

Onsite Energy Systems

Efficiency, Emissions, and Value



Talking Points

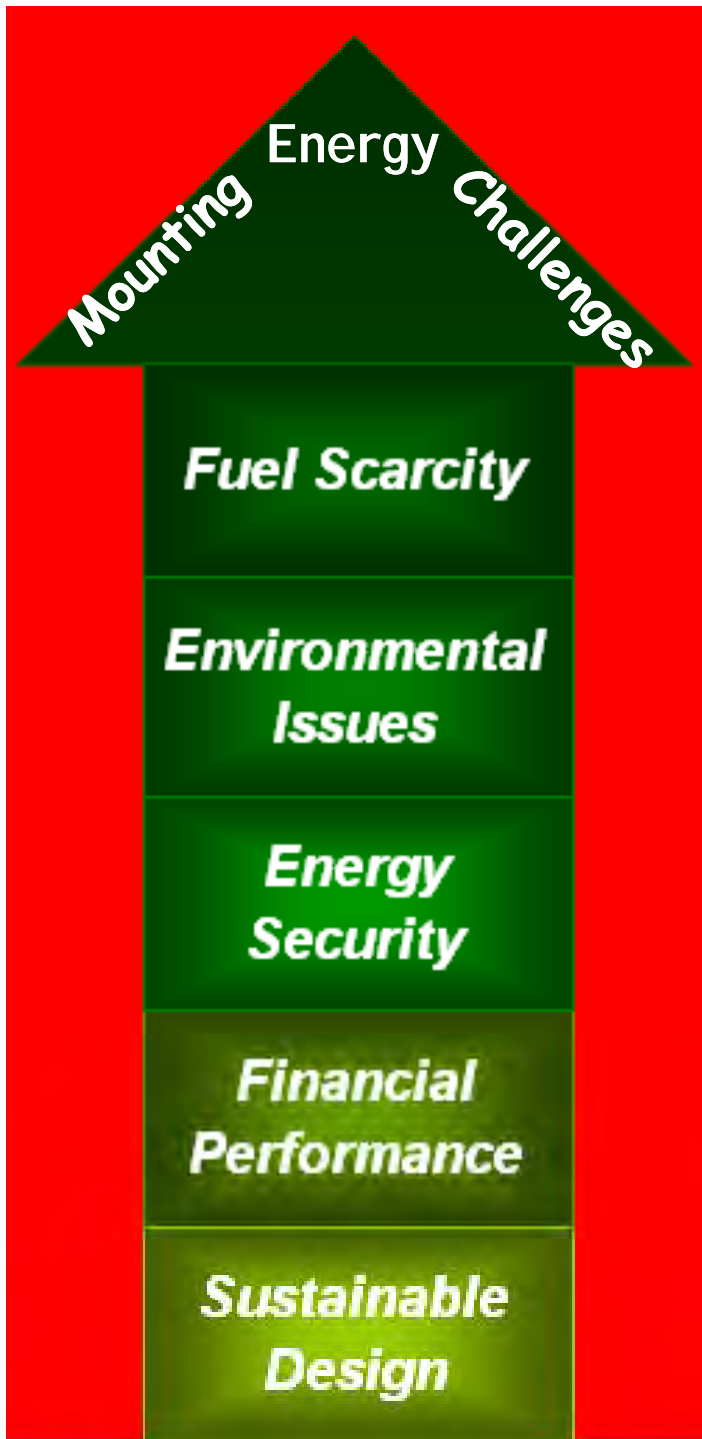
- Trends that impact energy decisions
- On-site Energy System Meets Challenges
- Design and Performance



Trends and Challenges

How do they affect customer choices?





Energy Solutions Must Deliver. . .

