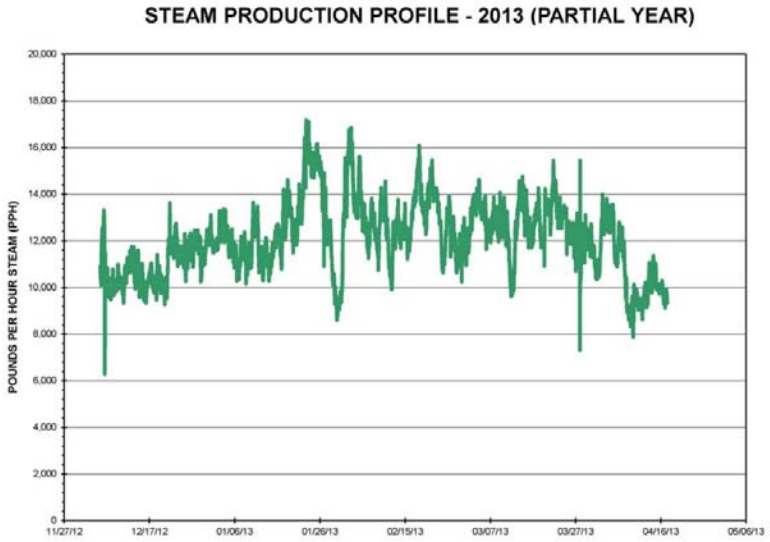


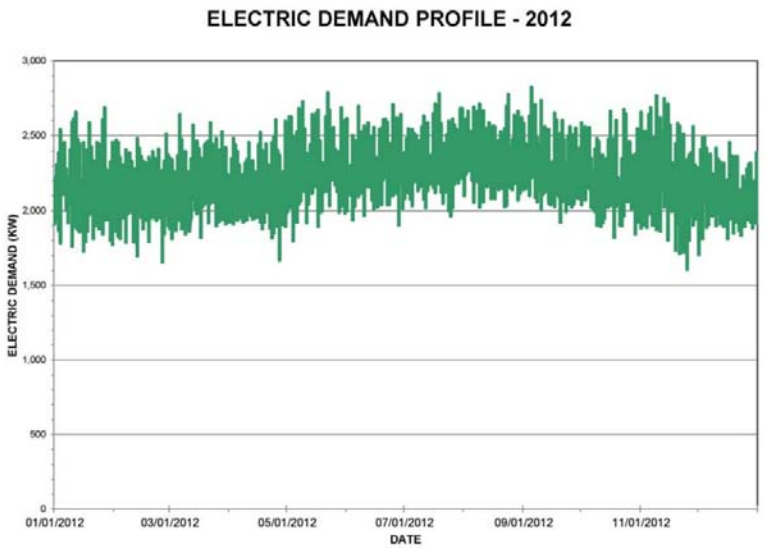
CHP Systems Can Be Tailor-Made



CHP Sizing

- Prime mover choice and sizing driven by the need to balance thermal and electric loads





