

# IAC Student Collaboration Webinar

U.S. DEPARTMENT OF  
**ENERGY**

Energy Efficiency &  
Renewable Energy



**Thomas Wenning, PE**  
Oak Ridge National Laboratory

**IAC Student Webinar  
Series  
February 2015**



# Industrial Assessment Centers 2012-2016

Energy Efficiency & Renewable Energy



- Alternative to student meeting
- Monthly student-led webinars
- Proposed Structure:
  - 30 min student presentation
  - 30 minutes of Q&A/open dialogue
- Allow students to connect



# Webinar Series Purpose

- Mechanism for IAC-to-IAC student collaboration
- Possible topics:
  - Relevant items for day-to-day IAC operations (client recruitment, report writing, etc.)
  - New technologies and innovations
- Rotate speakers and topics each month
- Each center will lead or contribute a presentation to a future webinar





We want your feedback (date, time, topics, etc)!  
....and Volunteers!

## Webinar Survey

1. Did you find this webinar helpful (1 being least helpful and 5 being most helpful) ?

1 2 3 4 5

2. What topic or topics would you like to see addressed in future IAC student-led webinars?


3. Would you be interested in leading a future webinar?

Yes  
 No

4. If interested in leading a future webinar, please list your name and contact email.


- **Topic:** U of Dayton's IAC approach to assessment preparation
- **Who:** Alex Brogan, University of Dayton IAC





## Industrial Assessment Center

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### IAC Webinar: UD-IAC's Assessment Preparation

Date: 02-17-2015

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Alexandra Brogan  
Lead Engineer, UD-IAC  
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300 College Park, KL-311A, Dayton, OH 45469-0238  
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[www.udayton.edu/engineering/industrial\\_assessment/](http://www.udayton.edu/engineering/industrial_assessment/)

# PREASSESSMENT LETTER

Before we put anyone on the schedule, we obtain the following information:

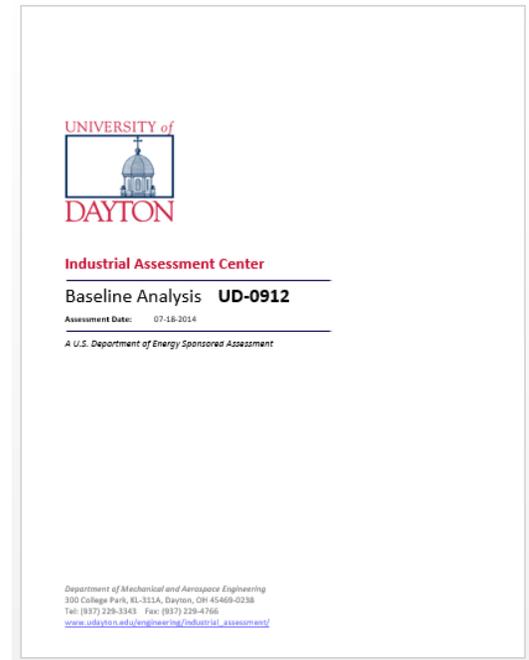
1. 12 months of Utility Bills
  - Electricity
  - Natural Gas
  - Water & Sewer
2. 12 months of production data (example. Pieces/month)
3. Electric and Natural Gas Equipment List
4. Corporate Data

MAJOR ELECTRICAL EQUIPMENT

Type	Quantity	Rated Power (hp or kW or ton)	Operating Hours Per Week
LIGHTING			
AIR COMPRESSORS			
PROCESS BLOWERS/FANS			

# PREPARATION CHECKLIST

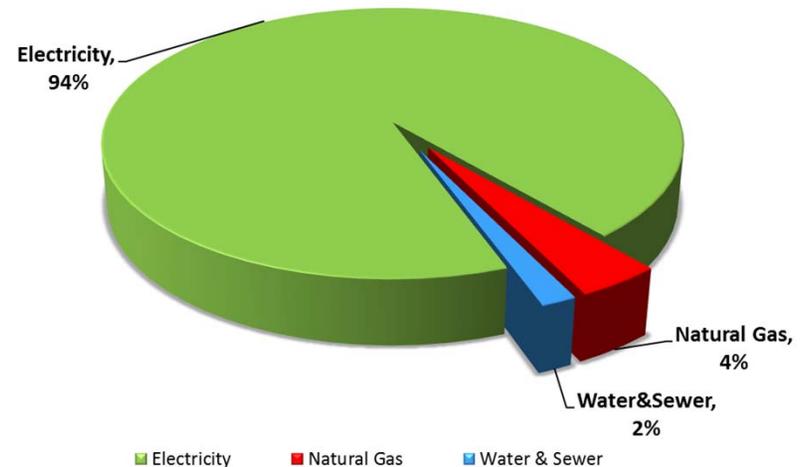
- ✓ 1. Full Utility Bill Analysis
- ✓ 2. Plant Energy Balance
- ✓ 3. Lean Energy Analysis
  - Creates first portion of Final Report
- ✓ Print copies of Baseline Analysis to share with plant personnel
- ✓ Create Baseline Analysis PowerPoint to present to plant personnel in Opening Meeting (similar to this PPT)
  - We bring along a projector with the rest of our equipment



# I. UTILITY ANALYSIS

Resource	Annual Usage	Avg. Monthly Demand	Annual Cost	Unit Cost	Annual CO <sub>2</sub> Emission
Electricity	7,316,358 kWh	1,311 kW	\$628,306	\$0.086 /kWh	5,176 tonnes
Natural Gas	4,935 mmBtu	-	\$26,827	\$5.44 /mmBtu	262 tonnes
Water	3,363 ccf	-	\$6,823	\$2.04 /ccf	-
Sewer	1,622 ccf	-	\$4,441	\$2.65 /ccf	-
<b>Total</b>	-	-	<b>\$666,397</b>	-	<b>5,438 tonnes</b>

Benchmark Utility Costs		
Resource	You	Last 25 Industries
Electricity	\$0.086/kWh	\$0.078
Natural Gas	\$5.44/mmBtu	\$6.94
Water	\$2.04/ccf	\$3.54
Sewer	\$2.65/ccf	\$5.21



- This facility's annual CO<sub>2</sub> emissions are equivalent to about **585** typical U.S. homes.
- Average industrial companies spend **2%** of their annual sales on energy. The average for the last 25 industries that we have audited is about **1.7%**

