Campus Based Energy Security & Carbon Footprint Reduction: *The University of Minnesota's Master Energy Plan*

Presented by
U.S. Energy Services, Inc.
Wednesday, February 10, 2016

AGENDA

Discussion Topics: A Two-Part Solution

- **Situation Background and CHP Solution**
- **Price Risk Management Plan Solution**

Background and *Cleaner* Power Generation Solution with CHP

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U of M Energy Management Requirements

- Reliable
  - ➢ Ensure reliable energy supply

- Sustainable
  - ➢ Reduce CO_2 emissions

- Cost-effective
  - ➢ Identify energy efficient opportunities and balance upfront investment costs with long-term savings potential

Utility Master Planning

As of June 2009, the situation was clear:

- Steam capacity was inadequate
- Boilers were aging and beyond their useful life
- Competing with other higher education institutions
- Sustainability plans – Zero Carbon by 2050
- The conclusion was to add two package boilers…

BUT

- Benchmarking other district energy facilities
- Another option, CHP, could save the University **$'s**

Summary of Challenges

- **Reliability**
  - Projected shortage of 'firm' steam capacity
  - Risk to research, teaching and operations due to 100% of steam for Minneapolis campus coming from one site served from single tunnel away from campus
- **Sustainability**
  - Commitment to provide energy with less carbon output
- **Cost Effectiveness**
  - Impact to utility rates after adding steam capacity
  - Projected increases in purchased electrical costs
  - Needed site for next efficient chilled water plant

Sustainability

Sustainability Commitment

Carbon Footprint Reduction

- 10 to 13.5% of the Campus 2008 baseline
- **81,000 metric tons of CO2 (Recalculated number from 65,000)**

Equivalent to:

- 17,000 passenger vehicles in a typical year or
- 192,857,143 miles driven by the average car or, **22.3 wind turbines**

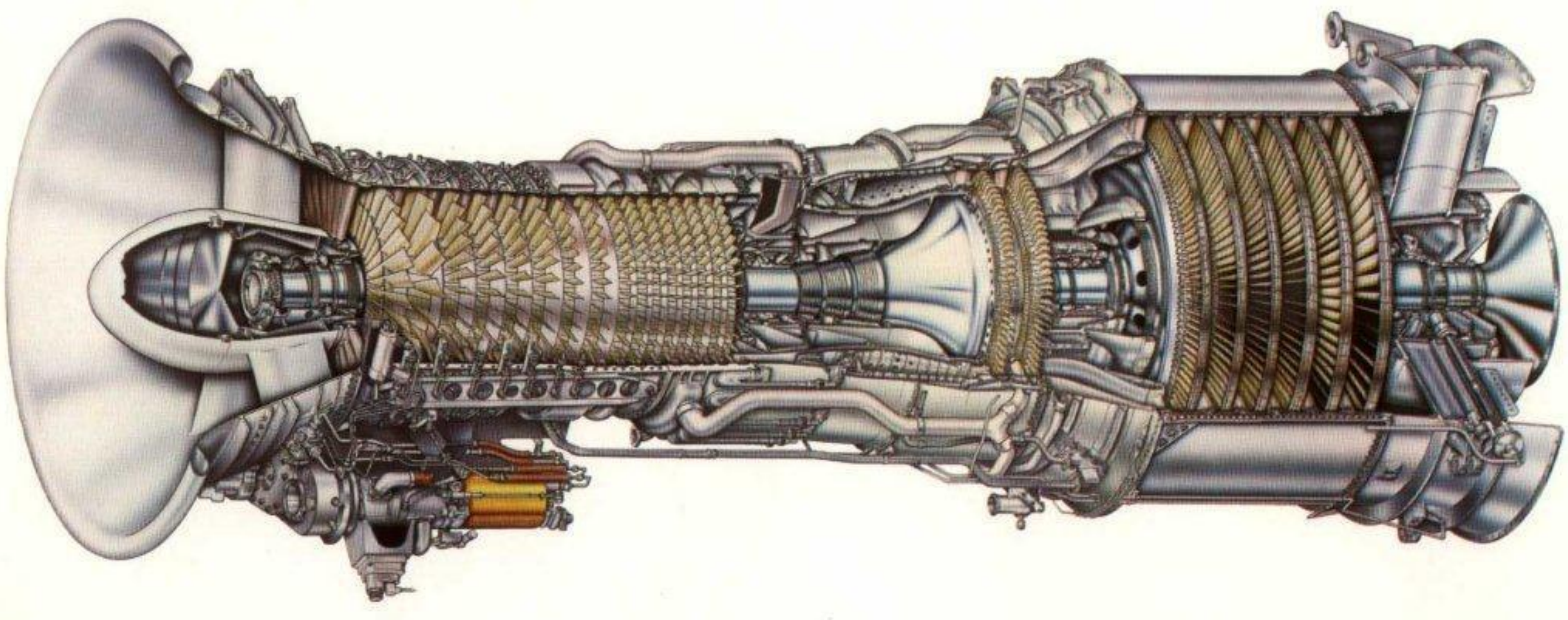
Source: epa.gov/cleanenergy/energy-resources/calculator