- Thermal capacity is typically the limiting factor

- Tie in to existing CHW/HW/Steam and electrical systems

Factors Making CHP Installation an Attractive Option

Benefits of CHP

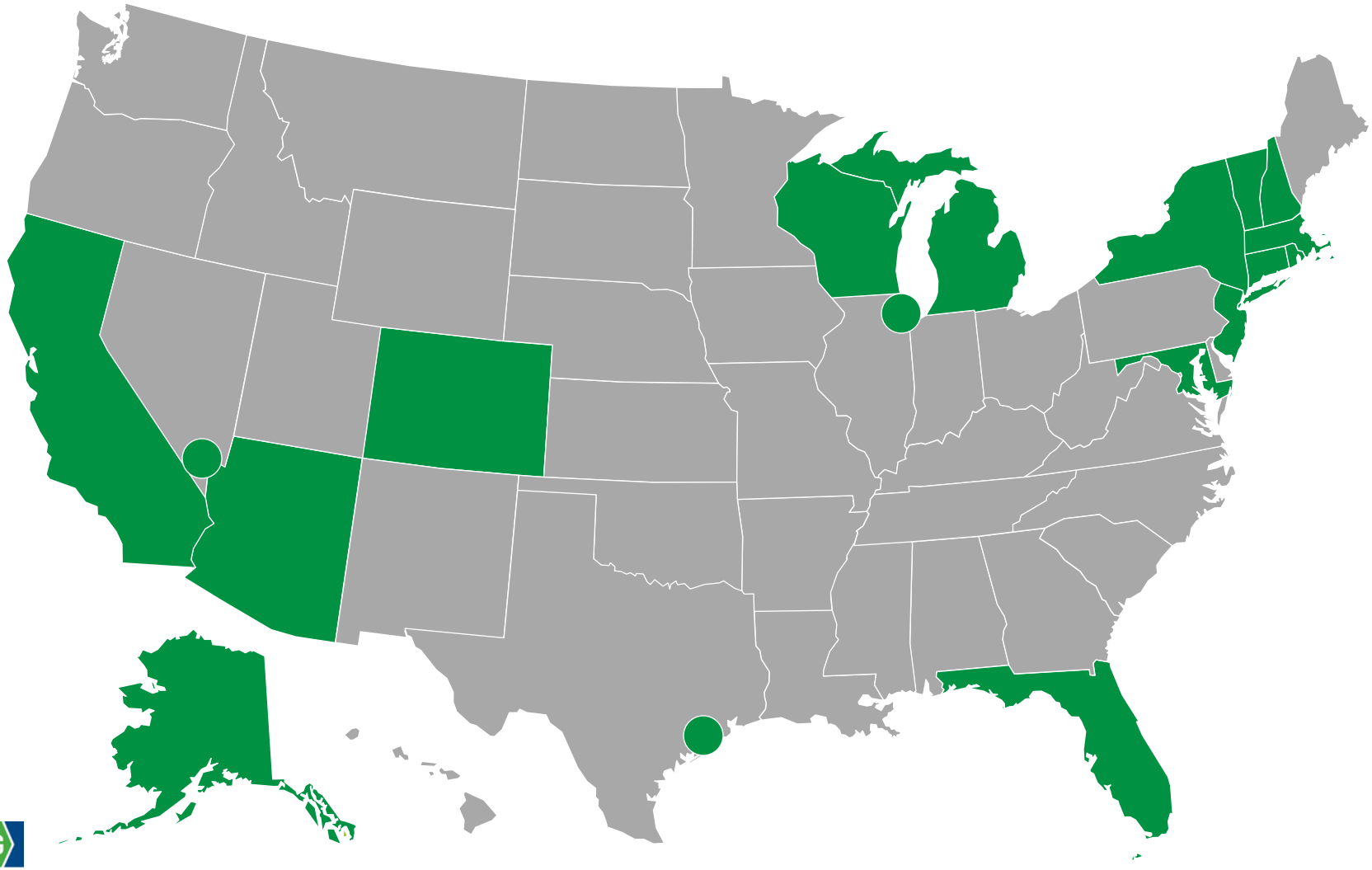
- **Reliability:** Additional source of primary and emergency generation for both electricity and heating/cooling
  - Proven technology with thousands of applications globally
  - Backup to diesel generators if prolonged outage or diesel failure
- **Community Service:** Allows hospital to serve as a safe haven to the community during a disaster
- **Cost Savings:** Given efficiency and "spark spread," can often generate heat and power at a lower cost than traditional systems
- **Stability:** Less volatile lifecycle costs of energy vs. unpredictability of the grid
- **Environmental:** Significantly reduces environmental impact and pollution
- **Political:** Reduces reliance on foreign oil and increases energy independence of U.S.