# ELECTRIC RATE STRUCTURE

## City of Hamilton Utilities

**Service:** \$ 10.71 /month

**Energy:** \$ 0.1302 for the first 1,000 kWh  
\$ 0.1009 for the next 1,000 kWh  
\$ 0.1004 for the next 4,000 kWh  
\$ 0.0800 for the next 9,000 kWh  
\$ 0.0794 for the next (300 kWh/kW of billing demand-9,000 kWh)  
**\$ 0.0523 for all additional kWh**

**Demand:**

**Summer: (May, Jun, Jul, Aug, Sep)**

**\$ 11.73 /kW for first 2,000kW**  
\$ 9.95/ kW for additional kW

**Winter: (Oct, Nov, Dec, Jan, Feb, Mar, Apr)**

**\$ 7.91 /kW for first 2,000kW**  
\$ 6.12/ kW for additional kW

Set over a 15-minute period during the course of a month.

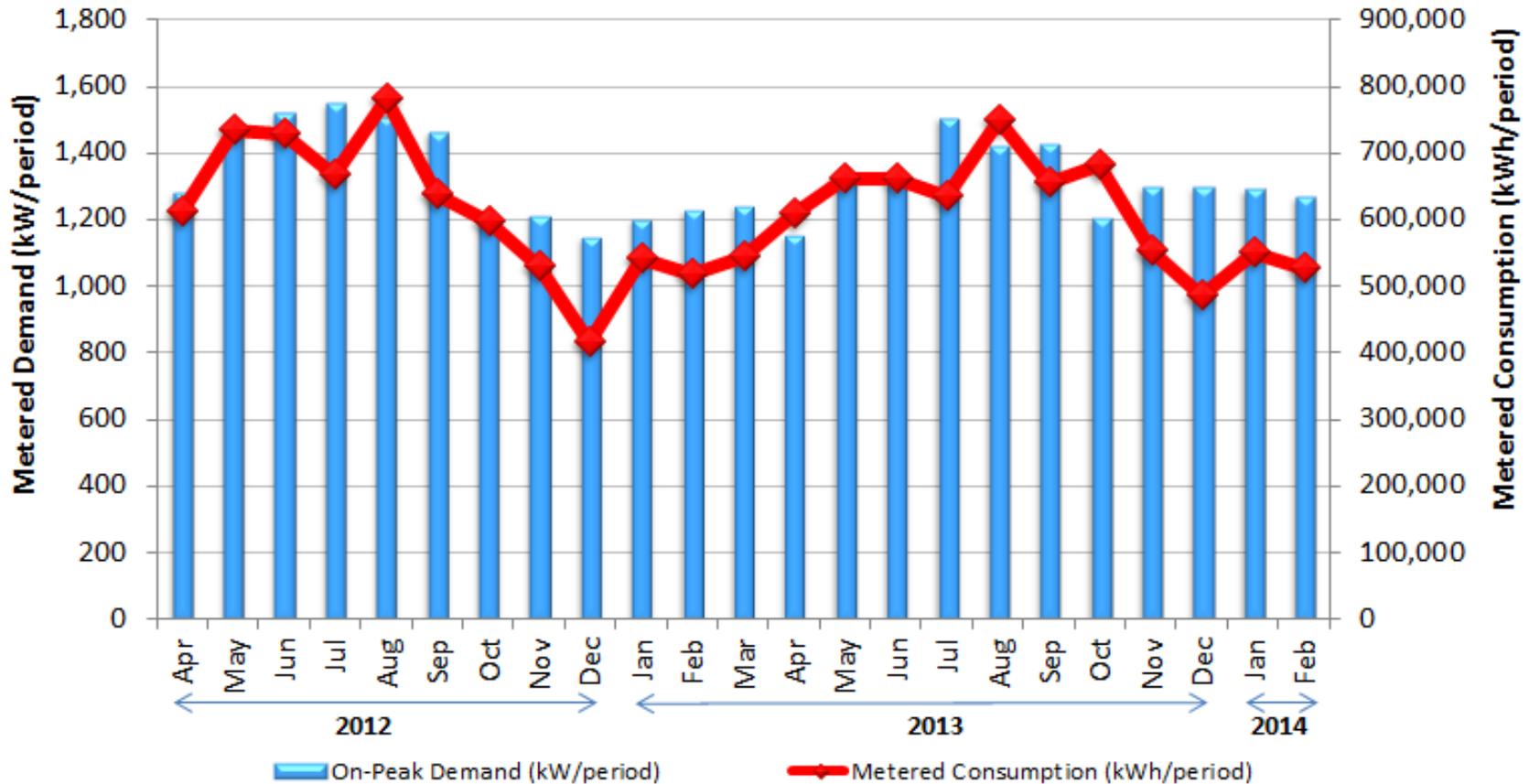
Billed demand is the greater of

- (1) Metered demand
- (2) 70% of the highest billed demand in the last 12 months
- (3) 70% of contract demand

