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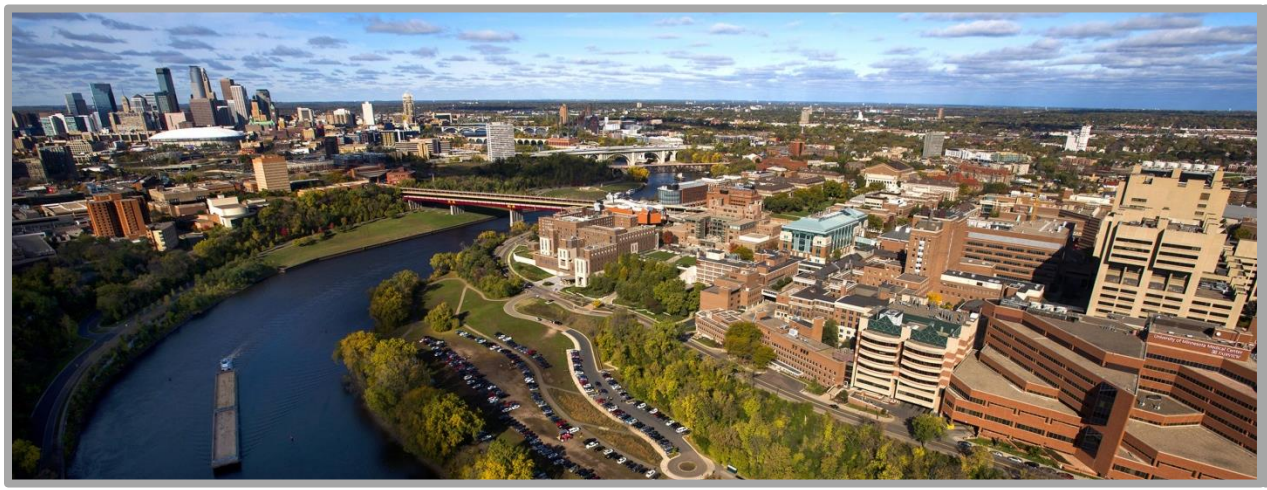
Confronting Murphy's Law: Dealing with Energy Price Uncertainty in your CHP Project

Presented by:

Kinect Energy Group

Thursday, February 23, 2017



Agenda

- Energy History at U of MN – How did we get here?
- Murphy's Law and Lessons Learned
- Confronting Energy Price Uncertainty

University of Minnesota CHP plant

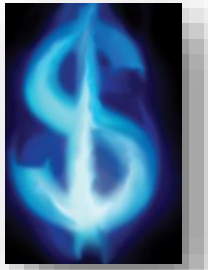
Project Background and History

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

- 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 utility electrical costs
- Needed site for next efficient chilled water plant