CHP Project Solution

- Addresses the deficiencies of the Old Main Utility Building as part of developing a multiple utility services building
- Installs a dual fuel Combustion Turbine Generator capable of exporting 20.4 MW to campus

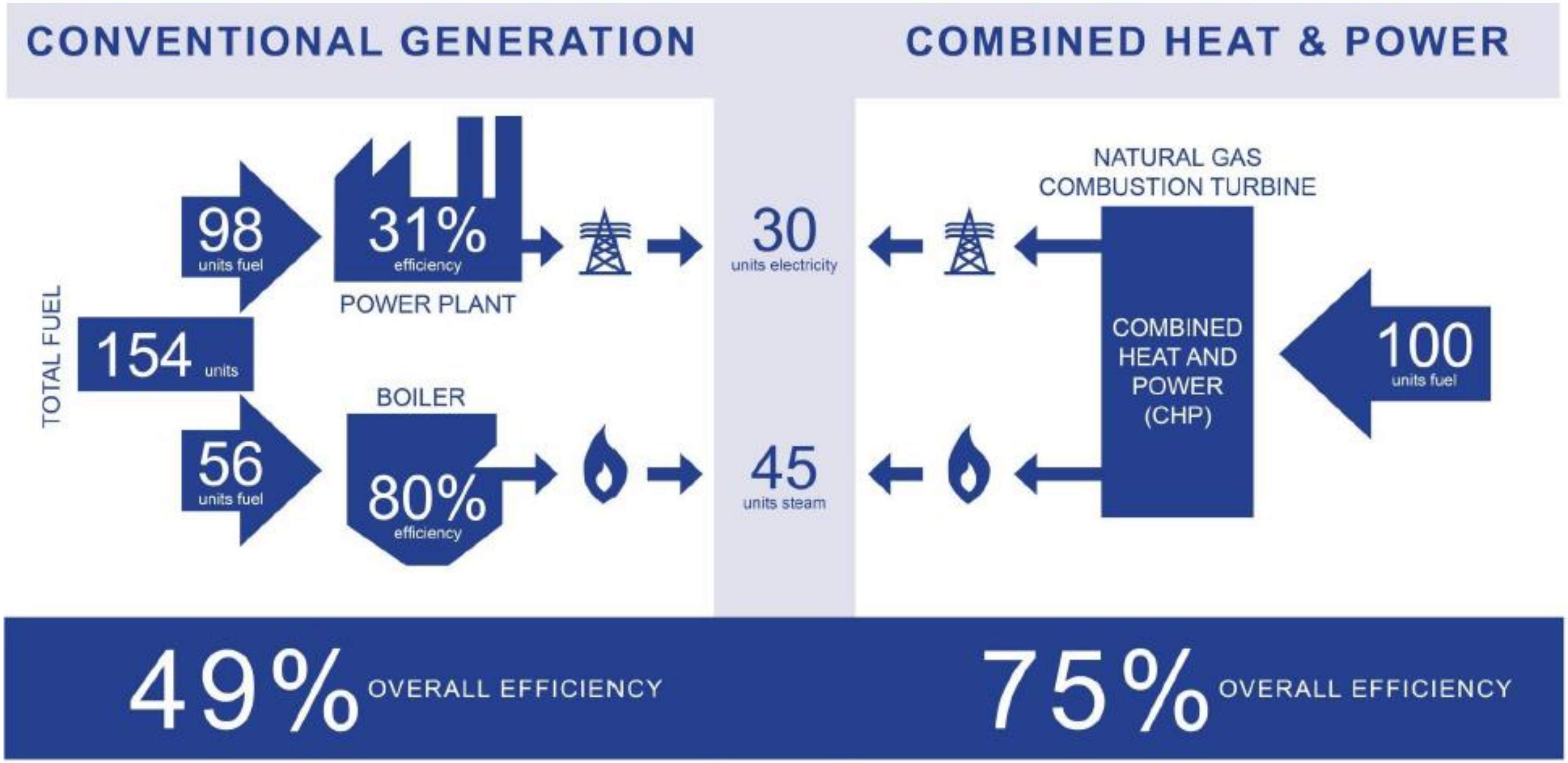
- Installs a duct fired Heat Recovery Steam Generator
- Enhances campus electrical power distribution infrastructure
- Provides dedicated space for future chilled water and package boiler equipment