External Factors Driving CHP Adoption

- Historically-low natural gas prices
- Favorable tax incentives and state financial support
- National energy security and resilience post-Hurricane Sandy
- U.S. Government/regulatory support and mandates

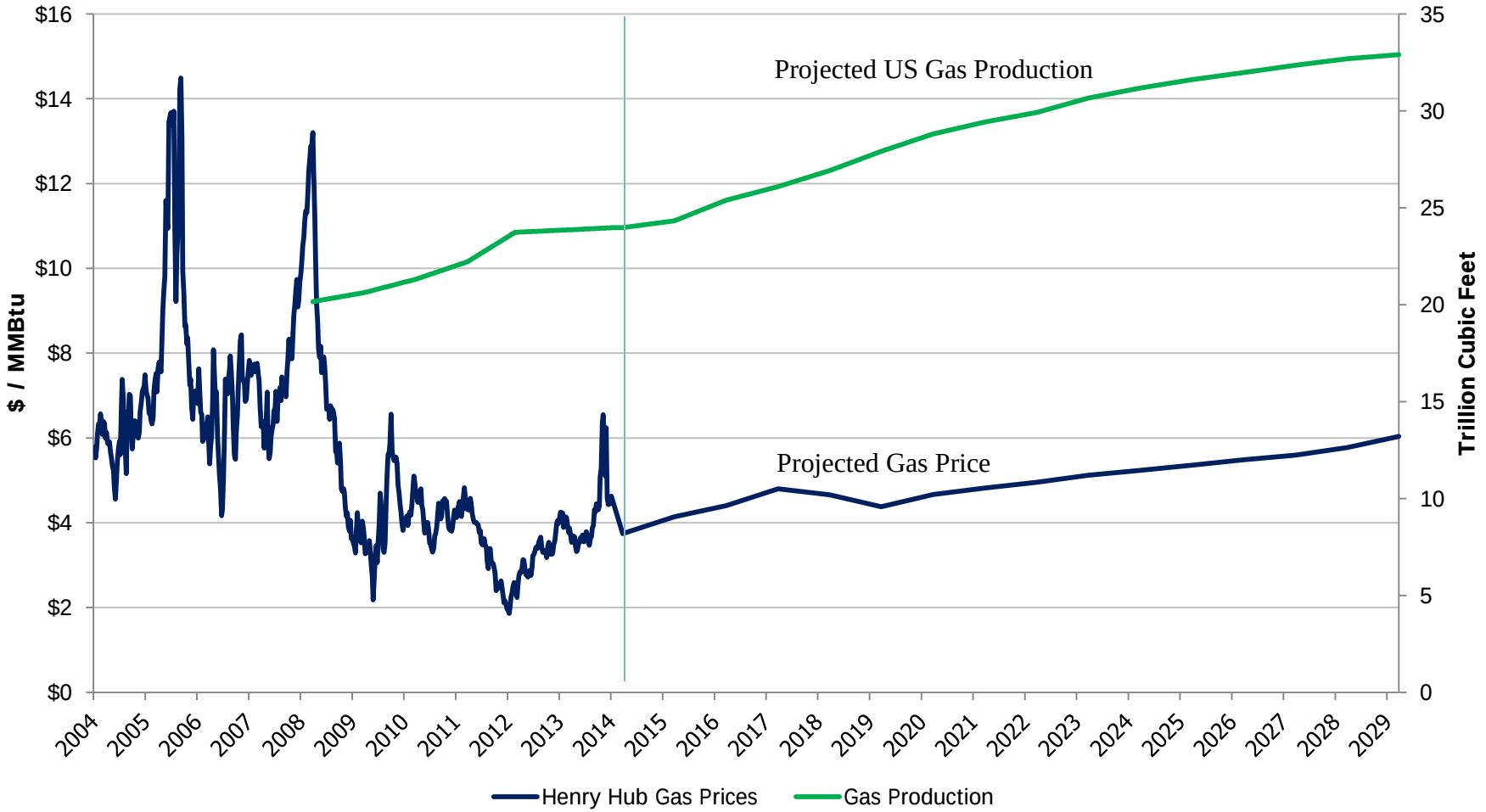
Attractive “Spark Spread” Enhances Project Economics

