GRAHAM PARTNERS

Addressing Barriers to Industrial Energy Efficiency, ICT and M&V

Lizzie Grobbel, Director of Sustainability, Graham Partners
December 8, 2015

AGENDA

- State of Industrial Energy Efficiency
- Barriers to Energy Efficiency/ICT
- Business Case for Energy Efficiency and ICT
- Opportunities for ICT and M&V in Industry

GRAHAM PARTNERS OVERVIEW

Graham Partners is a private investment firm focused on growth-oriented industrial and manufacturing-related businesses

The Graham Partners team is comprised of 45 individuals, including 26 investment professionals

Operations Team plays a critical role with our 15 portfolio company management teams

The committed capital raised since inception through the Graham Partners funds together with Graham led co-investments totals approximately $1.9 billion

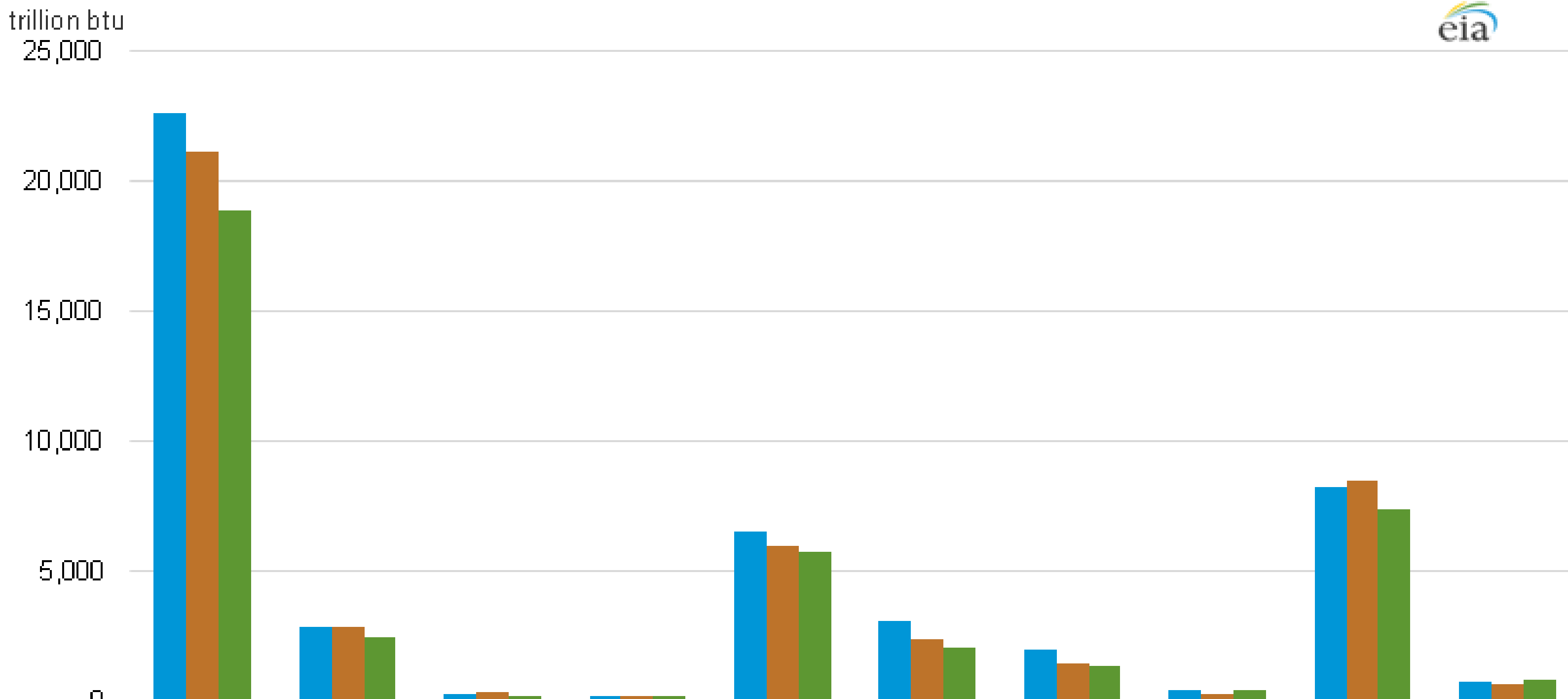
Note: The Graham Partners team is com[illegible] individuals employed by Graham Partners, Inc., as well as its wholly-owned operations consulting subsidiary, Graham Partners Operating Company, LLC, which provides operations and accounting [illegible] services to the Graham Partners portfolio companies and Funds. The Graham Partners team is supplemented by part-time operations consultants and independent advisors, who provide consulting s[illegible] the Graham Partners portfolio companies or Funds. Graham Partners had $1.4 billion of Regulatory Assets Under Management as of 12/31/2013.