Sustainability Commitment

Carbon Footprint Reduction

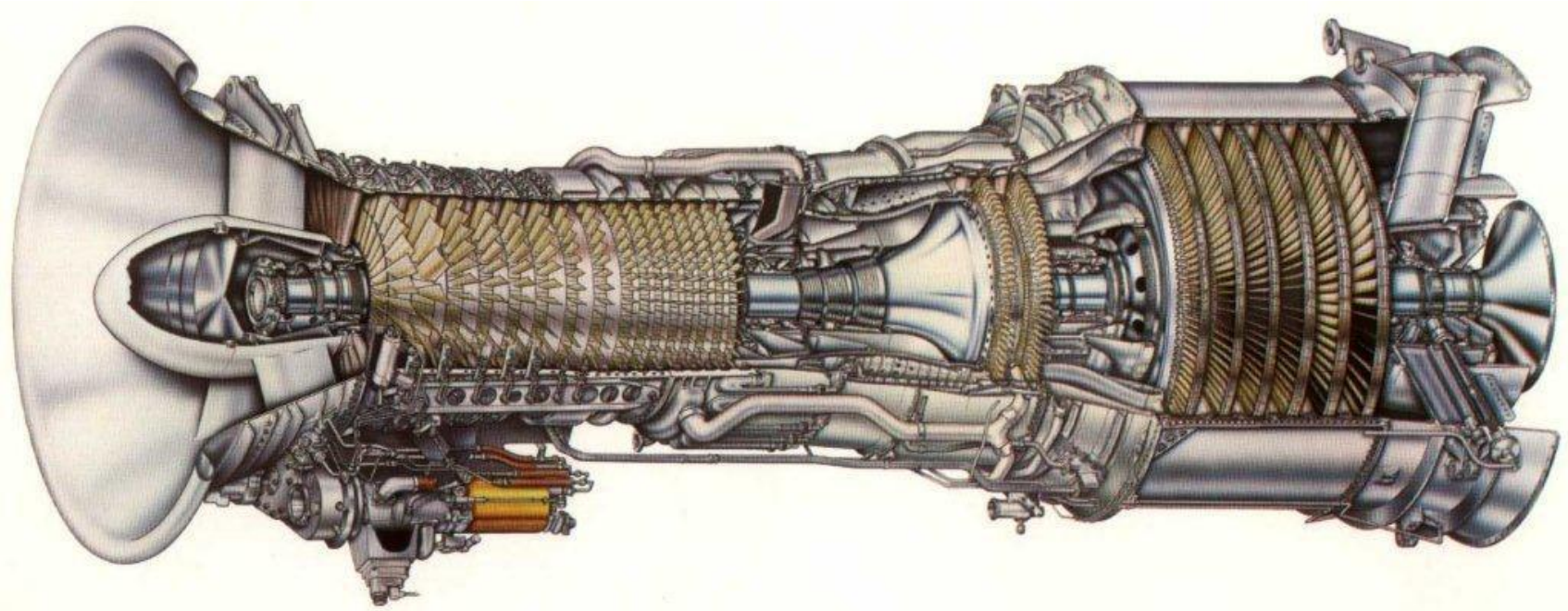
- 10 to 13.5% of the Campus 2008 baseline
- 81,000 metric tons of CO2