CHP Combustion Turbine



General Electric LM2500 Gas Turbine

CHP Efficiency



U of M: 83%!

Projected Utility Rates with CHP

	Current University Utility Rate	Projected Rates With Project
Steam (Rates $/Mlb)	$21.95[1] $21.98[2]	$19.99[1] $22.27[2]
Electric (Rate $/kWh)	$0.0991[1] $0.0991[2]	$0.0900[1] $0.0950[2]

1 = FY12
2 = FY14

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Projected Utility Costs with CHP

	Current University Utility Costs	Projected Costs with a New Boiler and NO CHP Project	Projected Costs with the CHP Project
Steam (Annual Total)	**$43,141,000**	**$45,553,000**	**$43,720,000**
Electric (Annual Total)	**$39,338,000**	**$41,658,000**	**$37,692,000**
Total Annual Cost:	**$82,478,000**	**$87,211,000**	**$81,411,000**

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Projected Cost to Produce vs. Purchase Electricity $/kWh with CHP

	Projected Rates with Project:
U's Cost per kWh to Produce	$0.0258
Effective Cost/kWh	$0.0770
U's Cost per kWh to Purchase	$0.0810

Project Benefit Summary

- **Cost-effective**
  - Projected to reduce University utility costs by $7 million annually
  - Provides a financial hedge against purchased electrical costs
  - Creates cost effective site for next chilled water plant

- **Reliable**
  - Provides sufficient ‘firm’ capacity for 15 years based on current projections
  - Provides 2nd source of steam production dramatically reducing risk to campus research, teaching, and campus community

- **Sustainable**
  - Reduces Campus Carbon Footprint by 10%
  - Significant increase in efficiency of utility systems

