

Spartan Students Say “Go Green”!

Michigan State University Switches
From Coal to Natural Gas

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Introductions

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Agenda

- Michigan State Overview
- CHP Plant Transition
- Coal Capacity Reduction
- Developing a Natural Gas Management Strategy

Campus Detail

- Founded in 1855
- 5,200 acres of campus grounds
- 532 buildings, 103 academic buildings
- 21.7 million square feet of building space
- 50,543 students (fall 2015)
- 15,000 on-campus residents
- 11,100 faculty and staff
- 1 CHP power plant
Combined = Heat + Power (Electric)



What We Do

- Steam for comfort heating, hot water, process steam, and yes, cooling.
- Electricity
- Water: 18 wells producing 1.3B gallons annually

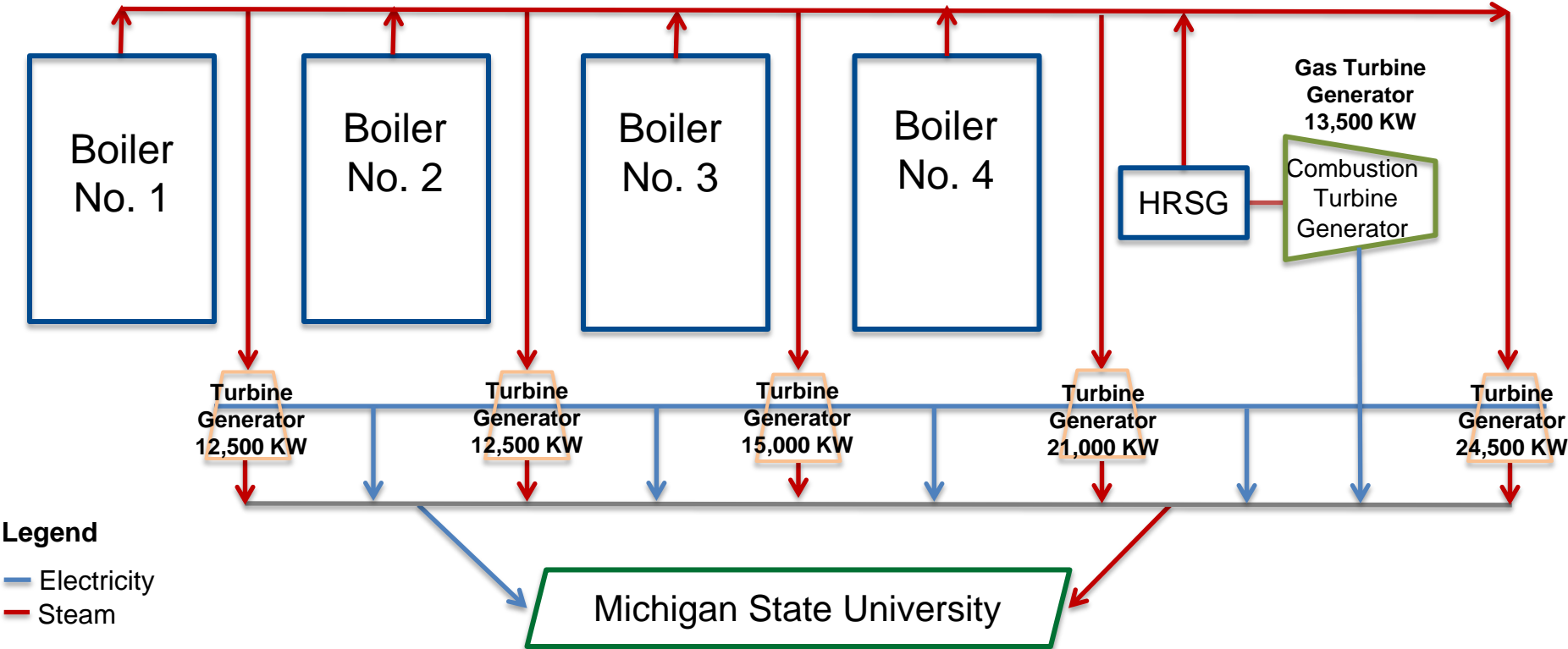


Simon CHP Plant Detail

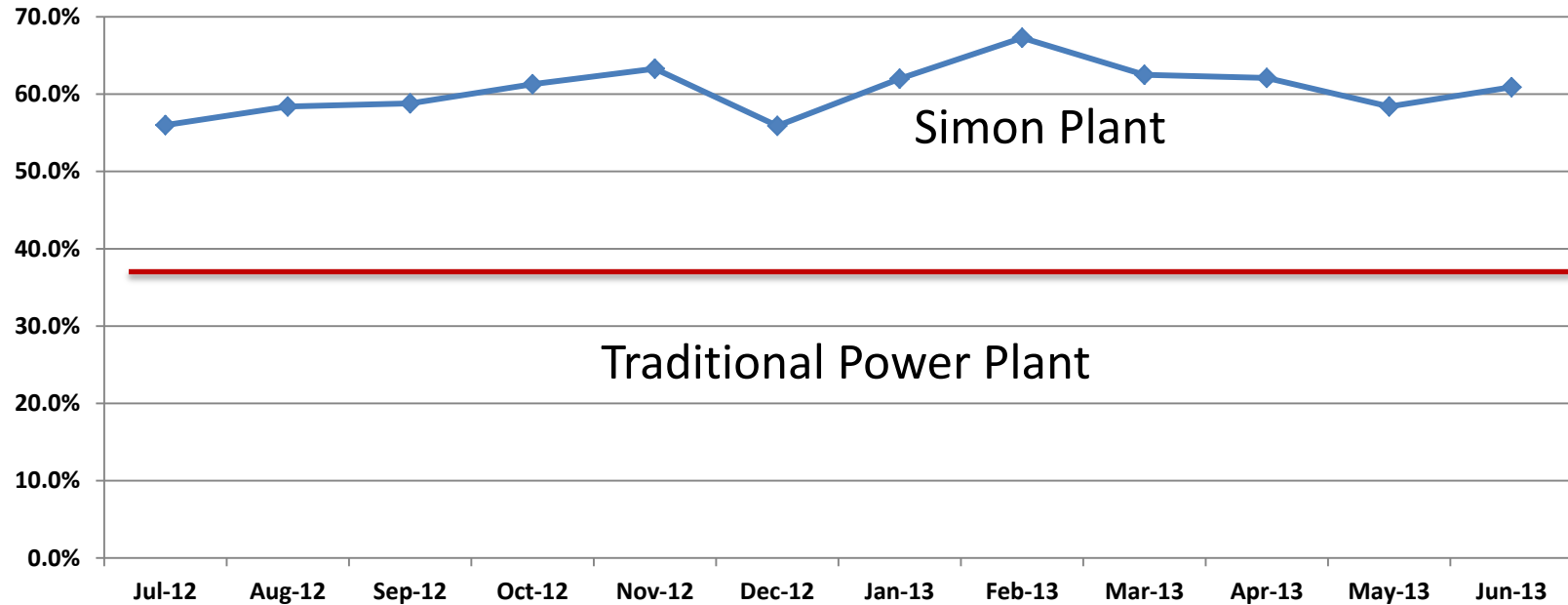
- Built in 1965, 5th in the series of MSU plants.
- 4 boilers (1,200 kpph max) of steam 900 psig, 835F
- 1 HRSG (115 kpph max) with duct firing
- All boilers on a common header
- 85 MW across 5 steam turbine generators
- 13.5 MW on 1 NG combustion turbine (black start)
- 21 MW grid tie-line with local utility



Simon CHP Plant



Total plant efficiency (steam and electricity) July 2012 - June 2013



Conclusion: Simon plant CHP efficiency is continually above 55%, which is favorable compared to non-CHP efficiencies (39%). This results in significantly less CO₂ and other emissions.