Maximum possible energy efficiency

**Significant reduction in emissions,
Especially carbon**

**Improved reliability
With grid independence option**

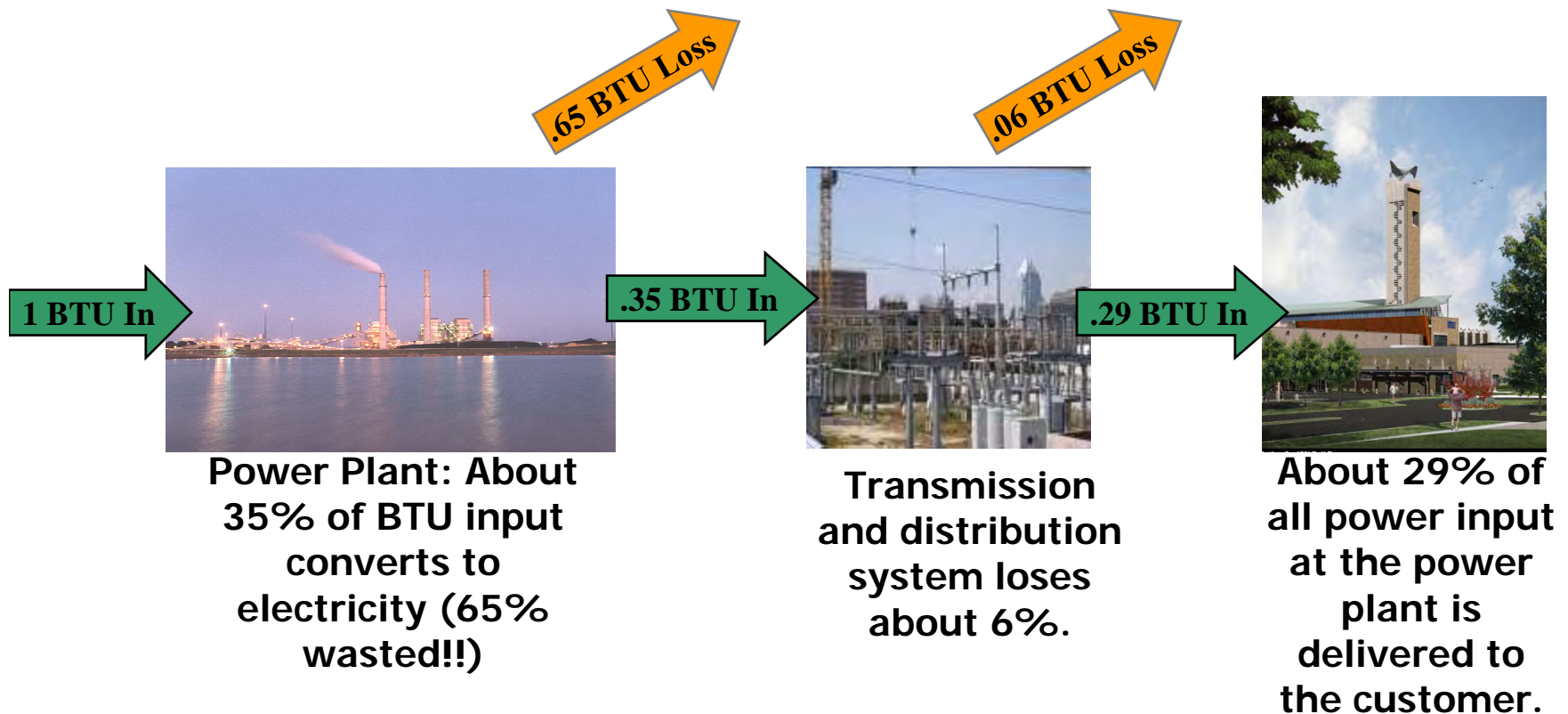
Investment grade financial returns

Green Building and LEED® points



Challenge 1: Energy Efficiency

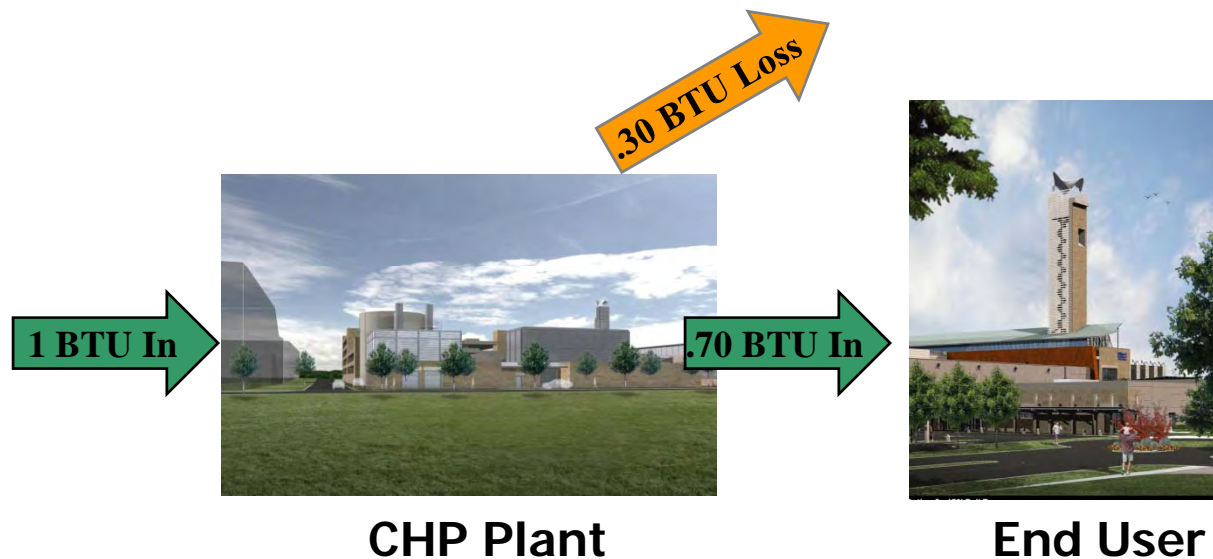
Typical Power Delivery is less than 30% effective



A Better Solution: On-Site Energy Production

CHP Energy Delivery

CHP has **140% greater efficiency** at conversion of primary fuel to useful energy.



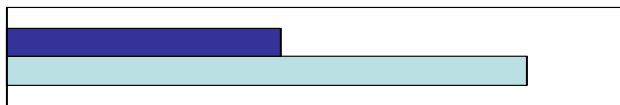
Challenge 2: Environmental Impact

Positive Environmental Impact with Efficient CHP plant

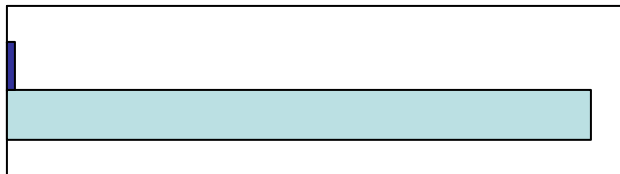
Mueller Energy Center



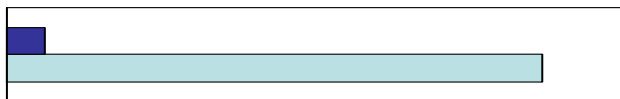
CO₂ 615 lbs / MWh
SO₂ 0.003 lbs/Mew
NOx 0.043 lbs/MWh *



CO₂ 47% reduction



SO₂ 99% reduction



NOx 93% reduction

Austin Energy Central Power Plant Fleet



CO₂ 1162 lbs/ MWh
SO₂ 2.33 lbs/MWh
NOx 0.6 lbs/MWh



Challenge 3: Electrical and Thermal Reliability

Electrical Reliability

- N+2 Redundancy
- 4.3 MW Gas Turbine on-site
- Dual 12.5 kV Electrical

Distribution Feeds

- Standby (black start) Generator
- Grid Parallel/Grid Independent

Thermal Reliability

- N+2 Chilled Water cooling (heat recovery chiller + electrical centrifugal + thermal storage)
- Redundant pumping and cooling tower
- 100% delivery capable during grid outages



Challenge 4: Financial Returns

- IRR and NPV's greater than other long term investments
- Use OPM for funding (Other People's Money)
- Outsource Business Model On-Site Energy System
- Lowest life-cycle costs vs. self provided power and thermal (avoid initial capital, predictable pricing, increased productivity)
- System provider secures revenue and profit from thermal and premium power sales



Challenge 5: Sustainable Solution

Earn “GREEN” credits

- CHP district energy is an alternative means to meet energy needs of buildings
- Significant Energy and Atmosphere credits can be attributable to CHP
- USGBC LEED Platinum rating
 - Example Project –Mueller Energy Center Dell Children’s Hospital in Austin, TX
 - Example Project -Oil & Gas Trading Facility / Data Center Houston, TX
 - Earned 7 LEED points for EAc1 (optimize energy efficiency) plus 1 LEED point for EAc4 (enhanced refrigerant management)