INDUSTRIAL ENERGY USAGE: EFFICIENCY OPPORTUNITIES[1]

- 32% of all energy consumption in the United States (2012)
- Projected to increase 22% by 2025
- Accelerating adoption rate of energy efficiency could reduce energy consumption by an additional 15%-32% by 2025 → Reduction in national consumption by 6%-12%

STATE OF INDUSTRIAL ENERGY USAGE

Figure 1. Total U.S. manufacturing energy consumption for all purposes declined 17percent from 2002 to 2010



	Total*	Net Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG and NGL	Coal	Coke and Breeze	Other	Shipments
2002	22,576	2,839	255	152	6,468	3,070	1,956	385	8,181	730
2006	21,098	2,851	314	143	5,911	2,376	1,433	272	8,443	645
2010	18,817	2,437	170	135	5,725	2,057	1,328	374	7,381	788

*Total is the sum of the energy sources minus the shipments. Shipments of energy sources produced onsite are those shipments produced or transformed onsite from the nonfuel use of other energy sources. Shipments are subtracted from the total to avoid duplication.

Source: U.S. Energy Information Administration, Manufacturing Energy Consumption Survey - Table 1.2: First Use of Energy for All Purposes (Fuel and Nonfuel), 2002, 2006, and 2010.

ECONOMIC BARRIERS TO INDUSTRIAL END-USE ENERGY EFFICIENCY[1]

- Internal competition for capital (1-3 year paybacks)
- Failure to recognize non-energy benefits

INFORMATIONAL BARRIERS TO INDUSTRIAL END-USE ENERGY EFFICIENCY[1]

- **Adoption of systematic energy management system (lack info on benefits of modern EnMS)**
- In-house technical expertise
- Awareness of incentives and risk
- **Metering and energy consumption data (lack of disaggregated data and evaluation tools)**

BARRIERS TO ENERGY EFFICIENCY: GRAHAM PARTNERS

- Graham Partners portfolio companies' top expenditures
  1. Raw materials
  2. Labor
  3. Energy

- Other operational priorities with material impacts competing against EE:
  - Inventory reduction
  - Throughput/cycle time improvement
  - Labor productivity

FOCUS ON SUSTAINABILITY AND ENERGY REDUCTION

Sustainability Achievements in Action

- Actively engaged with the **Graham Sustainability Institute** at the University of Michigan
- Focused on **energy assessments**

20	Energy/lighting assessments
13%	Annual energy cost savings identified
$1.7MM	Total annualized savings identified

$700,000 +

Portfolio-wide annual energy cost savings implemented since 2013

2,300+

Tons of CO_2 emissions reduced

PROMOTING ENERGY EFFICIENCY WITH ICT

- Monthly self-reported energy data - PortfolioManager
- Bottom line impact
  - Prospect quantification with data loggers
  - Demand response programs
  - Successful energy assessment results – year over year energy savings
- Top-down push
  - Semiannual sustainability reporting – year over year cost changes