- *Actionable Info:* Marginal Costs, Demand Shift

# ELECTRICITY USE

## Monthly Electrical Demand and Consumption



- *Actionable Info:* Billing Consolidation, Install Capacitors

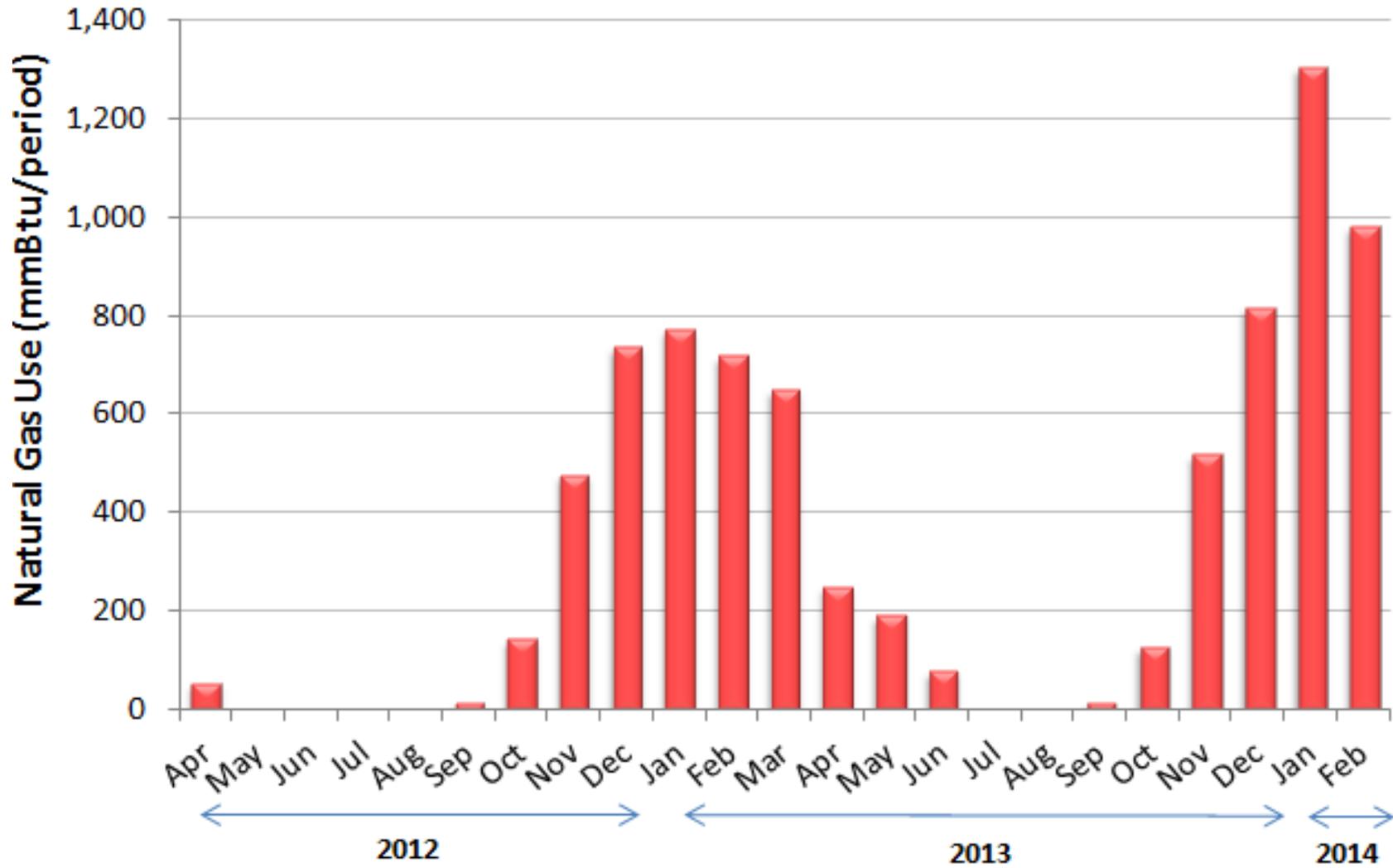
# ELECTRICITY COST BREAKDOWN

Meter Reading Date	Billed Cost (B) (\$/period)	Calculated Service Charge (\$/period)	Calculated Energy Cost (\$/period)	Calculated Demand Cost (\$/period)	Calculated Total Cost (C) (\$/period)	Billed Cost - Calculated Cost (B-C) (\$/Period)	Percentage Difference (B - C) / B
5/1/12	\$48,497	\$10.71	\$42,737	\$10,079	\$52,826	-\$4,329	-9%
6/1/12	\$62,513	\$10.71	\$50,591	\$17,040	\$67,641	-\$5,128	-8%
7/2/12	\$63,489	\$10.71	\$50,774	\$17,766	\$68,551	-\$5,063	-8%
8/1/12	\$61,286	\$10.71	\$47,750	\$18,099	\$65,860	-\$4,574	-7%
9/4/12	\$65,709	\$10.71	\$53,525	\$17,655	\$71,192	-\$5,482	-8%
10/1/12	\$58,367	\$10.71	\$45,663	\$17,089	\$62,762	-\$4,395	-8%
11/1/12	\$46,511	\$10.71	\$41,316	\$9,422	\$50,749	-\$4,237	-9%
12/3/12	\$45,277	\$10.71	\$37,876	\$9,554	\$47,441	-\$2,164	-5%
1/2/13	\$37,551	\$10.71	\$31,355	\$9,024	\$40,389	-\$2,839	-8%
2/1/13	\$44,999	\$10.71	\$38,460	\$9,447	\$47,918	-\$2,919	-6%
3/1/13	\$44,322	\$10.71	\$37,446	\$9,655	\$47,112	-\$2,790	-6%
4/1/13	\$45,782	\$10.71	\$38,944	\$9,763	\$48,718	-\$2,935	-6%
5/1/13	\$47,374	\$10.71	\$41,589	\$9,065	\$50,665	-\$3,291	-7%
6/3/13	\$57,473	\$10.71	\$45,614	\$15,401	\$61,026	-\$3,553	-6%
7/1/13	\$57,353	\$10.71	\$45,599	\$15,303	\$60,913	-\$3,560	-6%
8/1/13	\$59,992	\$10.71	\$45,799	\$17,594	\$63,404	-\$3,412	-6%
9/3/13	\$63,621	\$10.71	\$51,039	\$16,609	\$67,658	-\$4,038	-6%
10/1/13	\$59,429	\$10.71	\$46,280	\$16,670	\$62,960	-\$3,532	-6%
11/1/13	\$52,547	\$10.71	\$45,825	\$9,501	\$55,337	-\$2,789	-5%
12/2/13	\$47,138	\$10.71	\$39,894	\$10,220	\$50,124	-\$2,986	-6%
1/3/14	\$43,989	\$10.71	\$36,373	\$10,220	\$46,603	-\$2,614	-6%
2/4/14	\$47,552	\$10.71	\$39,567	\$10,161	\$49,738	-\$2,187	-5%
3/3/14	\$46,057	\$10.71	\$38,157	\$9,984	\$48,152	-\$2,095	-5%
<b>Total/Average</b>	<b>\$628,306</b>	<b>\$129</b>	<b>\$514,680</b>	<b>\$150,490</b>	<b>\$665,298</b>	<b>-\$36,992</b>	<b>-6%</b>