Moving From Coal & Natural Gas to Gas Only

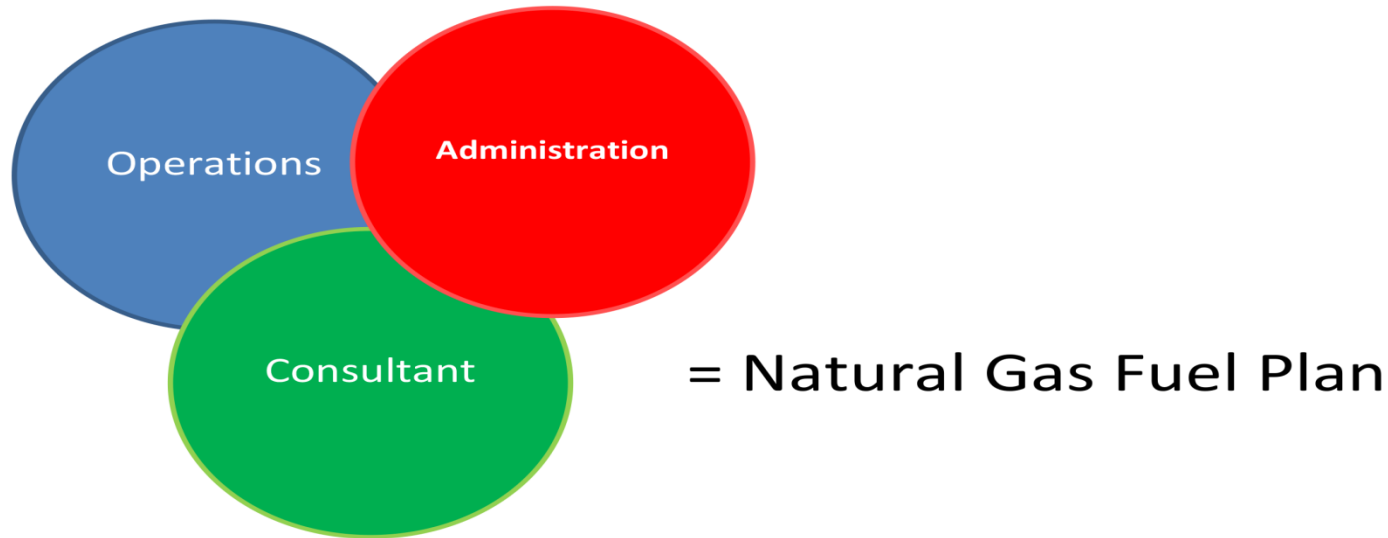
Fiscal Year 2008

- Coal: 248,320 Tons
- Natural Gas: .46 BCF

Fiscal Year 2017

- Coal: 0
- Natural Gas: 6.4 BCF

Fiscal Year 2016 – Forming The Energy Team



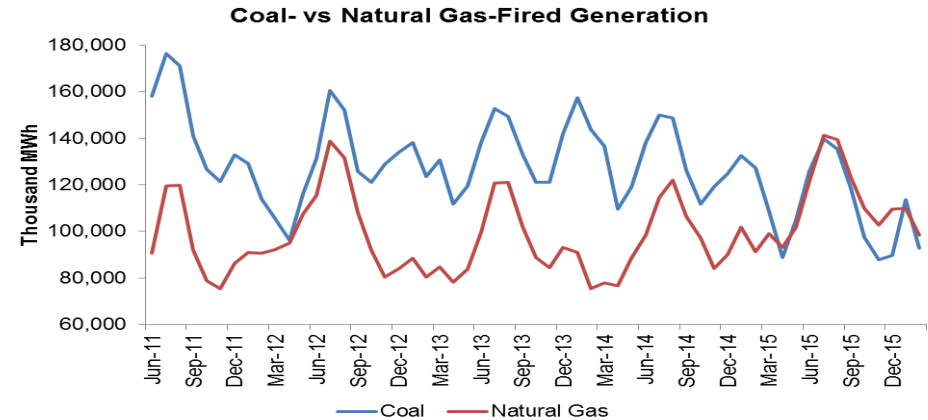
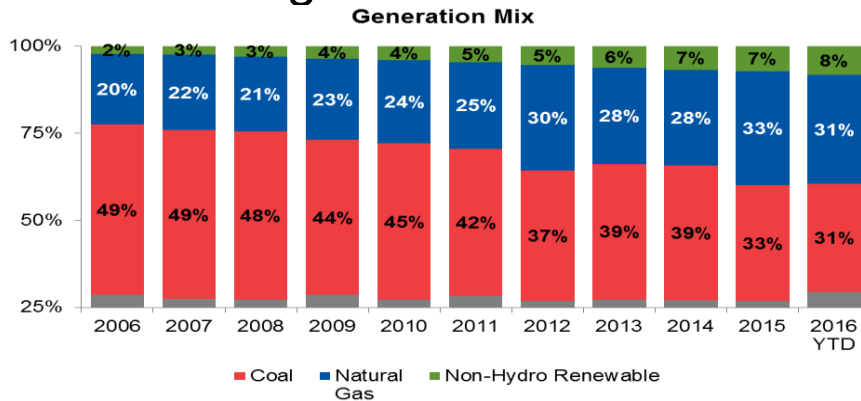
Coal Capacity Reduction