  - (Recalculated number from 65,000)

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

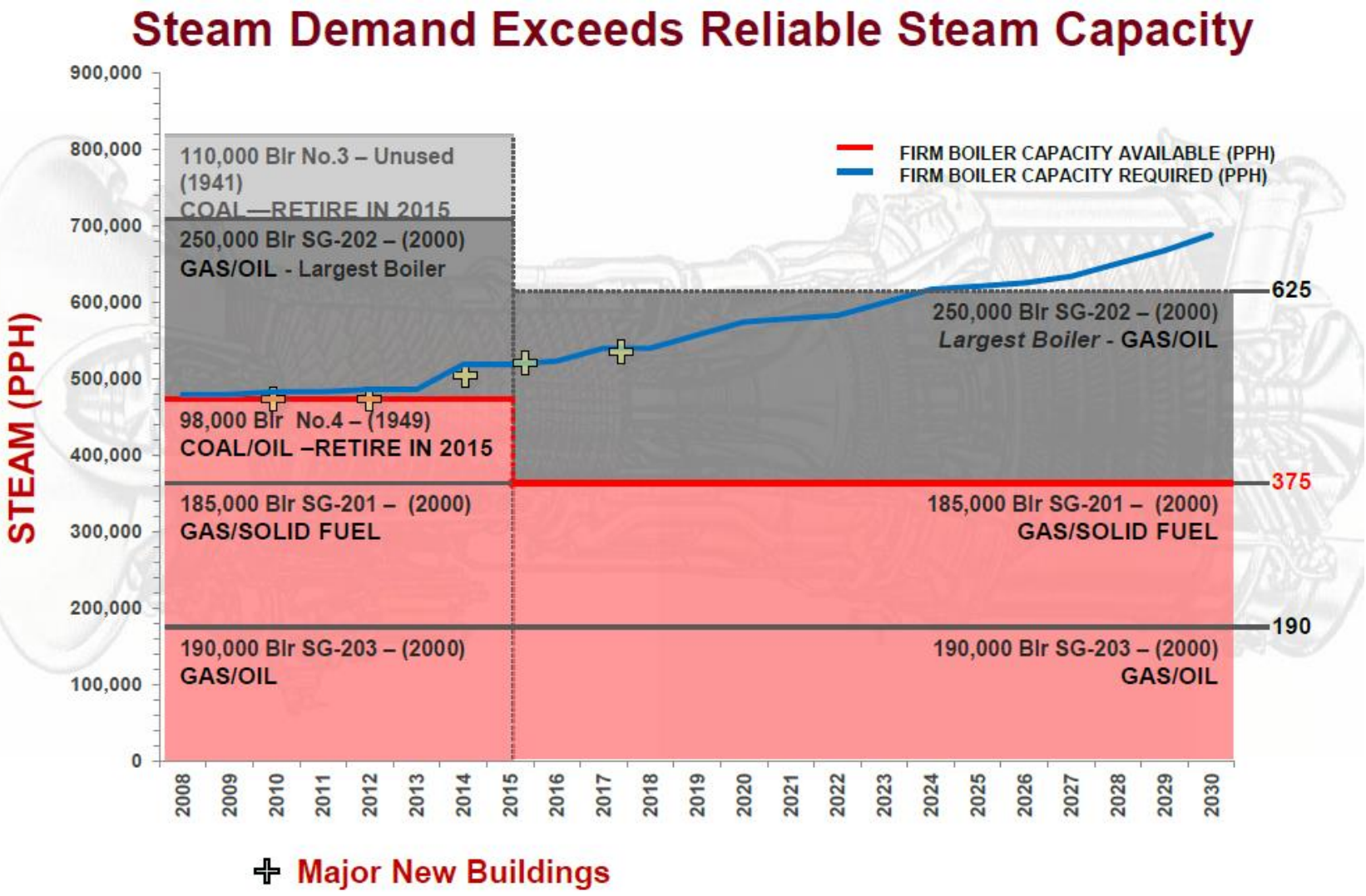
Source: epa.gov/cleanenergy/energy-resources/calculator