O&G Trading Facility / Data Center Houston, TX

Equipment Overview

- 4.3 MW Mercury 50 gas turbine
 - with heat recovery
- 1350 ton absorption chiller
- 1200 ton mechanical chiller
- 4,000 ton-hr thermal energy storage
- Dual electrical feeds
 - 100 kW from utility
 - Base load from GT
- N+1 Reliability
- >75% efficiency

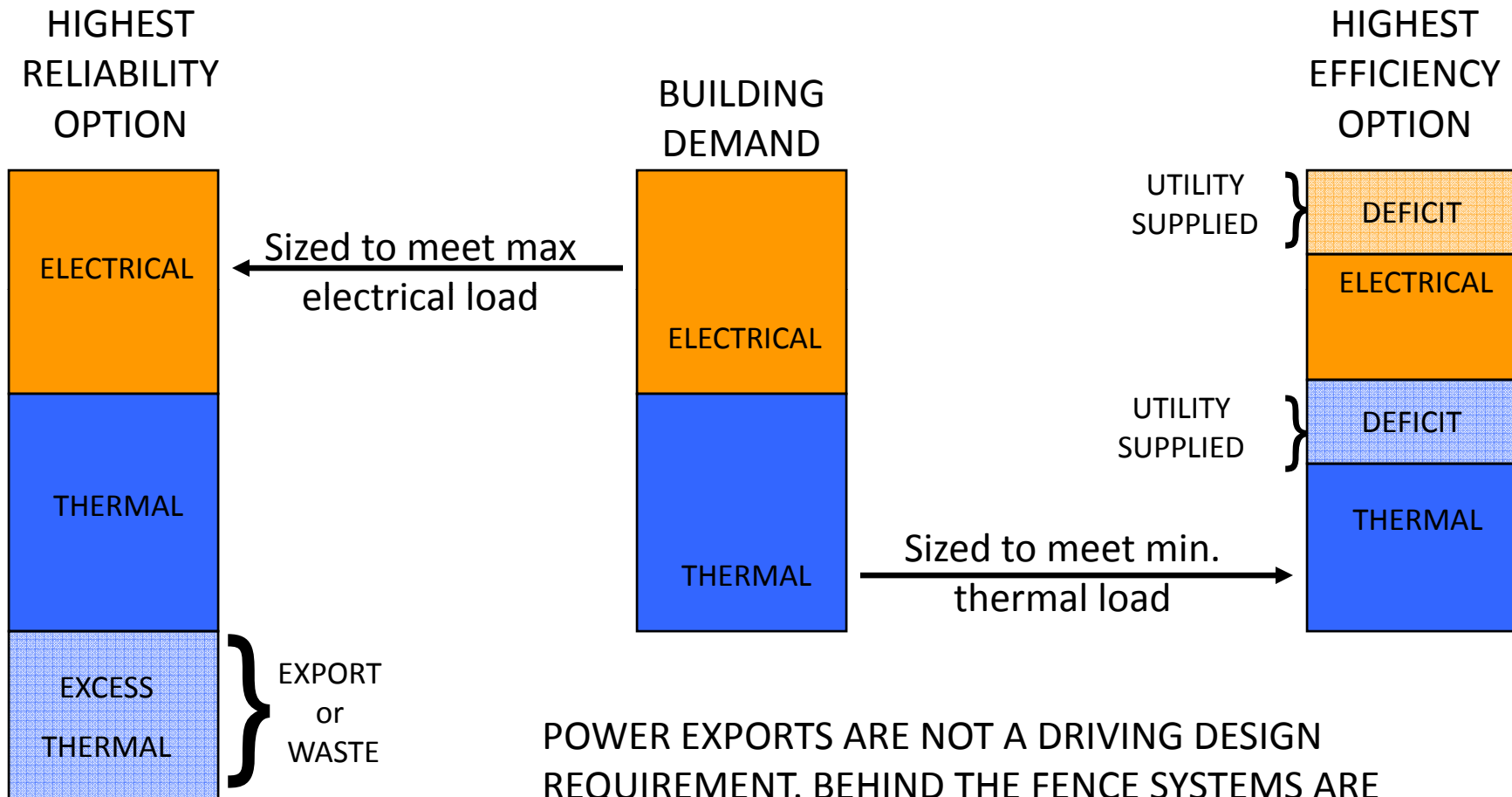


Design Strategies & Cost Decisions

How do these decisions affect project design?