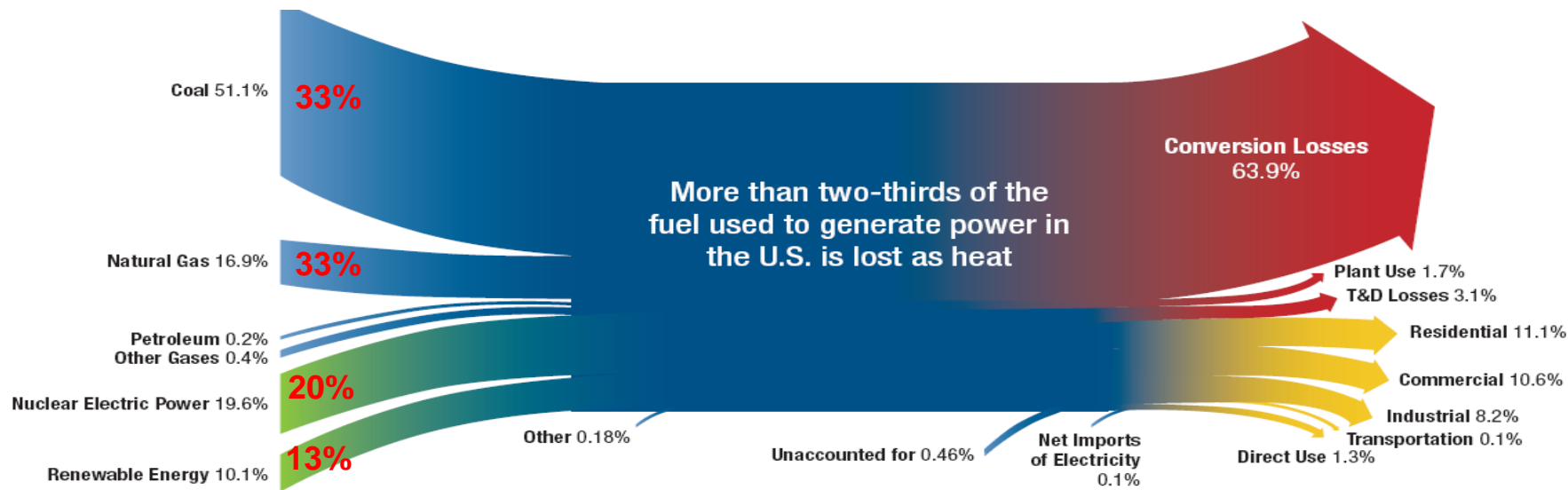
Scheduled retirements only include coal units for which there has been a firm retirement date reported between 2016 and 2020.
As of Feb. 19, 2016.
Source: SNL Financial, a part of S&P Global Market Intelligence
Map credit: Alip Artates