U of M's CHP Combustion Turbine

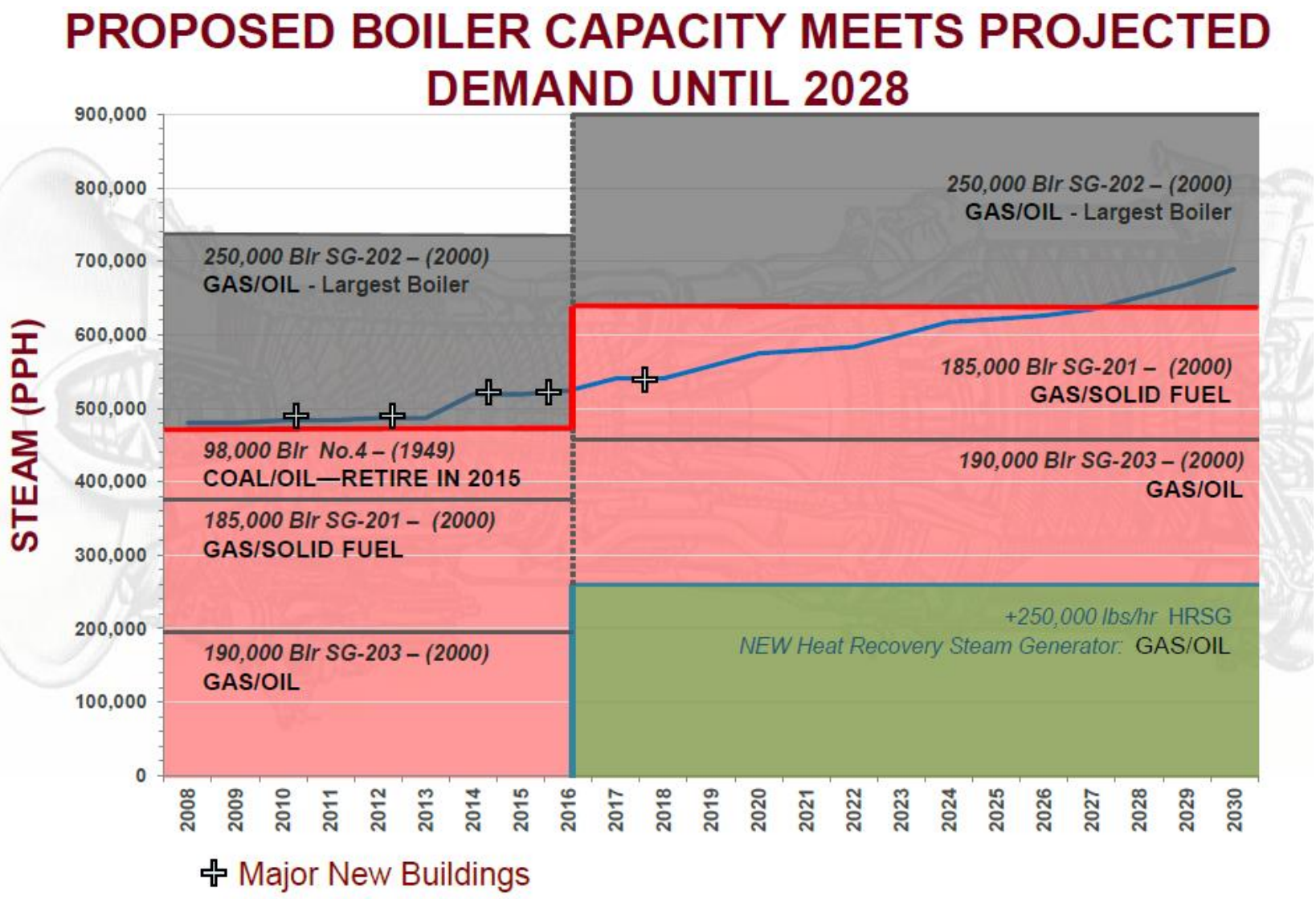


General Electric LM2500 Gas Turbine

Sizing Driven by U of M Campus Steam Requirements



U of M's Solution



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Murphy's Law and Lessons Learned

Stuff Happens – like Murphy's Law

- **Murphy's Law:** Anything that can go wrong, will go wrong – and at the worst possible time.

- **Corollary:** If nothing has gone wrong, you have obviously overlooked something.

Stuff Happens – like Murphy's Law

Everyday Life

- Wash car, then it rains
- Get sick on vacation day

In Research

- Experiment requires X number of parts; stockroom has X-1

In Electronics

- An device protected by a fast acting fuse will blow to protect the fuse

Finance

- Expenditures expand to fill the available budget

Car Repair

- Any tool dropped under the car always rolls to the exact center of the vehicle

Ski Racing

- Correct wax applied is perfect for conditions at race time…then conditions change

Lessons Learned

- **Know Utility MW Tolerance window – load balancing**
  - Utility started at 1 MW tolerance; now increased to 5 MW
  - Submit monthly electric nominations
- **Prepare to research and understand PURPA**
  - 80 MW Federal rule; 50 MW MN state rule
  - Need to know what to ask PUC – *don't expect full disclosure*
- **Aggressively pursue all rebate incentives**
  - Include Prescriptive and Custom financing programs -- $2M rec'd
- **Balance Electric and Thermal needs to ensure waste heat is used**
  - This is critical to economic success of project

Lessons Learned

- **Understand legacy conditions at construction site!**
  - Demolition needs, hazardous waste, asbestos, other issues
- **Read the fine print and ask questions on planned maintenance**
  - 3 year major overhaul interval (offline 1 month)
  - 6 month minor interval (offline 1 week)
  - 2-4 week water washing interval (offline 1 hour)
- **Plan on ongoing educational program**
  - Staff will need training on CT handling and operation
- **Get legal team involved early in process**
  - Used 3rd party consultant – *without ties to local utility*
  - Numerous opportunities to improve contracts
  - Example: interconnection liability insurance (negotiated to $1M)

Lessons Learned

- **Settle on best equipment configuration**
  - Planned for 2 turbines, ended up with single unit
  - NPV of turbine is important
  - Interconnection agreement – commercial terms negotiable
  - Who will own/maintain electric distribution system?
- **Will auxiliary equipment be required?**
  - Example: Learned gas compressor required to meet spec
- **Duel Fuel equipment planned?**
  - Necessary evil to avoid curtailment, but –
  - Introduces more complexity and rate structures
- **Negotiate a long-term maintenance service agreement**
  - Spend the time analyzing this, make sure it favors your needs