Differential Between Electricity and Natural Gas Pricing



Historically Low Natural Gas Prices

Increasing Capacity Suggests Lower Long-Term Pricing

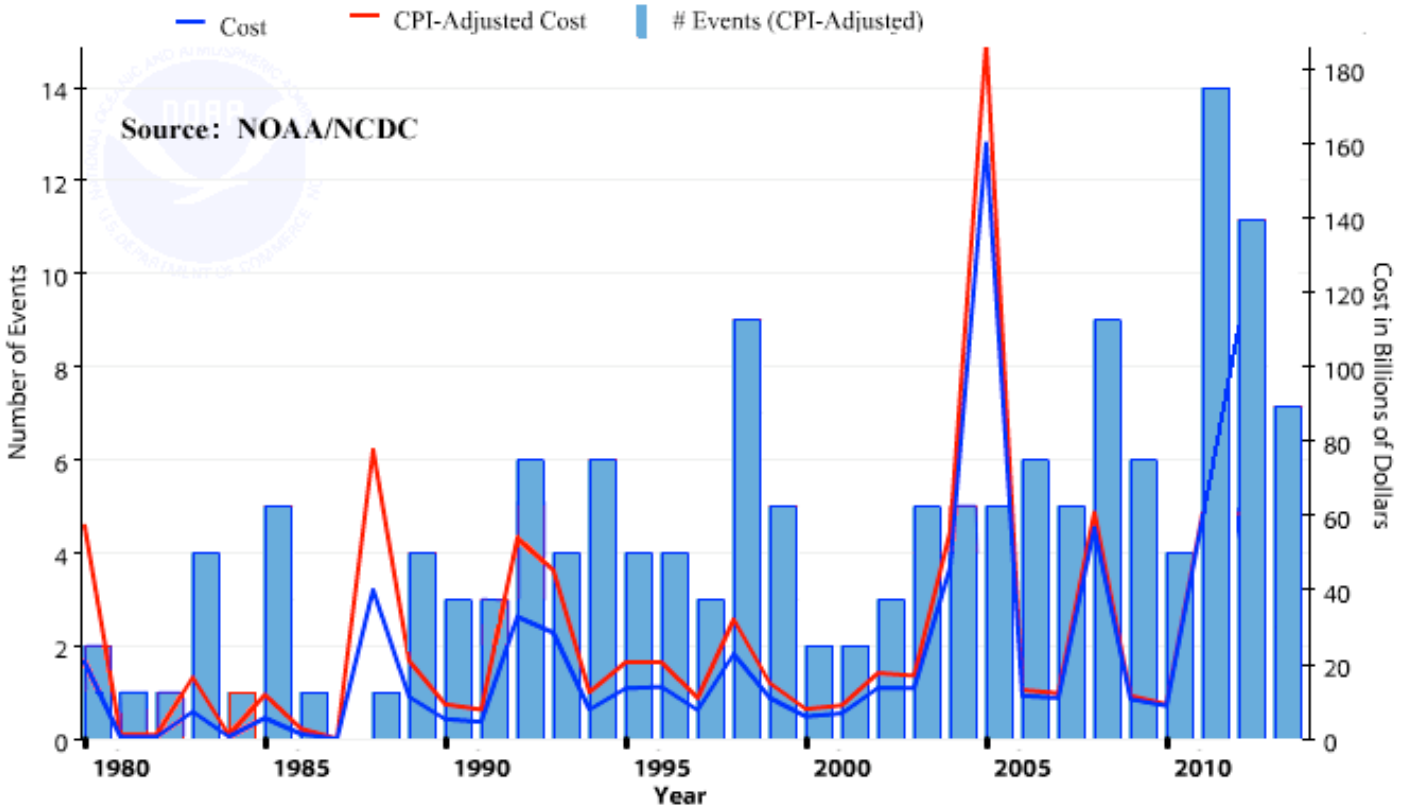


Source: Energy Information Administration

Increasingly Severe Weather Patterns On The Rise

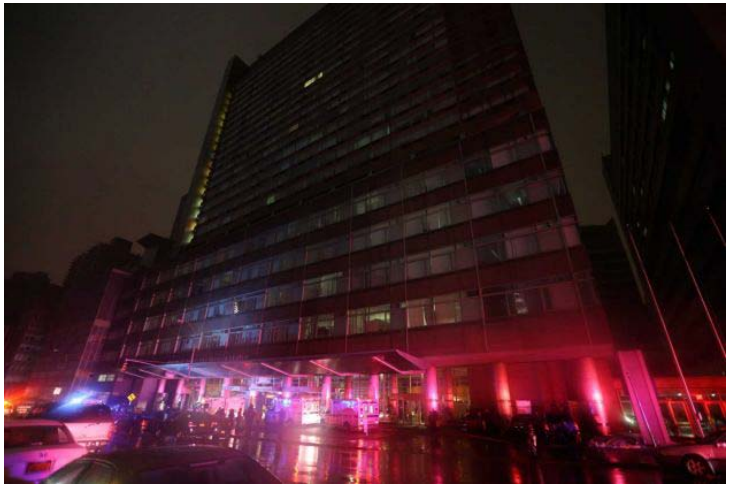
Hurricane Sandy, Derecho, Snowpocalypse/Snowmageddon

Number of Events & Remediation Costs of Major Storms



Some Hospitals Faced Dire Circumstances…

NYU Langone Medical Center



Experience During Hurricane Sandy

- Explosion at electrical substation causes Power Failure
- Back-up generators malfunctioned
- Critical care services shut down
- Evacuation of 300 patients

Post-Sandy Implementation

- Planning for a CHP system was underway before Hurricane Sandy
- Hospital to install a 10.5 MW CHP system with natural gas combustion and steam turbine generation
- Expected Completion: Summer 2016

…While Other Hospitals Rode Out The Storm

Danbury Hospital (CT)

- 371 Bed Hospital
- **4.5 MW Mercury™ 50 gas turbine**

During Hurricane Sandy

- Area lost power for several days
- Facility continued operation without loss of power and heat
- Provided continued critical care

Greenwich Hospital (CT)

- 175 Bed Hospital
- **(2) 1.25 MW Gas Reciprocating Engine**

During Hurricane Sandy

- Area around lost power for 7 days
- Restarted in Island Mode within 5 Minutes
- Continued operation of facilities