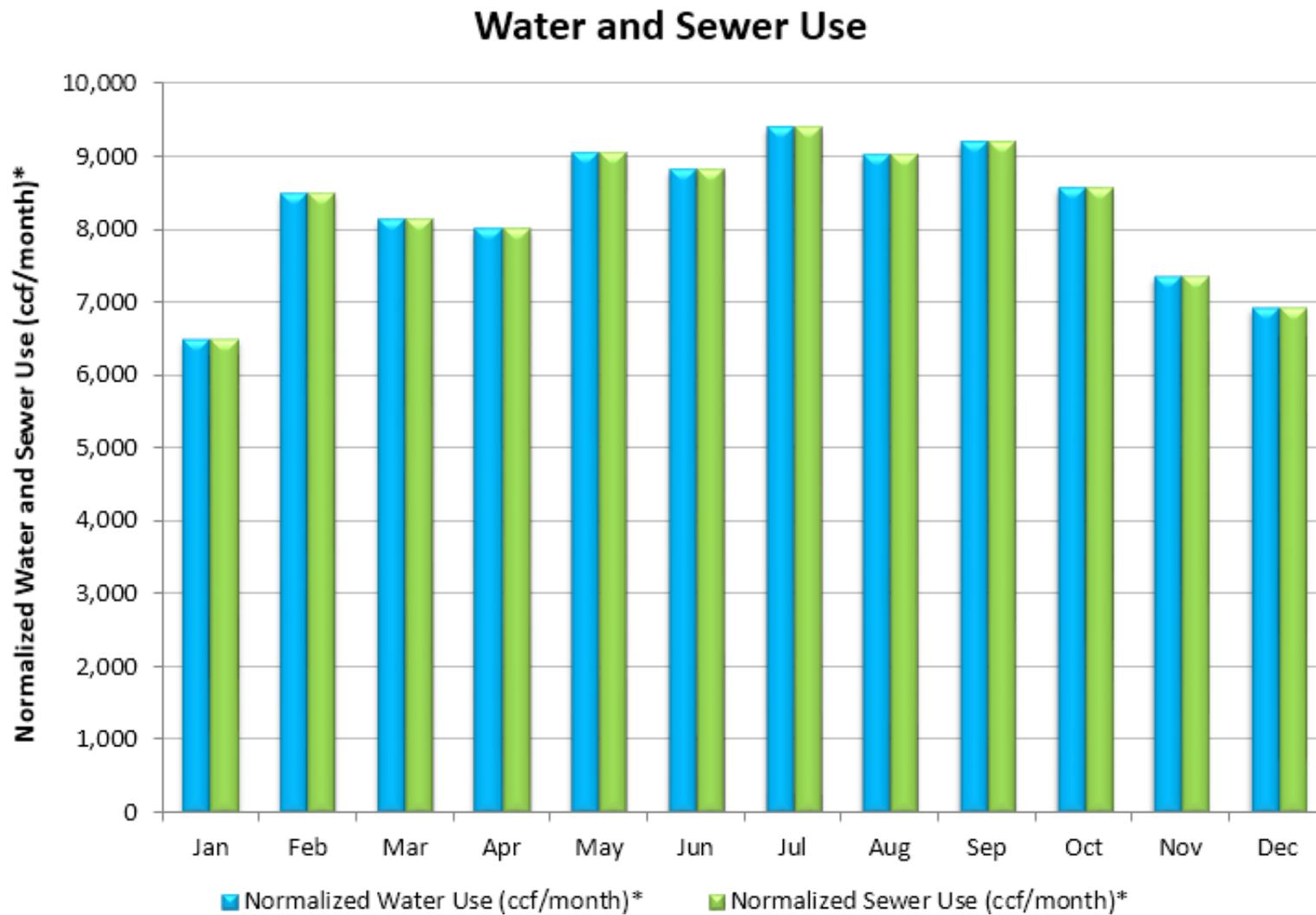
- *Actionable Info: Billing Discrepancies*