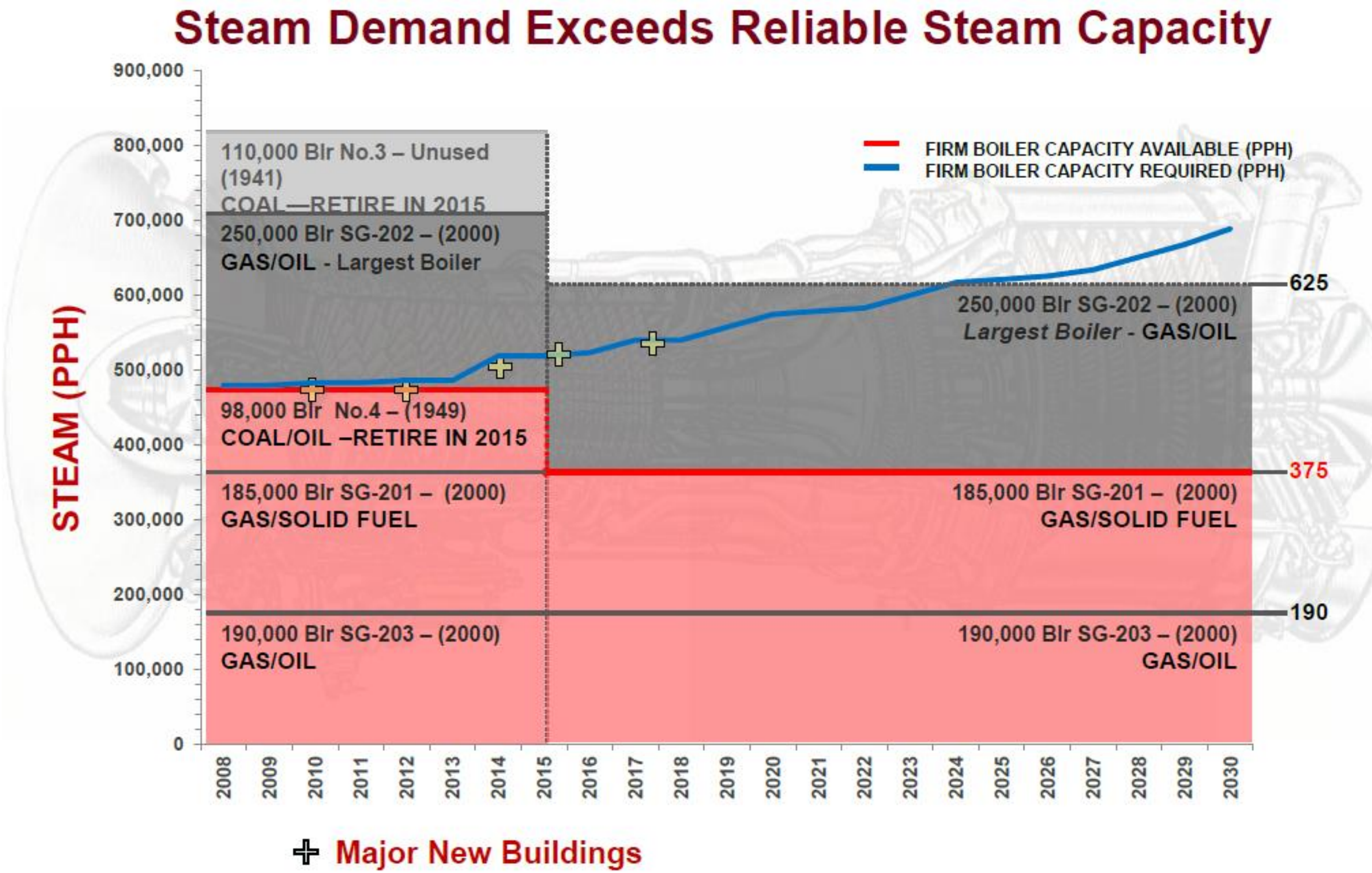
Potential Options for Operations:

Option	Ownership of Plants	Operation of Plants
1	University Owns: - State and U funding mix	University Operates
2	University Owns: - State and U funding mix	University Contracts Management (current arrangement)
3	U Enters into Long-term Lease w/ Third Party	U Purchases Utilities from 3rd Party