Shift in Generation Mix

- With relatively inexpensive natural gas and coal-fired generation units, the subject of increasing environmental regulation, the generation mix is shifting
- Natural gas and “non-hydro renewables” (i.e. solar and wind) are eroding coal’s share of the mix



The Ins and Outs of Electricity Generation

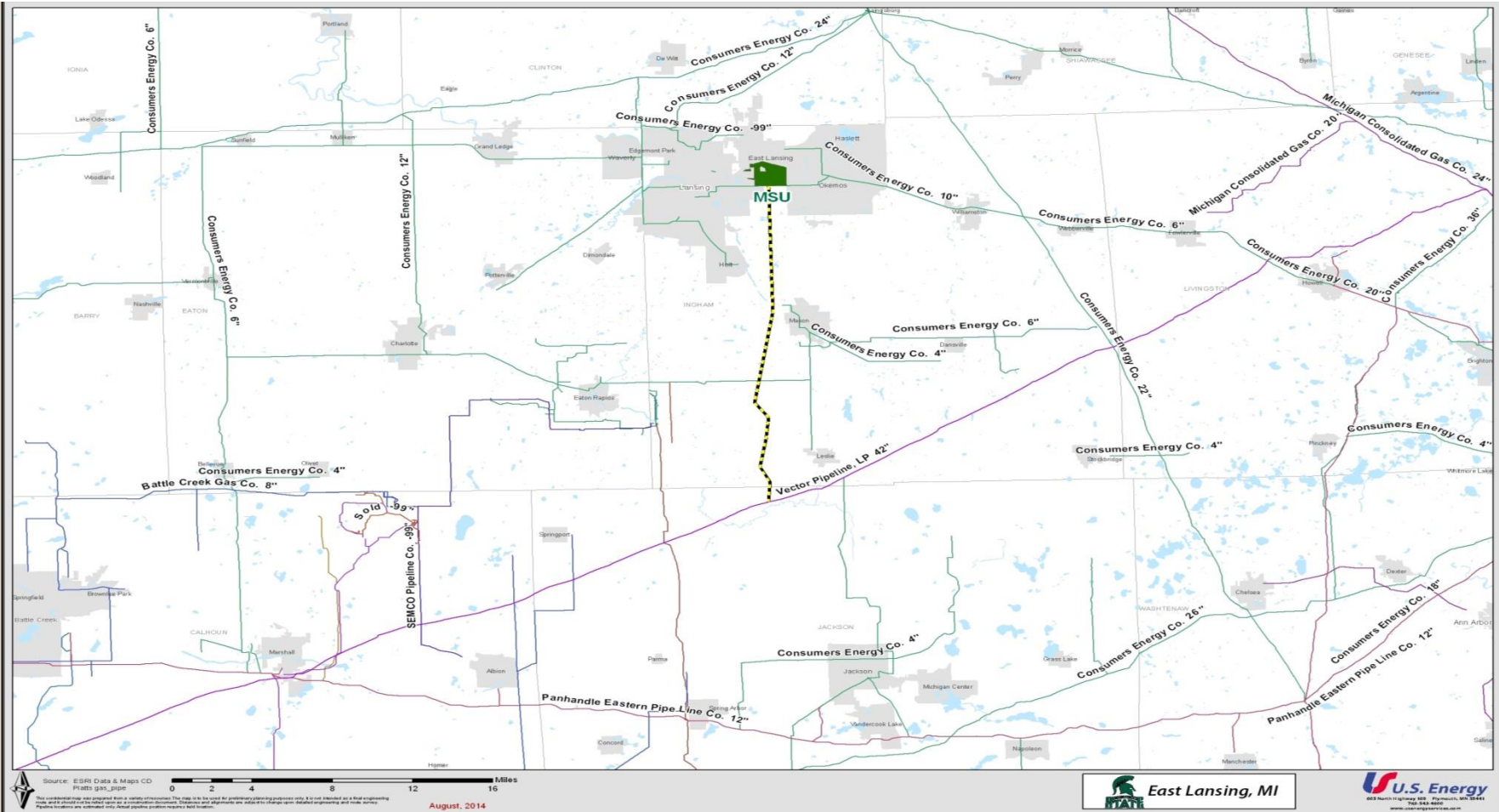


Source: DOE Energy Information Administration Annual Energy Review 2007

[2015 DOE updated %]