# NATURAL GAS USE

## Monthly Natural Gas Use

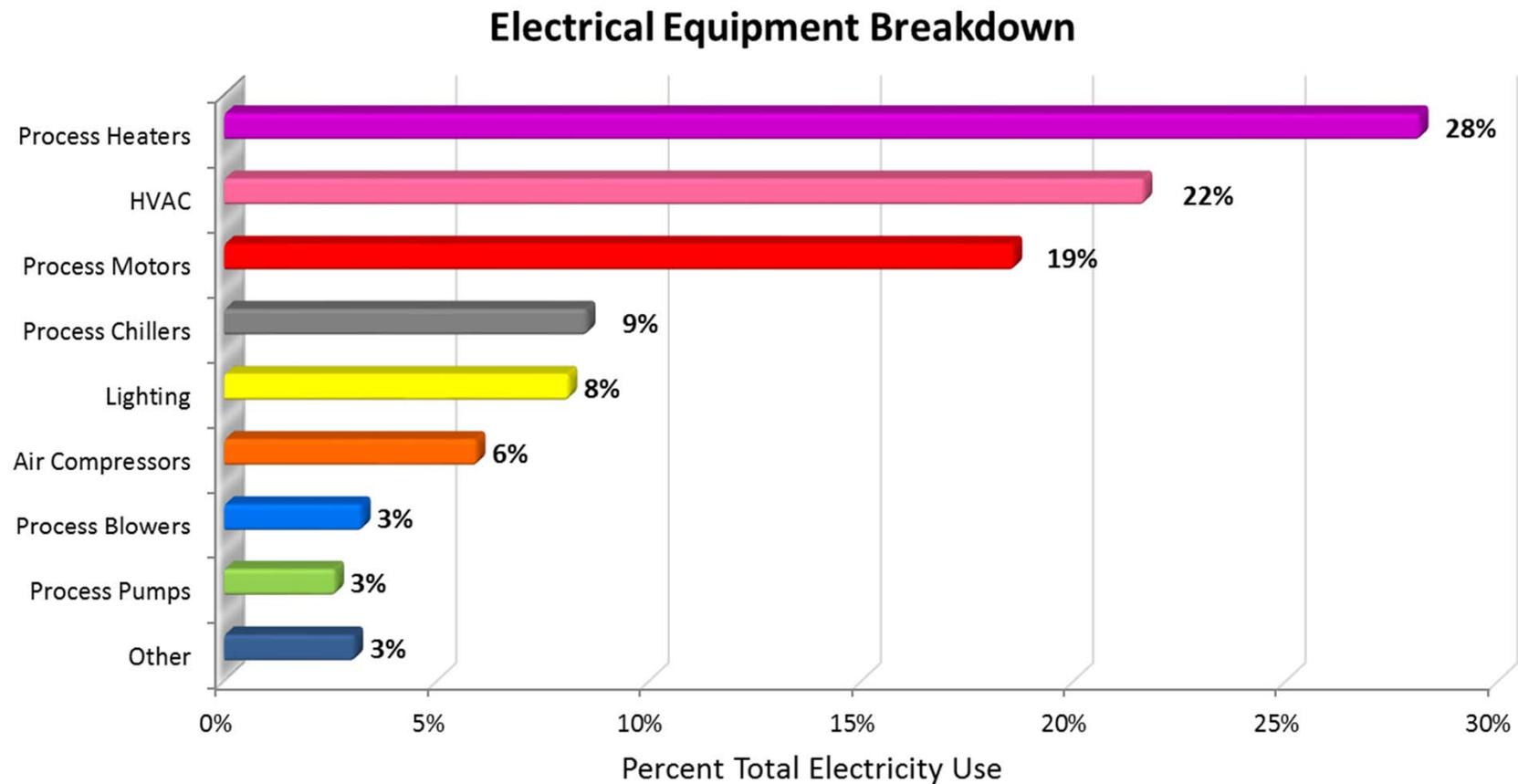


# WATER & SEWER USE



- *Actionable Info: Sewer Exemption*

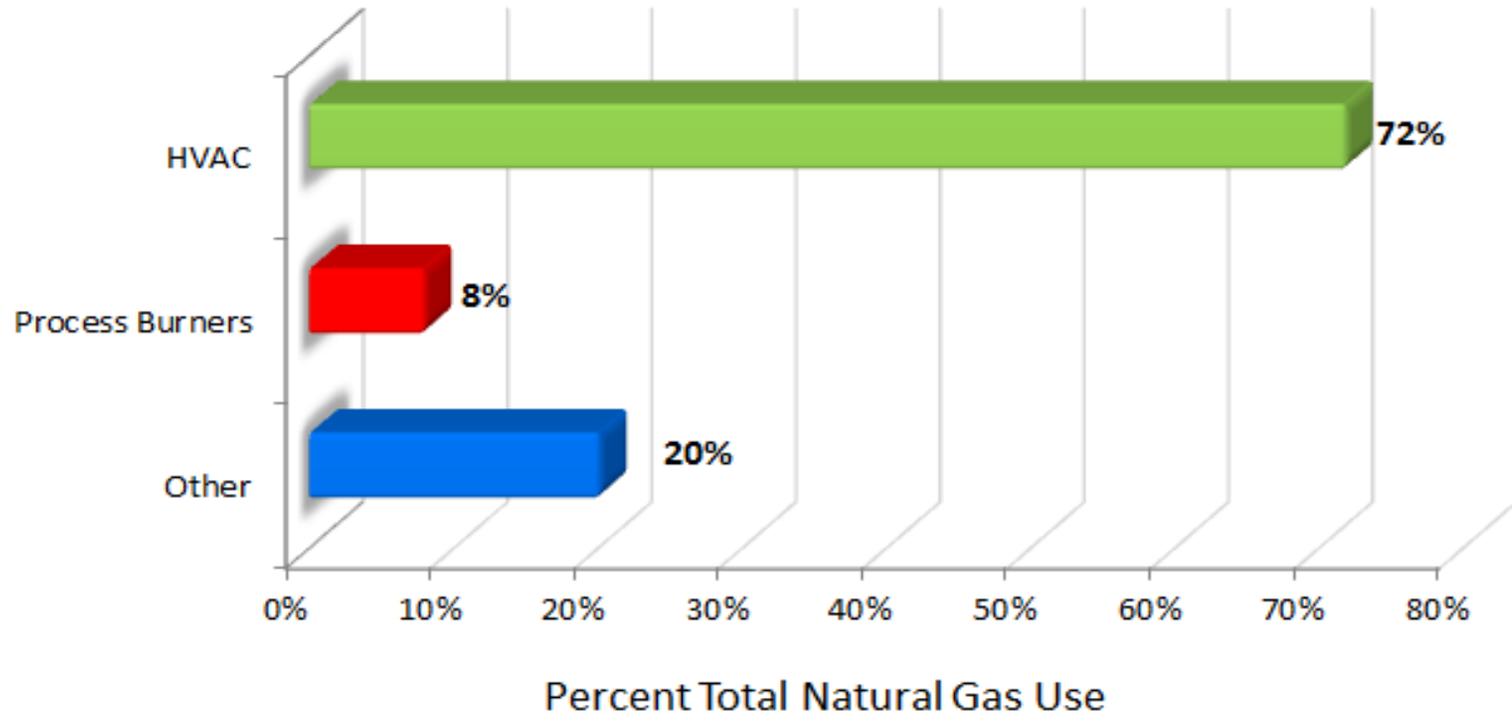
## II. PLANT ENERGY BALANCE – ELECTRIC



- *Actionable Info:* Focus on most energy-using systems

## II. PLANT ENERGY BALANCE – NATURAL GAS

### Natural Gas Equipment Breakdown



### III. LEAN ENERGY ANALYSIS

Like the well-known principles of lean manufacturing, Lean Energy Analysis (LEA) identifies energy use which does not directly:

- Add value to the product
- Add value to the plant environment

Our statistical analysis utilizes temperature data obtained from the Average Daily Temperature Archive