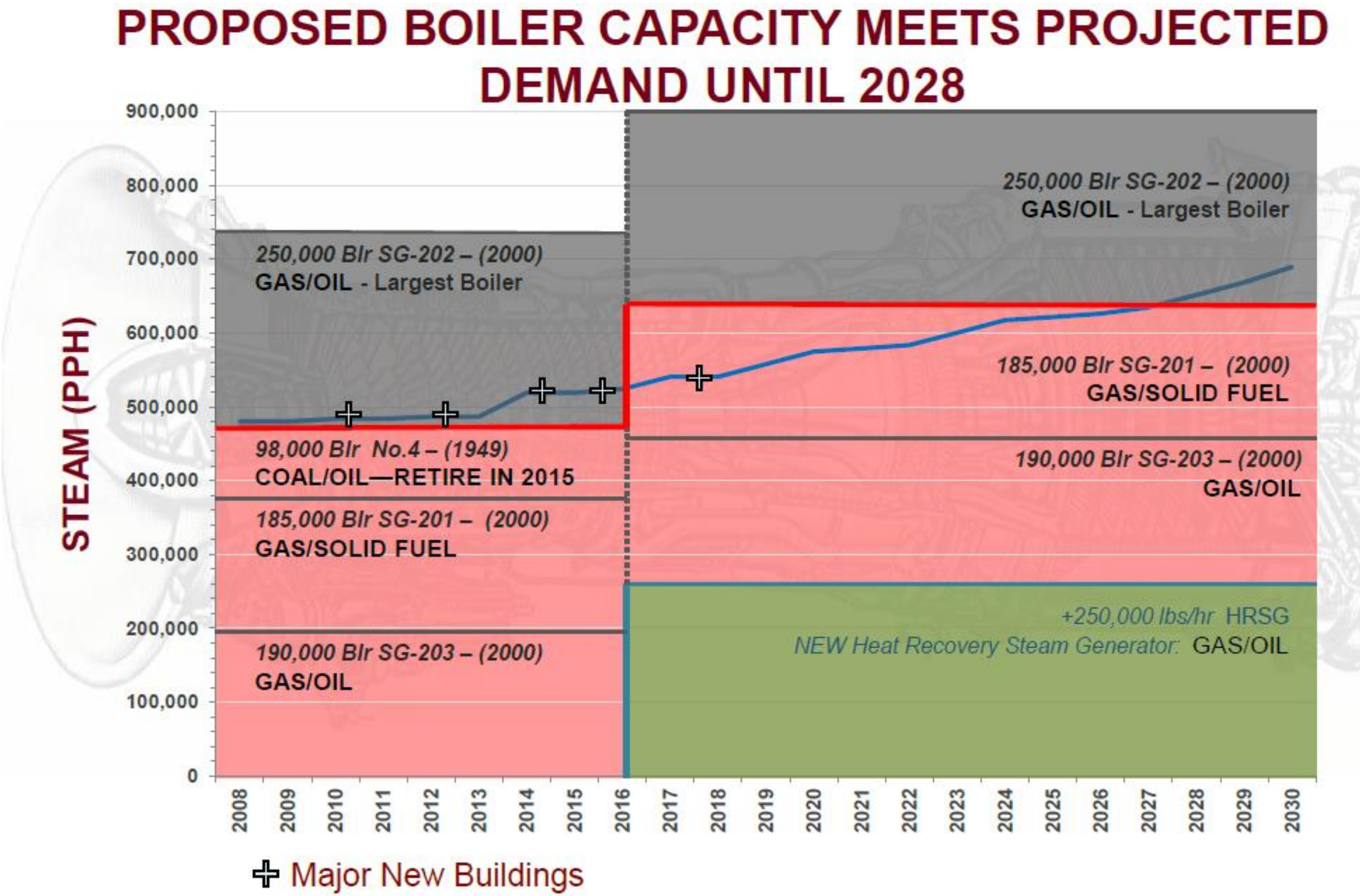
Potential Options – Analysis

	Option	Operating and Capital Costs	Reliability/Control
1	University Owns and Operates	Lowest: • U pays operational costs • U pays portion of capital cost	Highest: • University maintains most control. • Would require U to ramp up staffing/expertise.
2	University Owns but Contracts out Mgmt.	Moderate: • U pays operational costs • U pays portion of capital costs • U pays management fee • U pays profit/incentive	Moderate: • University manages through contract provisions • Utilizes industry expertise
3	U Enters into Long-term Lease w/ Third Party	Highest: • U pays operational costs • U pays 100% capital costs in rates • U pays management fee • U pays profit/incentive	Lowest: • University has least control • Subject to operational decisions by provider.

Sizing Driven by Steam Requirements



The Solution:



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Supplier Diversification and Long Term Balanced Risk Management Plan

Supplier Diversification & Long Term Contracts

- Credit approved for multiple suppliers (BP Energy, Shell Energy, UET, etc.)
- Typically $.02~$.10/MMBTU savings when suppliers compete for business
- Negotiated 25 year discounted gas transport rate with utility

Balanced Position Hedge Program: Definition

- Defined hedging strategy – quantifiable targets + process for reassessment
- Defined execution strategy – defines the "who" and "how" of hedging
- Budget oriented: 40-75% hedged up to 36 months into future

Balanced Position Hedge Program: Goals

- Insurance against volatility → component dedicated to budget predictability
- Defines timeframe windows for layering up to supply hedge targets
- Bounded view of the market: % around equilibrium
- Maintain flexibility and cost effectiveness