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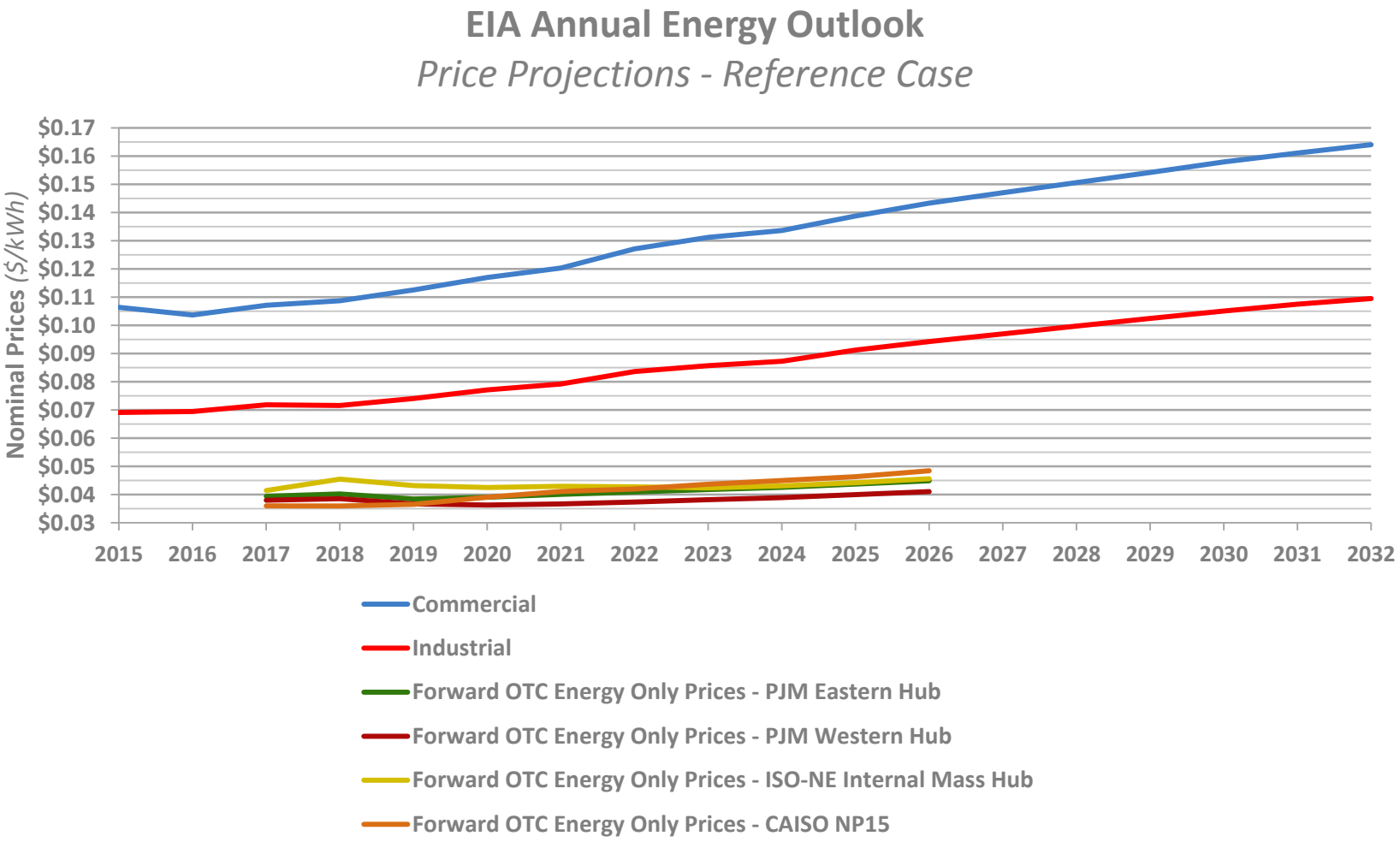
Confronting Energy Price Uncertainty

Electric Forward Price Curves



Managing Natural Gas Input Cost

- **Provides financial hedge against utility electric costs**
- **Defined gas 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

Managing Natural Gas Risk: 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**