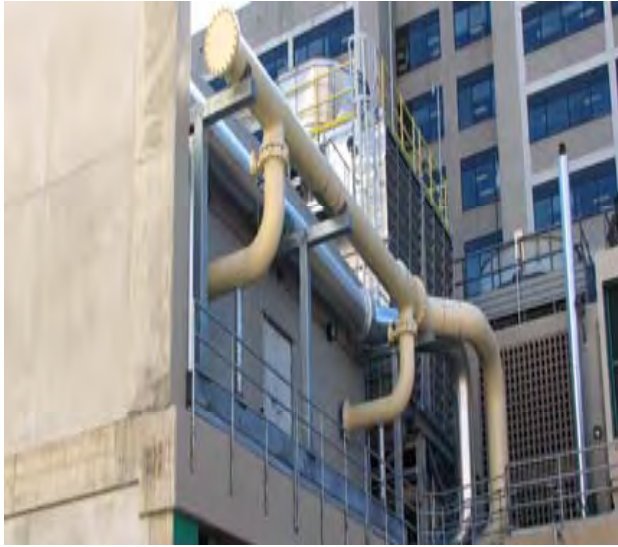


Design Strategies



POWER EXPORTS ARE NOT A DRIVING DESIGN REQUIREMENT. BEHIND THE FENCE SYSTEMS ARE MOST DESIRABLE.





Large Hospital Example



<u>EQUIPMENT</u>	<u>RELIABILITY</u>	<u>ECONOMY</u>
Generator Size	3,300 kW	470 kW
CHP Efficiency	58%	73%
Power from CHP	100%	25%
Thermal from CHP	100%	84%
Power Utilization	75%	100%
Thermal Utilization	35%	86%
Installed Cost	\$5,000,000	\$950,000

Traditional vs. Emerging Cost Methods

- Traditional Industry Model (*purchase cost*):
 - \$ / ton of Component Cost (Capital Cost focus)
 - Plan & Spec model
 - Price / Time
 - Primary metric is initial capital cost (although process waste not measured)
- Emerging Industry Model (*ownership cost*):
 - \$ / ton – hour (cooling)
 - \$ / kWh (power)
 - The cost to “use”
 - Life-Cycle Cost
 - Performance Based
 - Primary metric is NPV (or \$/T-Hr)
 - NPV should be maximized or cost / ton-Hr should be minimized



Regulatory / Economic Convergence

Efficiency • Emissions • Value

- Convergence of public policy and economic sense:
 - Legislative / regulatory policy (macro)
 - CenterPoint Energy
Houston, TX
 - Cost of energy and energy consumption (micro)
- Decision criteria and process are changing



Public Assembly Cost Analysis with CenterPoint Rebate

<u>Cash Flows – Field Erected</u>	<u>% Total Cost</u>	<u>Net Present Cost – 20 yr Period (\$)</u>
Capital Investment	16.4	889,547
Energy Cost	76.1	4,139,553
Demand Charge	0.0	0
Water & Chemical Costs	0.0	0
Fixed Facility Maintenance	3.9	211,959
Operations	<u>3.7</u>	<u>198,712</u>
TOTAL	100.0	5,439,771

<u>Cash Flows – TAS Plant</u>	<u>% Total Cost</u>	<u>Net Present Cost – 20 yr Period (\$)</u>
Capital Investment	29.7	1,147,531
Energy Cost	56.9	2,196,287
Demand Charge	0.0	0
Water & Chemical Costs	2.8	108,231
Fixed Facility Maintenance	5.5	211,959
Operations	<u>5.1</u>	<u>198,712</u>
TOTAL	100.0	3,862,720

TOTAL SAVINGS	1,557,051	DOLLAR/TON-HR SAVINGS	.720
Energy Efficiency Rebate	222,102.94		



GOT GREEN?

- Are you measuring operating efficiency today?
- Do you understand what components, functions, designs can impact efficiency?
- Do you have a method for periodically compiling reliable operating data?
- Are your market providers incentivized based on the full cost of ownership?
- Is there a set of goals for ongoing monitoring & measurement?
- Have you developed a Life Cycle Cost model updated with real performance & cost data?
- Are you taking positive steps toward reducing GHG emissions?



What It Means

Is there VALUE?

- The need for CHP
- ASHRAE
- LEED Platinum

Is there a PREMIUM?

- Experience matters
- Keep CHP in mind
- The trend