Balanced Position Hedge Program: Goals

- Purchases slide forward from prompt month → min/max targets
- Purchase layers are *guides*, not absolutes: maintain flexibility to adjust
- Sliding purchase scale is synchronized to budget cycles
- Basis managed separately from NYMEX commodity pricing

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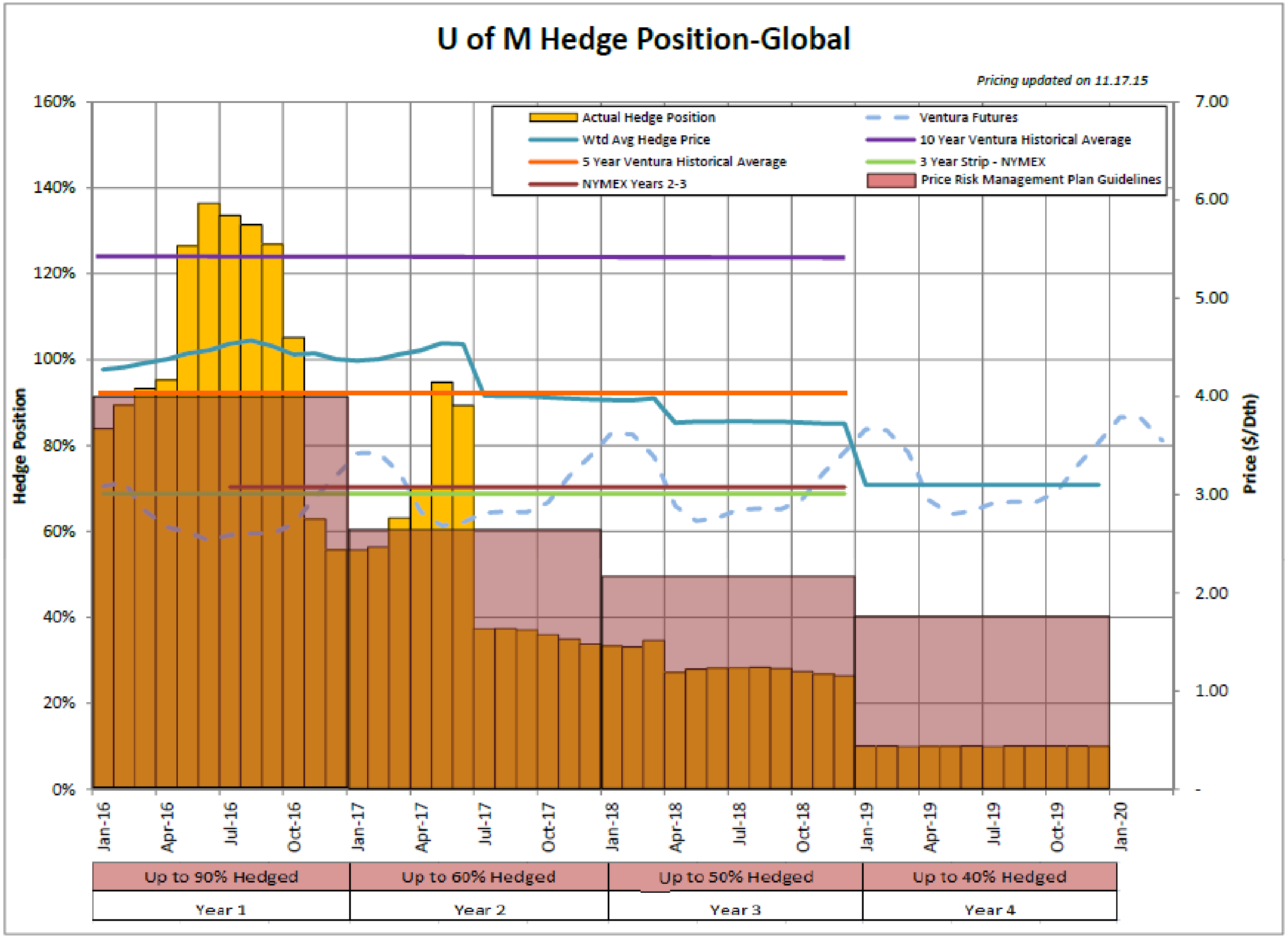
Balanced Position Hedge Program: Backtesting

- Budget Year FOM index + transport + fuel
- Yearly budget costs
- 3 year average FOM index + transport + fuel
- 3 year average budgeted costs

University of Minnesota Hedge Position



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Thank you for your time and attention!