Developing Natural Gas Fuel Plan

- Pipeline study/LDC rate negotiation
- Risk aptitude measurement
- Risk management plan
- Plan implementation & quarterly monitoring
- Creation of competition among multiple suppliers



Energy Risk Management Survey Results

U.S. Energy Price Risk Management Survey

Objectives		Lock Margins	Budget Driven	Mitigate Volatility, Some Budget Consideration	Actively Manages Hedges, Seeks Price Opportunities	Market Driven	Score			Subtotal	Total
Objectives of the Price Risk Management program	Score	1	2	3	4	5	2.5	x 0.50 =		1.25	1.25

Price Volatility		No		Sometimes		Yes	Score			Subtotal	Total
Do you hedge other commodities?	Score	1	2	3	4	5	2.67	x 0.17 =		0.45	1.56
Have you analyzed the effect of hedging on your business?	Score	1	2	3	4	5	2.67	x 0.17 =		0.45	
Have you analyzed the effect of basis on your burner tip price?	Score	1	2	3	4	5	4	x 0.17 =		0.67	

MARKET APPROACH SCORE

2.81

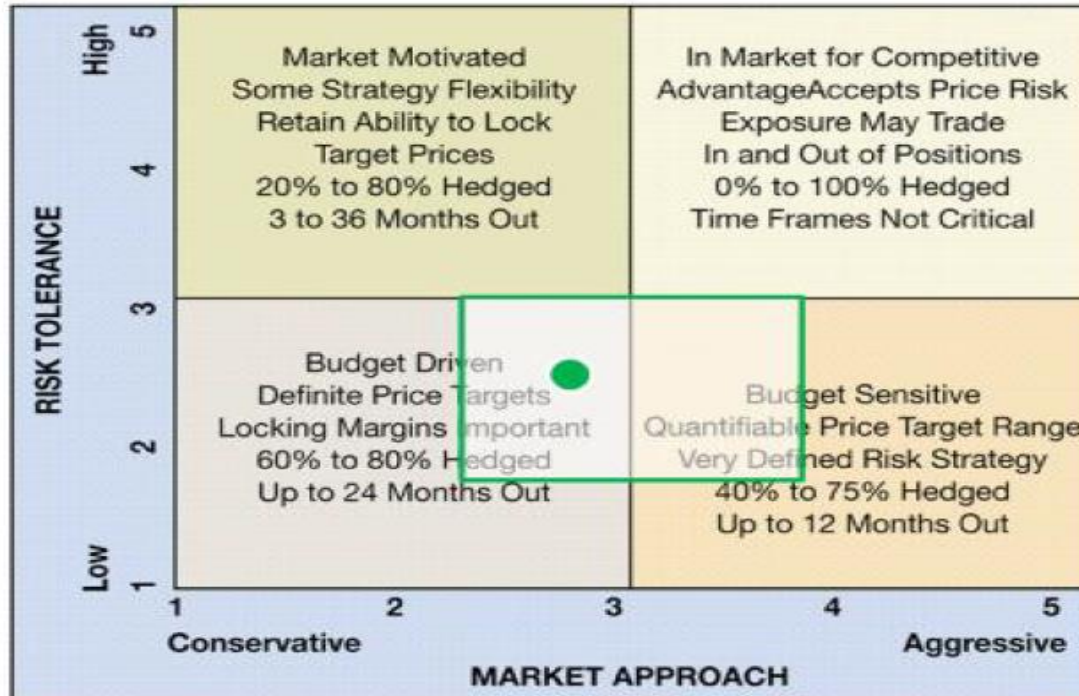
Financial Impact		No				Yes	Score			Subtotal	Total
Can you tolerate a large swing in energy prices? (Impact on earnings, cash flow, budget, etc.)	Score	1	2	3	4	5	2	x 0.25 =		0.50	1.75
Can you charge more for your product/service if energy prices rise?	Score	1	2	3	4	5	2.5	x 0.50 =		1.25	