Average Daily Temperature  
Archive

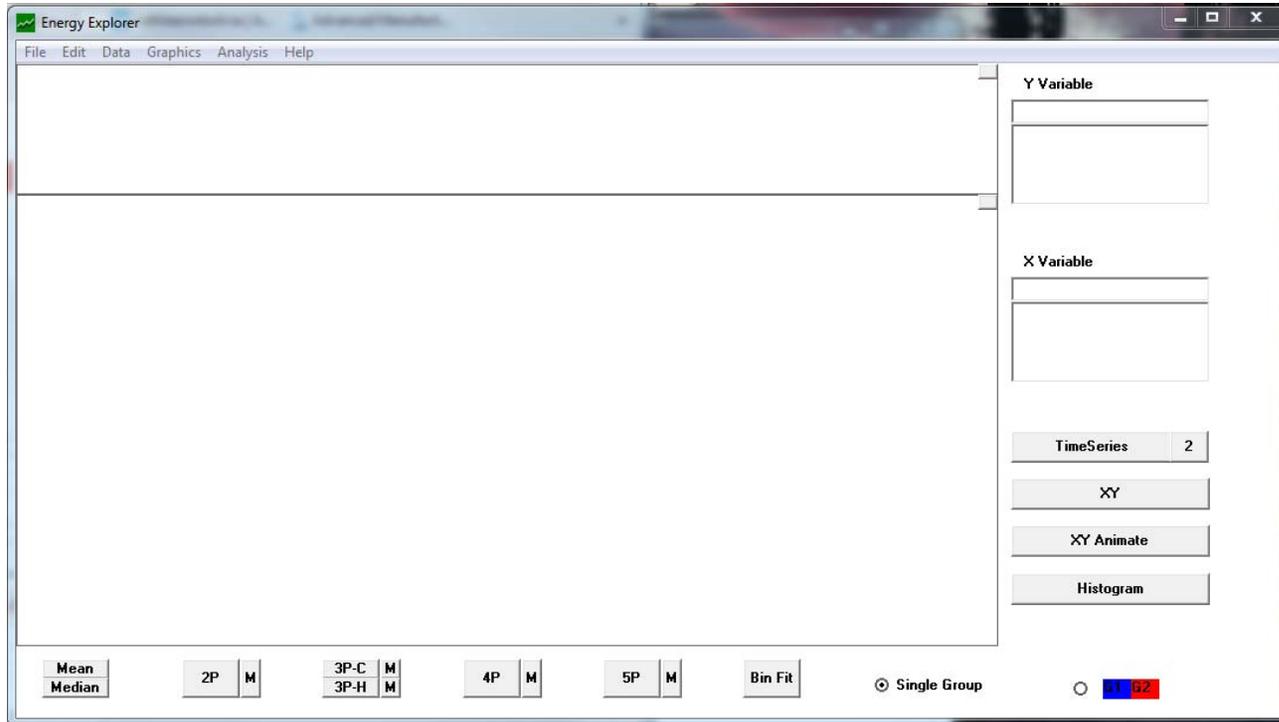
The UNIVERSITY  
of  
DAYTON



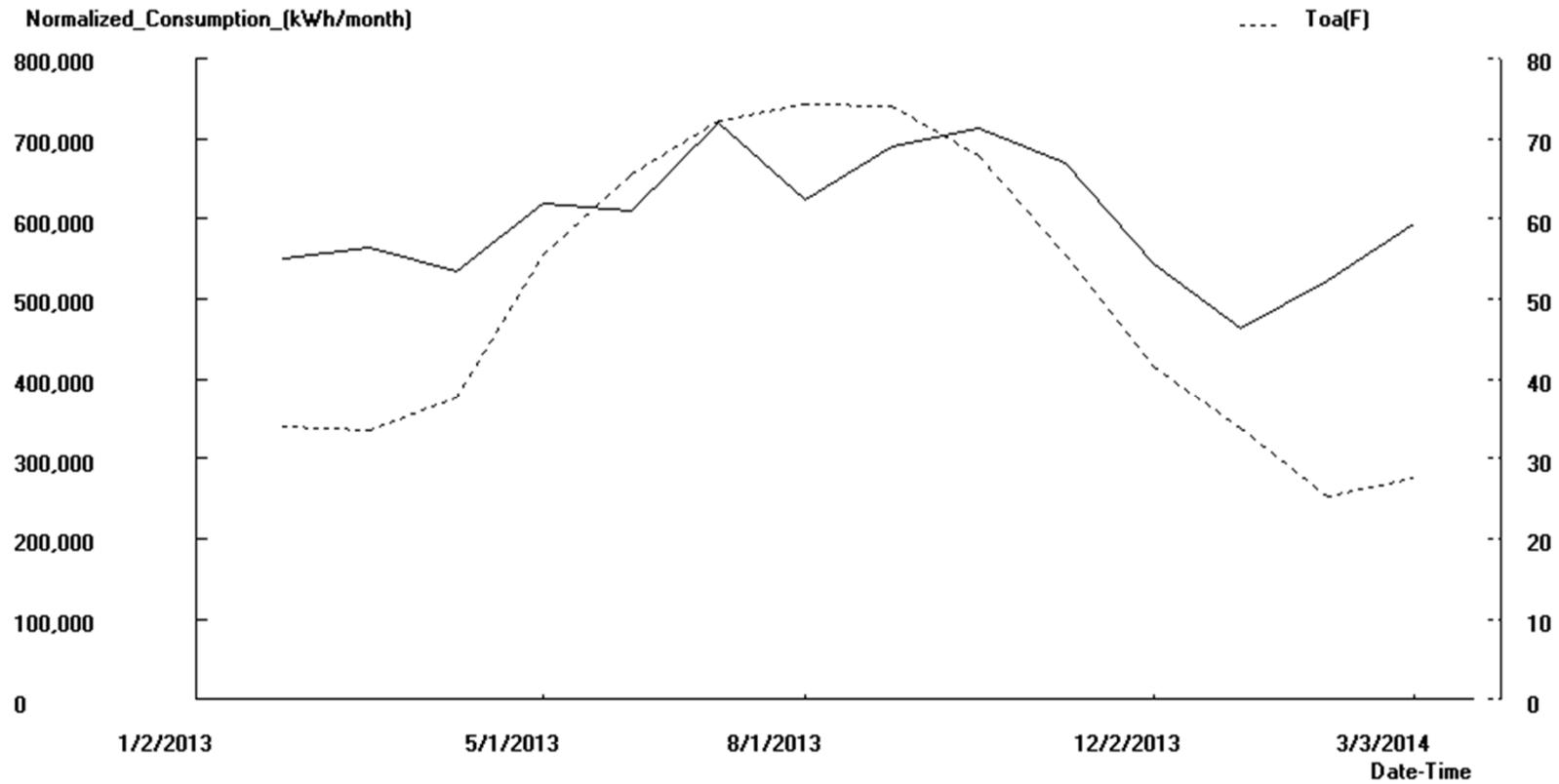
LEA Indicators of Savings Opportunities

- High “Independent” indicates waste
- Departure from expected shape
- High scatter indicates poor control