- 156 Patients were provided care

Regulatory Drivers

DHHS proposed rule (Federal Register Vol. 78 No. 249) would require hospitals to have alternate sources of energy to maintain temperatures to protect patient health and safety and for the safe and sanitary storage of provisions

President Obama signed Executive Order 13624, setting a national goal of deploying 40 GW of new, cost effective industrial CHP in the United States by the end of 2020

- New Jersey has set a CHP goal of 1,500 MW by 2020 with a grant program
- Maryland has incentives for up to $2M per project (goal of 21.5MW)
- New York City has a CHP goal of 800MW new capacity by 2030
- California has set a goal of 6,500 MW by 2030 and an SGIP incentive program
- Connecticut has a grant program worth $200/kW

Financial Incentives Make it Attractive To Implement Now

- Interest rates are at historical lows, reducing debt costs
- Federal tax incentives are available
  - Investment Tax Credit (ITC) is equal to 10% of project cost (set to expire 12/31/2016)
  - Accelerated depreciation (using 5 Year MACRS schedule) applied to qualifying energy costs
  - Bonus Depreciation may be available through 2015 offering a 50% increase in Year 1 depreciation
- Numerous State incentives exist to support CHP applications
  - EmPOWER Maryland $2M incentive
  - California SGIP program
  - North Carolina State tax credits
  - New Jersey grant programs
  - Connecticut grant programs