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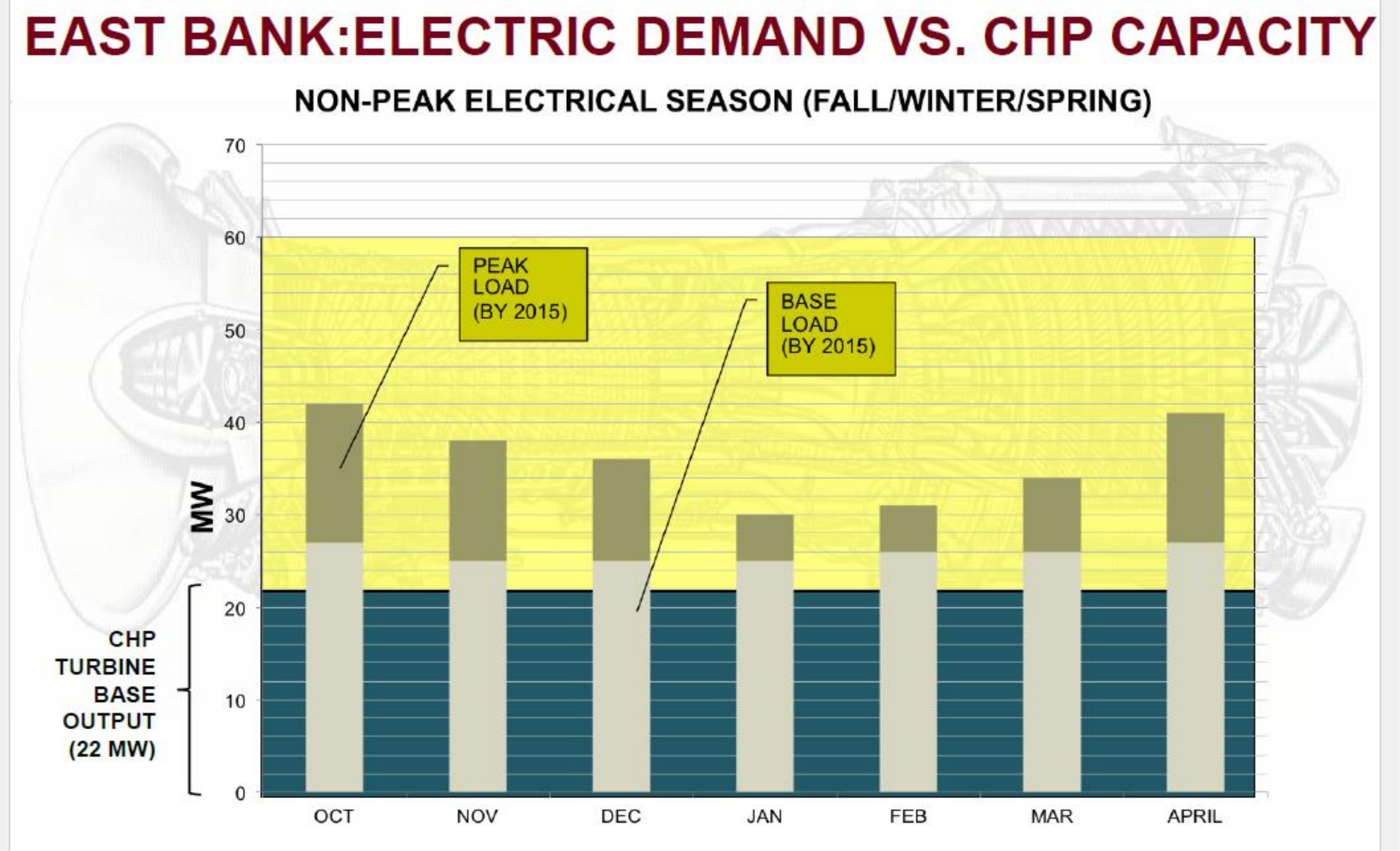
Appendix