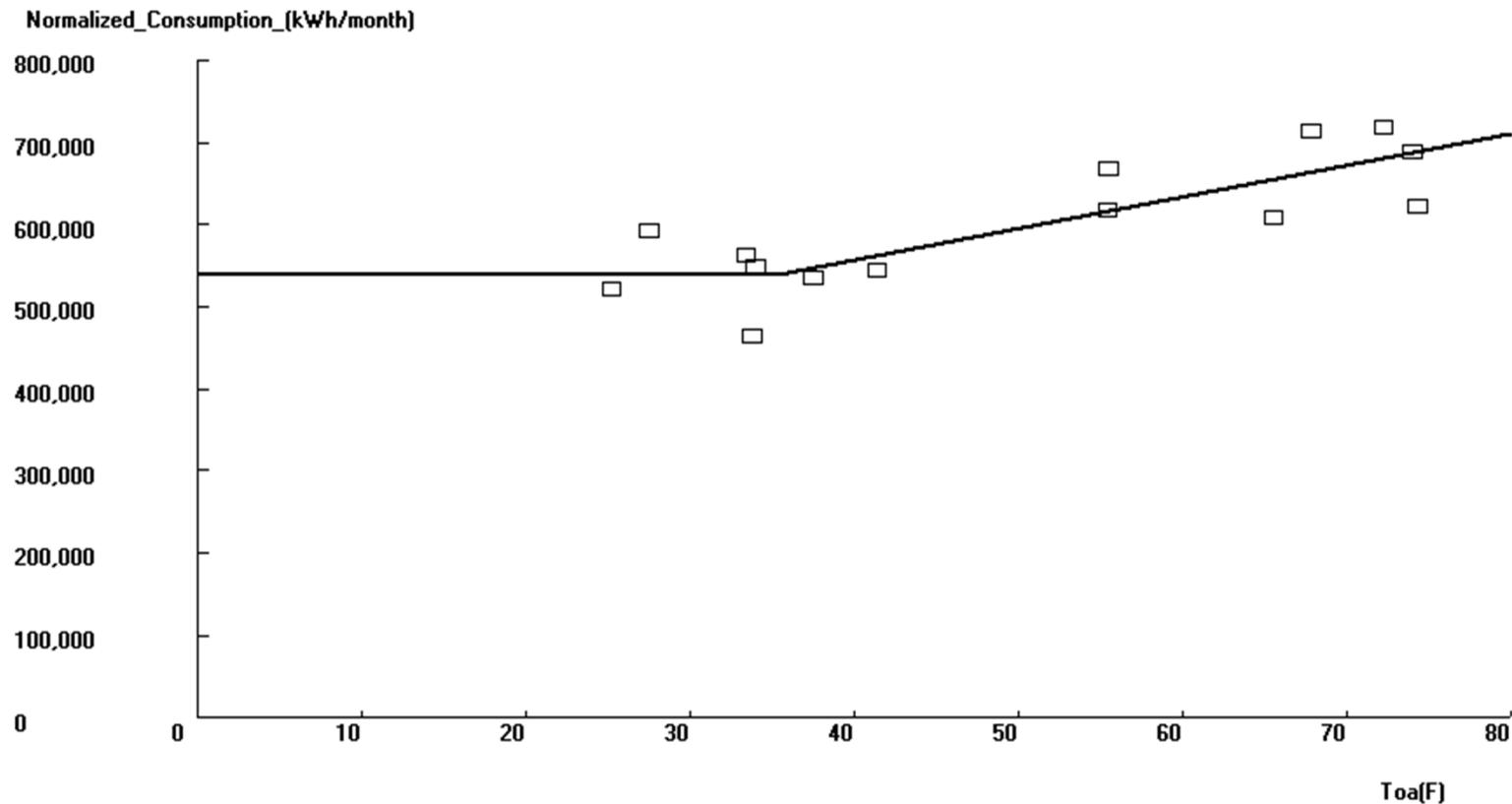
# ENERGY EXPLORER DEMO



# VARIATION OF ELECTRICITY USE WITH WEATHER



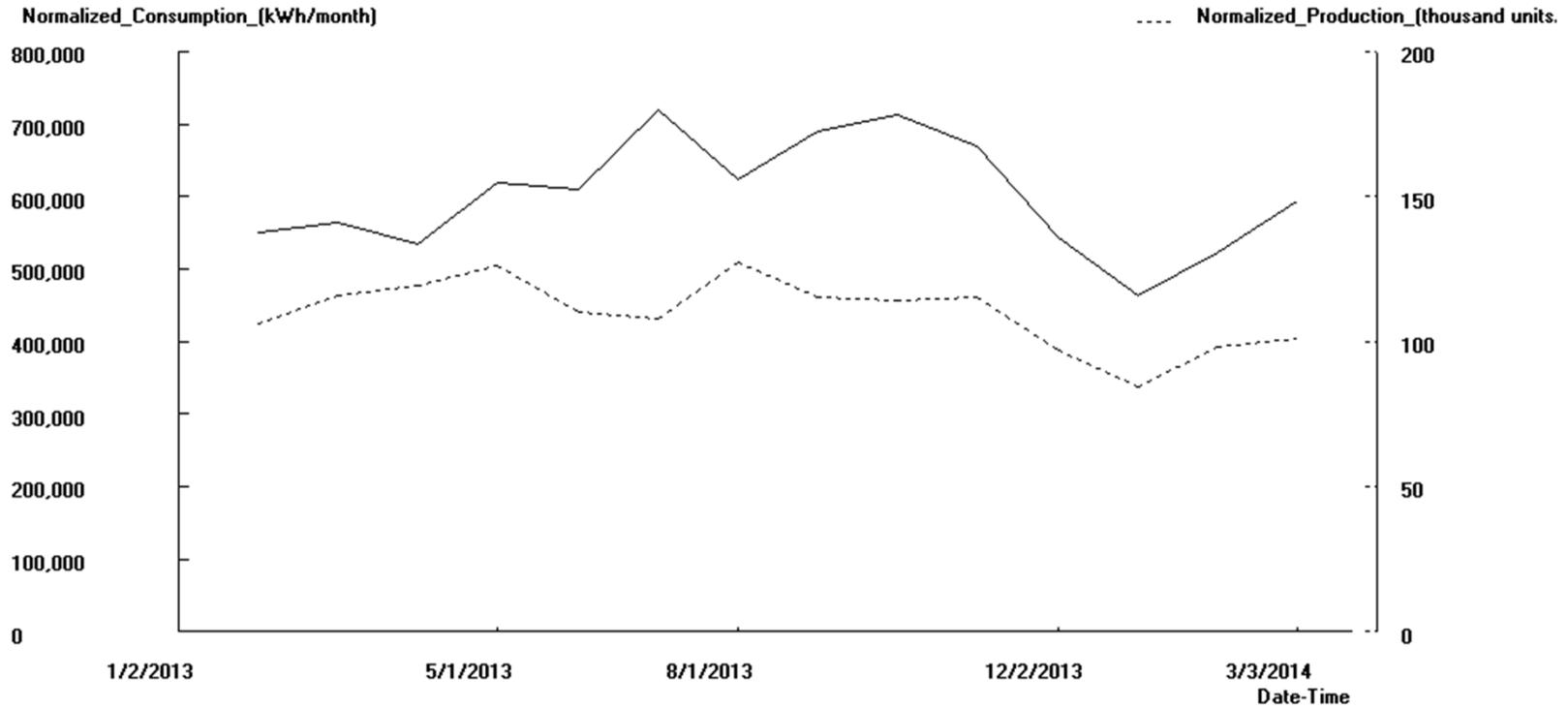
# VARIATION OF ELECTRICITY USE WITH WEATHER