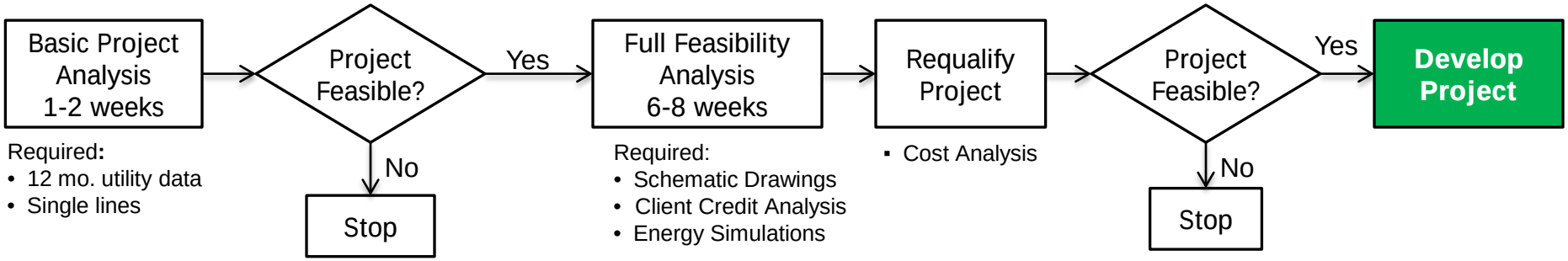
CFSG
ENERGY & STRUCTURED FINANCE

Considerations When Evaluating a CHP Installation

Facility Considerations When Assessing CHP

- Total base electrical load
- Seasonal needs for cooling, hot water and steam
- Centralized electrical and thermal distributions on campus
- Location to place system (square feet needed)
- Funding source and “payback”