Electric Sizing Limited by Loads



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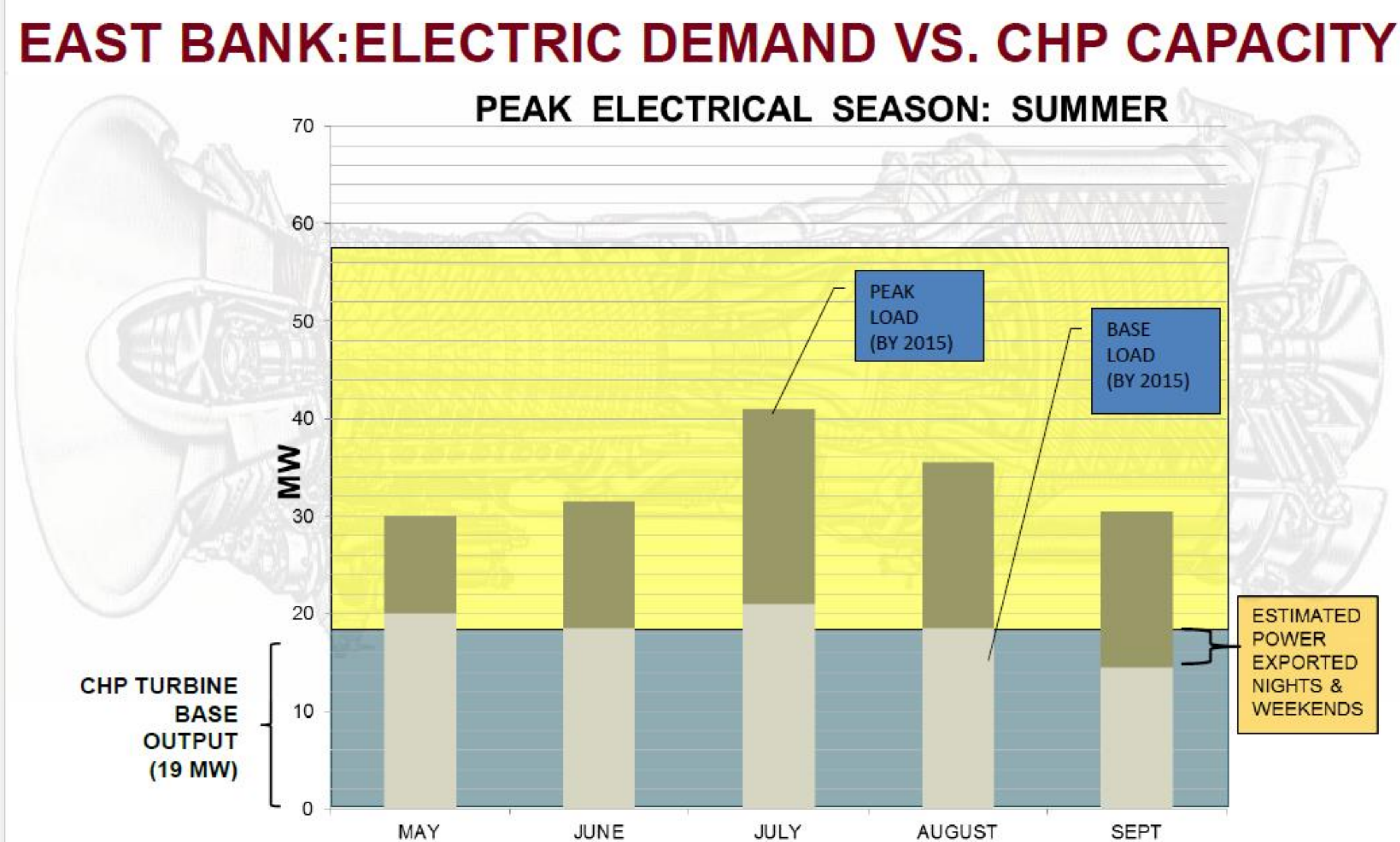
Electric Sizing Limited by Loads



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