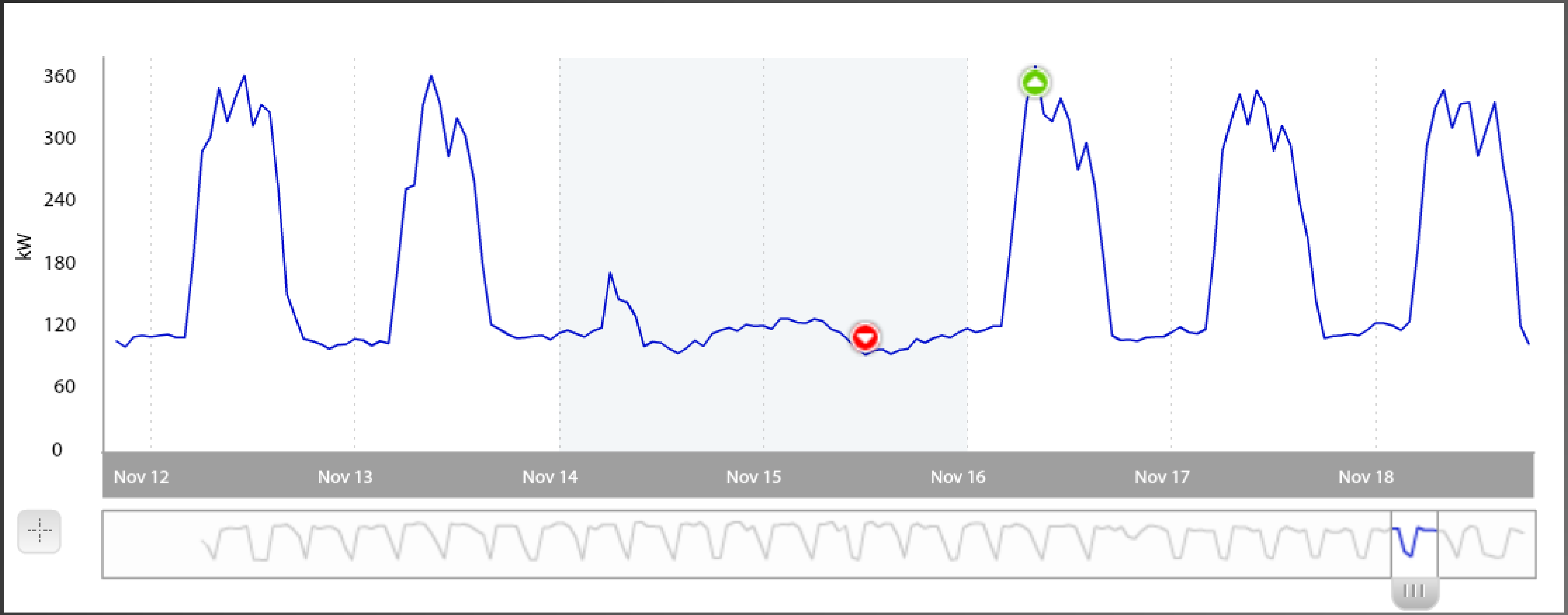
DEMAND RESPONSE AND EIS PILOT

"In my opinion the EIS is the meat of our current curtailment program. Without it, making a concerted reduction effort would not be nearly as fruitful. Having the data as to what your draw is almost real time (5 minute delay) was and is quite an eye opener...

Barriers to implementation if any, are largely **cultural in changing employee habits**. Simply turning equipment off if it is not being used can yield some decent efficiency gains. **Presenting the data that the EIS captures goes a long way in gaining understanding and awareness**."

– Henry Kimberton Plant Manager

ENERGY VISUALIZATION TO REDUCE CONSUMPTION



“One of the most **shocking things we learned** using the software was what our base load was during non-working hours. Much to our surprise we found out that **our load during non-operational times was 1/3 of peak demand**. That **visibility really made us ask why** and launched multiple **investigations that have ultimately led to conservation**.”

DOE AND INDUSTRIAL ASSESSMENT CENTER PARTNERSHIP

- University Industrial Assessment Centers (IAC)s conduct no-cost, one day assessments
- Seven of these assessments have thus far identified a total of $500,000 in annual cost savings opportunities

- Piloting DOE’s strategic energy management tool, eGuide, at select portfolio company facilities
- All portfolio companies provided access to an educational strategic energy management (SEM) webinar