Managing Natural Gas Risk: Supplier Diversification & Long Term Contracts

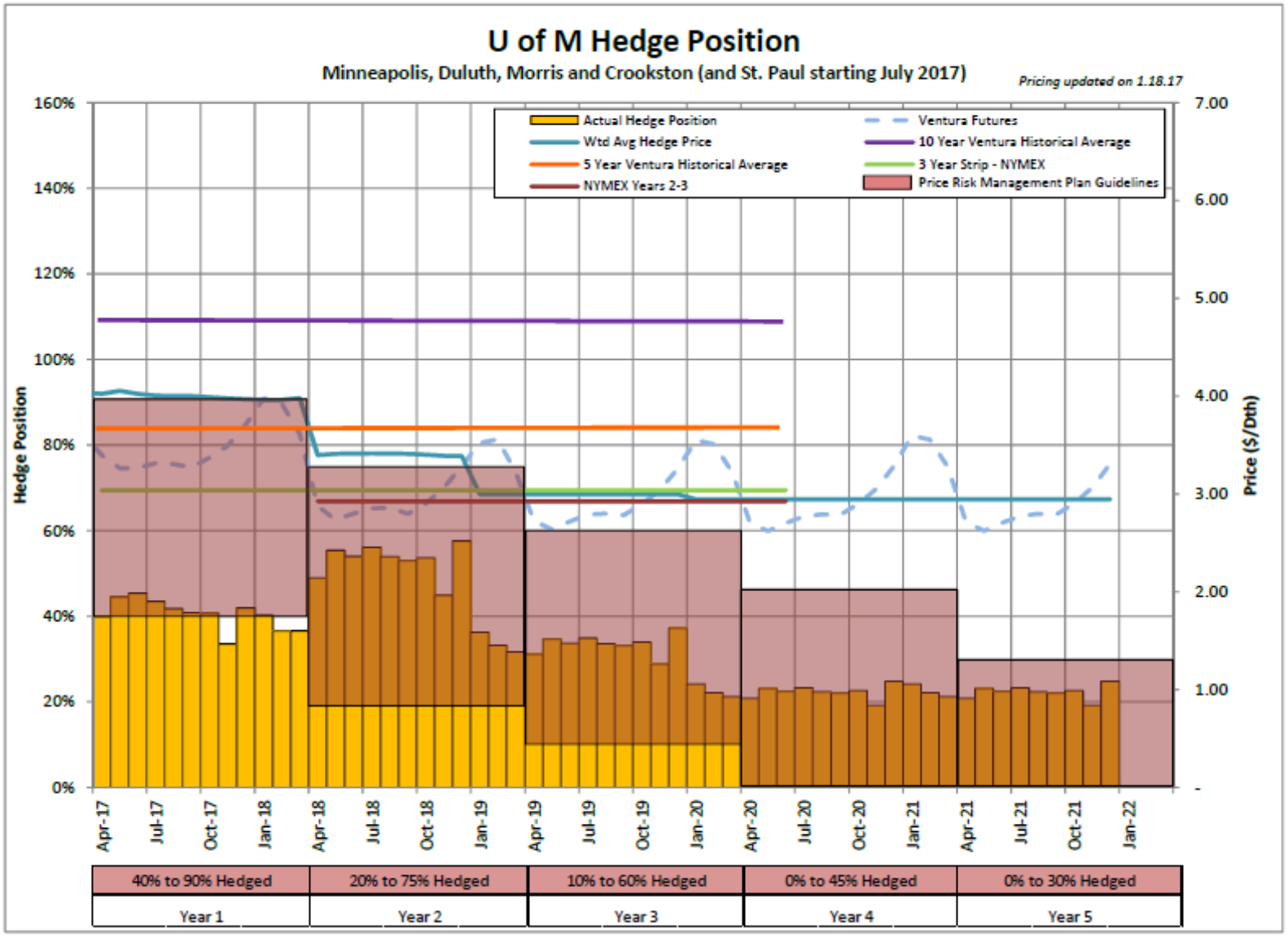
- **Credit approved for multiple suppliers**
  - (BP Energy, Shell Energy, UET, etc.)
- **Typically $.02~$.10/MMBTU savings when suppliers compete for business**
- **Negotiated 25 year discounted gas transport rate with utility**

Balanced Position Hedge Program: 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**

Energy Risk Management Survey Results

University of Minnesota Hedge Position



Thank You!

We greatly appreciate your time and attention!

- Matt Haakenstad
  - Vice President, Advisory Services
  - Kinect Energy Group
  - mhaakenstad@kinectenergy.com
  - 763-543-4640
- Bruce Hoffarber
  - Vice President, Market Development
  - Kinect Energy Group
  - bhoffarber@kinectenergy.com
  - 763-543-4625

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Thank You

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