CHP Project Evaluation Process



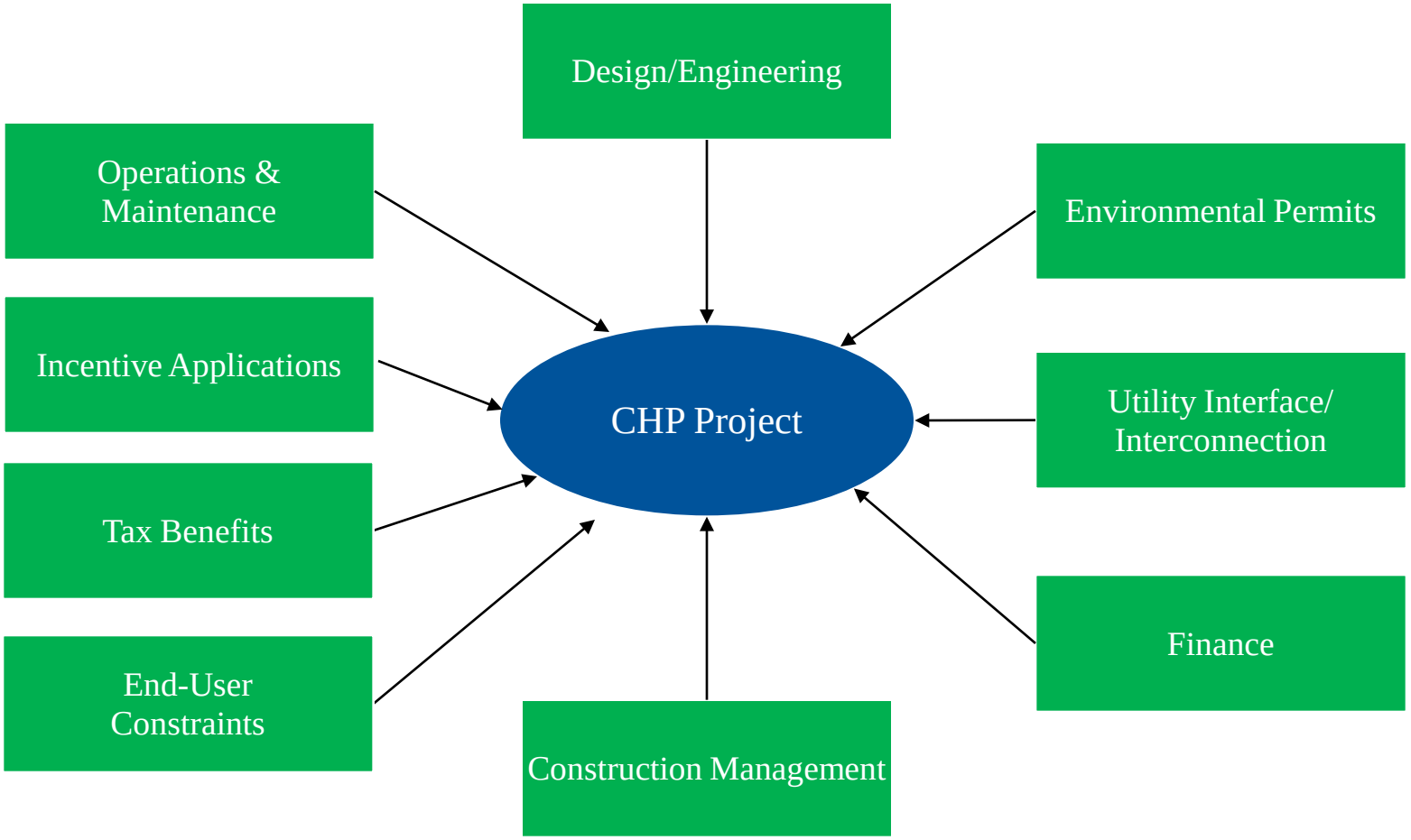
- Iterative project evaluation process can determine project feasibility, while minimizing cost
- First steps include general projections and fatal flaw analysis, then move on to in-depth engineering study and design

Project Obstacles Relative to Other Capital Demands

- ROI or Payback may be insufficient
- Project complexity may limit ability to undertake given demands on facility staff
- Competing uses of capital dollars may prevent approval, especially if other investments generate revenue