EGUIDE STRATEGIC ENERGY MANAGEMENT: ENERGY BASELINE

- **Historical usage and metrics**

General Energy Performance Results

	FY1	FY2	FY3	FY4
Electricity (MMBTU)	15,865	14,875	10,575	8,340
Natural Gas (MMBTU)	463	358	172	174
TOTAL (MMBtu)	16,328	15,233	10,747	8,514
Electricity (MMBTU) Annual Savings	0	990	5,290	7,526
Electricity (MMBTU) Estimated Cost Savings	$ -	$ 7,740.35	$ 51,084.94	$ 55,188.35
Natural Gas (MMBTU) Annual Savings	0	105	292	289
Natural Gas (MMBTU) Estimated Cost Savings	$ -	$ 747.56	$ 1,533.33	$ 5,747.29
Total Production Output	149,341	122,786	64,775	43,040
Production Energy Intensity (MMBtu/unit production)	0.109	0.124	0.166	0.198
Total Improvement in Energy Intensity (%)	0.00%	-13.47%	-51.74%	-80.92%
Annual Improvement in Energy Intensity (%)	0.00%	-13.47%	-38.27%	-29.18%
Total Savings Since Baseline Year (MMBtu/Year)	0	1,095	5,582	7,815
New Energy Savings for Current Year (MMBtu/year)	0	1,095	4,487	2,233
Estimated Annual Cost Savings	$ -	$ 8,487.91	$ 52,618.27	$ 60,935.65

ICT: USING SUBMETERING TO TRACK PERFORMANCE METRICS

- **Collaboration with Oklahoma State University to pilot DOE Strategic Energy Management (SEM) eGuide and implement submetering**

1. **Determine data needs**: Identify data needs that will support goals and objectives of energy management program (ex. performance indicators).
    - So far we have discussed logging the main equipment and/or product lines of the new/re-worked facility in order to calculate energy intensities

Source: Patrick Smith, PhD Candidate, Oklahoma State University

ICT: USING SUBMETERING TO TRACK PERFORMANCE METRICS

2. Analysis methodologies: Data by itself isn't of much use without some analysis to determine what it means.

- So far we have discussed using some type of Excel based analysis to determine energy intensity by product unit to complement your existing cost calculation

Source: Patrick Smith, PhD Candidate, Oklahoma State University

ICT: USING SUBMETERING TO TRACK PERFORMANCE METRICS

3. Equipment needs: based on data requirements and analysis methodologies, what types of metering/monitoring equipment and hardware/software tools would be most appropriate to provide data.

- OSU is working on gathering this information

Source: Patrick Smith, PhD Candidate, Oklahoma State University

COMAR CASE STUDY: EFFICIENCY AND COLLABORATION PAY BACK

✓ Buena, NJ

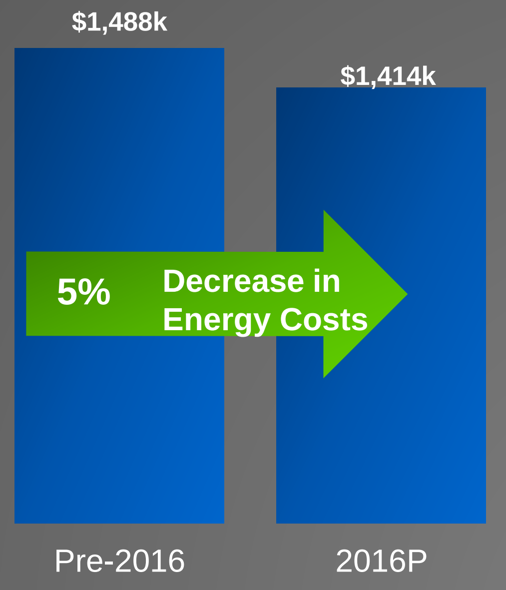
- Aware of utility incentives but had not done costing work
- Unsure of pumping system configuration

→ Conducted energy assessment with Graham Partners and University of Delaware Industrial Assessment Center using energy data loggers

✓ Decreased compressed air energy costs by **$74,000 (5%)** annually at Buena, NJ facility with average payback period of 1.1 years

Annual Energy Costs

Comar Facility – Buena, NJ



Note: Occupancy in Universal's Malvern facility began in January 2015. Cost savings are estimated.