Other Factors (Company Culture)		Budget		Neutral		Market	Score			Subtotal	Total
Is "success" measured against Budget or Market?	Score	1	2	3	4	5	2	x 0.25 =		0.50	0.50

RISK TOLERANCE SCORE

2.25

Energy Risk Management Survey Results



Natural Gas Risk Management Plan

1. Institution Background & Document Purpose
2. Input to the Risk Management Strategy
3. Goals
4. Implementation
5. Timeframe(s)
6. Hedge Thresholds
7. Layering Approach
8. Position Tracking and Management
9. Hedging Tools
10. Authority Requirements and Gas Purchasing
11. Communication
12. Feedback
13. Program Review

Energy Risk Management Survey Results

■ Prioritized Goals:

1. Primary: Manage natural gas input costs so that they are at or below budgeted levels on an annual basis
2. Execute hedges that limit long term upside risk
3. Obtain budget and long term protection in a manner that minimizes the cost of protection

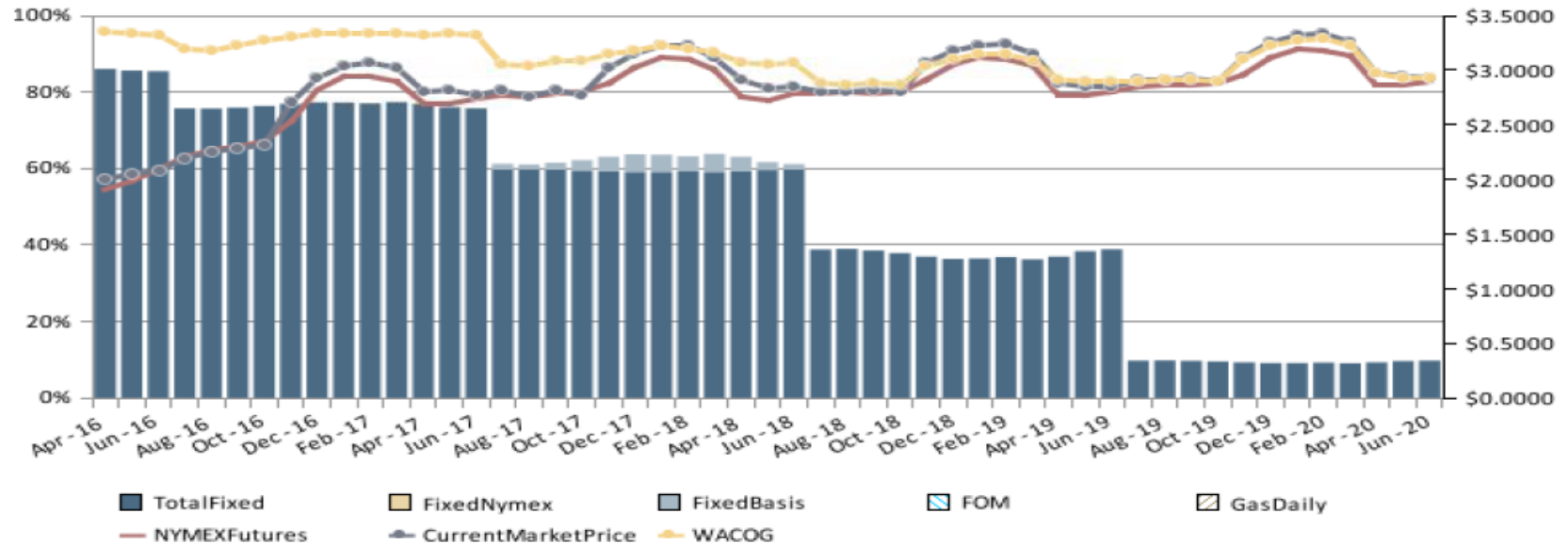
Strategy Hedge Ranges



Position Report



Michigan State University Position Report



Questions?

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Thank You for your Time!