Benefits of Turnkey Approach

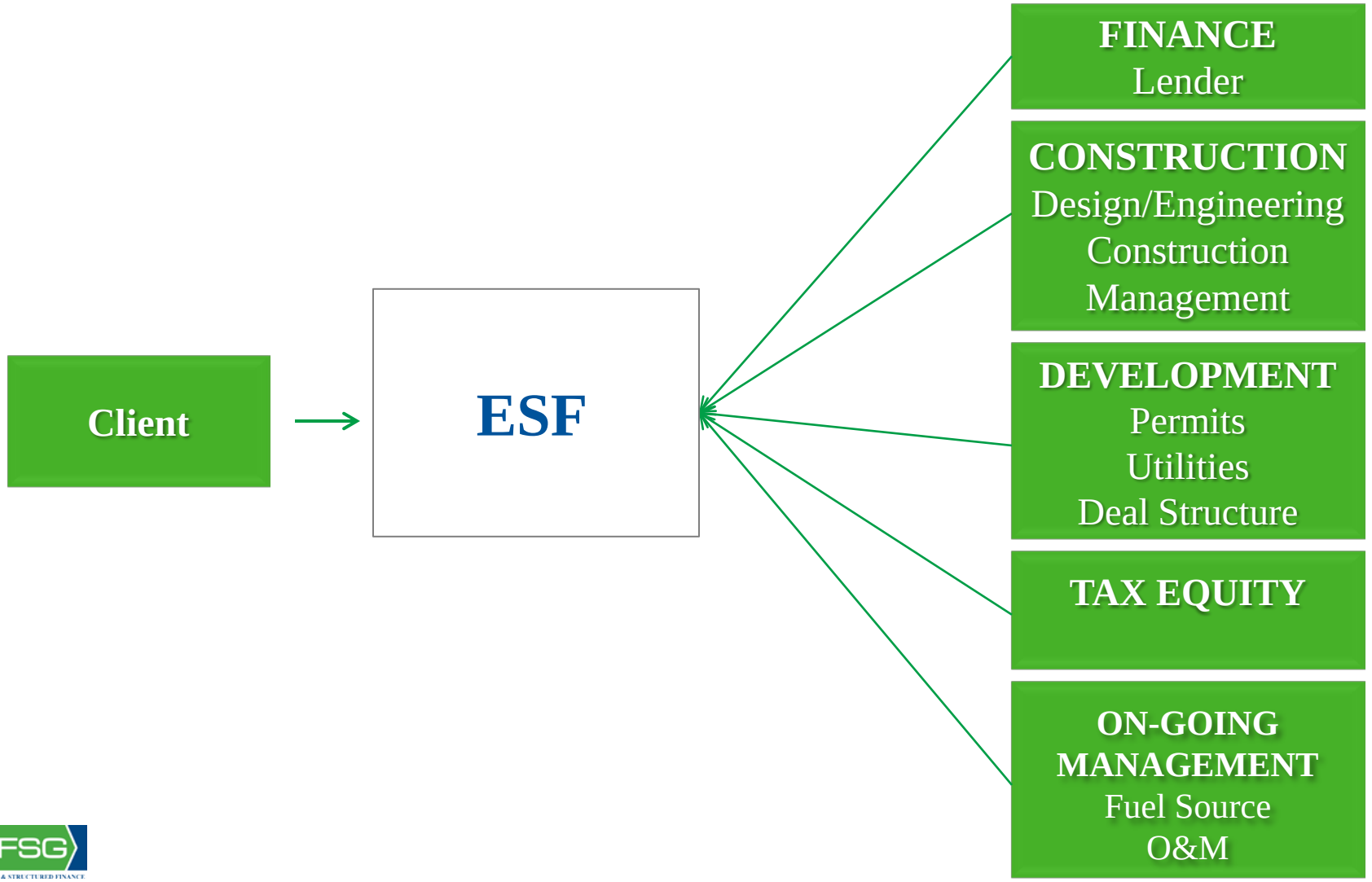
Project Involves Multiple Disciplines & Risks



Healthcare Operational Challenges

- Hospital functioning under all conditions
- Do no harm
- Ongoing operational management responsibilities
- Integration of new system
  - Complexity
  - Need to minimize shutdowns / system outages

Turnkey Approach with ESF



Turnkey Approach Can Include Financing

- Under a Power Purchase Agreement (PPA) structure, a 3rd party owns the system and sells power to a customer
- Project risk is shifted from the facility to the PPA provider
- Customer should have the opportunity to buy out the system at a Fair Market Value early in life-cycle
- PPA arrangement allows public sector / non-profit organizations to access Federal and State tax incentives
- Other incentives (e.g. Maryland CHP Incentive) can be rolled into PPA rate
- Can be structured to remain off credit and potentially off balance sheet

CFSG
ENERGY & STRUCTURED FINANCE

Other Benefits of Turnkey Approach

- Frees capital for other uses (e.g., MRIs, staff, other infrastructure)
- Balance sheet treatment should not affect debt capacity of hospital
- Allows staff to focus on core business (you have day jobs!)
- Project delivery risk transferred to an able third party

Summary

- CHP system at UCMC will save hospital over $9 million over 20 years (system operational 30-35 years with regular maintenance)
- Hospital able to serve community during disasters
- UCMC able to avoid any upfront capital outlay for project through PPA structure
  - May choose to purchase system based on proven track record
  - Transferred performance, delivery, O&M and other risks
  - Facilities staff trained in operations and ready to take over system in future

Project a Great Example of Team Effort!!