HENRY CASE STUDY: EFFICIENCY PAYS BACK

✓ Lachine, QC

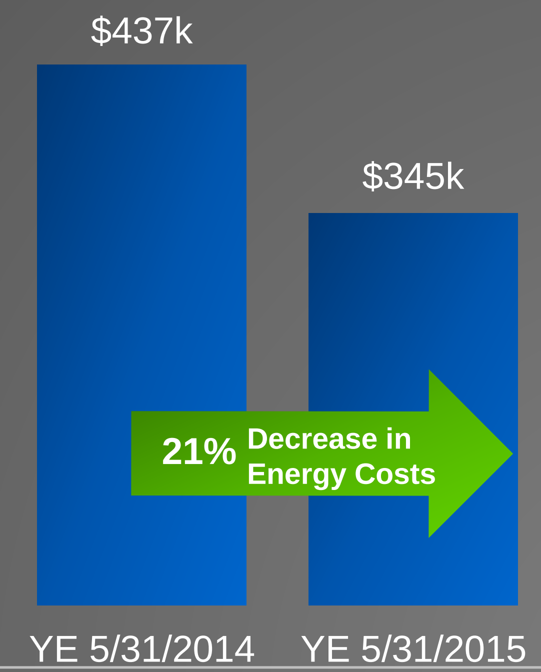
- No in-house energy expertise
- 100+ year old facility
- No tracking of historical usage

→ Conducted 2-day energy assessment and monitored annual energy cost changes

✓ Decreased energy costs by **$92,000 (21%)** through improved lighting and compressed air efficiency at Lachine, Quebec facility with average payback periods <1 year

Annual Energy Costs

Henry Facility – Lachine, Quebec



Note: Occupancy in Universal's Malvern facility began in January 2015. Cost savings are estimated.

GAPS: ENERGY EFFICIENCY M&V

- Post-energy-audit, reassess LTM energy costs vs. prior LTM energy costs
- No guaranteed savings projects – savings estimates
- No specific equipment or project monitoring

THANK YOU!

Questions?

Lizzie Grobbel
Director of Sustainability, Graham Partners
lgrobbel@grahampartners.net

REFERENCES

1. U.S. Department of Energy. “Barriers to Industrial Energy Efficiency” June 2015.

APPENDIX

BARRIERS TO INDUSTRIAL END-USE ENERGY EFFICIENCY[1]

<u>Economic/Financial</u>

- **Internal competition for capital (1-3 year paybacks)**
- **Failure to recognize non-energy benefits**
- Corporate tax structures (depreciation, treatment of energy bills)
- Program planning cycles (mismatch with utility and state cycles)
- Split incentives between business units
- Energy price trends (uncertain returns)

<u>Regulatory</u>

- Utility business model
- Industrial participation in ratepayer-funded energy efficiency programs
- Failure to recognize all energy and non-energy benefits
- Energy resource planning not required
- Environmental permitting (uncertainty, complexity, costs can deter facilities from moving forward with efficiency)

<u>Informational</u>

- **Adoption of systematic energy management system (lack info on benefits of modern EnMS)**
- **In-house technical expertise**
- Awareness of incentives and risk
- Metering and energy consumption data (lack of disaggregated data and evaluation tools)

CEO SURVEY: TOP SYMPTOMS AND OPPORTUNITIES

	Symptoms	Mostly	Somewhat	Not At All
1)	High number of sole source vendors for mission critical parts/commodities	42.86%	50%	7.14%
2)	Buyers focus on day to day buying duties rather than strategic cost reduction efforts	38.46%	46.15%	15.38%
3)	Frequent supplier performance issues – late deliveries, long lead times, quality issues, shortages, etc.	23.08%	61.54%	15.38%
4)	Higher than desired manufacturing overhead / facility spend	38.46%	38.46%	23.08%
5)	Limited Value Analysis / Value Engineering activities and savings goals (Sourcing and Engineering collaboration)	30.77%	46.15%	23.08%

	Opportunities	
1)	Establish a steady pipeline of cost savings projects	71.43%
2)	Establish annual Purchasing / Strategic Sourcing organization savings goals	57.14%
3)	Formalized Value Analysis / Value Engineering savings goals for Engineering	50%
4)	Rigorous RFQ process execution and commodity negotiation	28.57%
5)	Establish vendor management process or vendor scorecarding – savings goals, quality goals, delivery metrics, dual source for critical parts, gain sharing etc.	21.43%