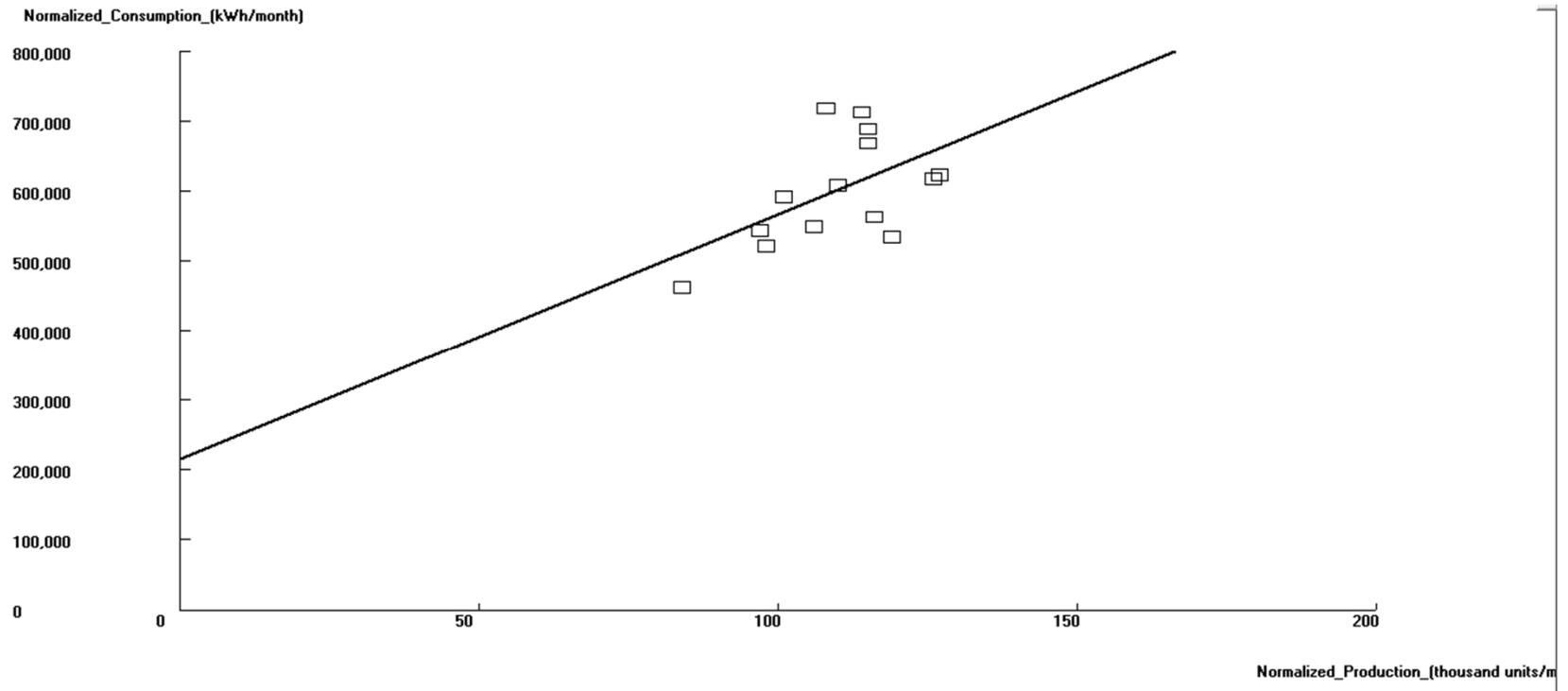
$$R^2 = 0.70$$

- *Actionable Info*: High Baseline Usage, Low Balance Point Temperature

# VARIATION OF ELECTRICITY USE WITH PRODUCTION

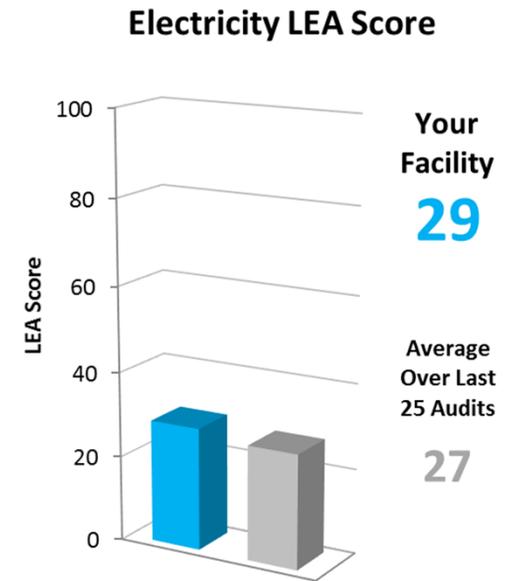
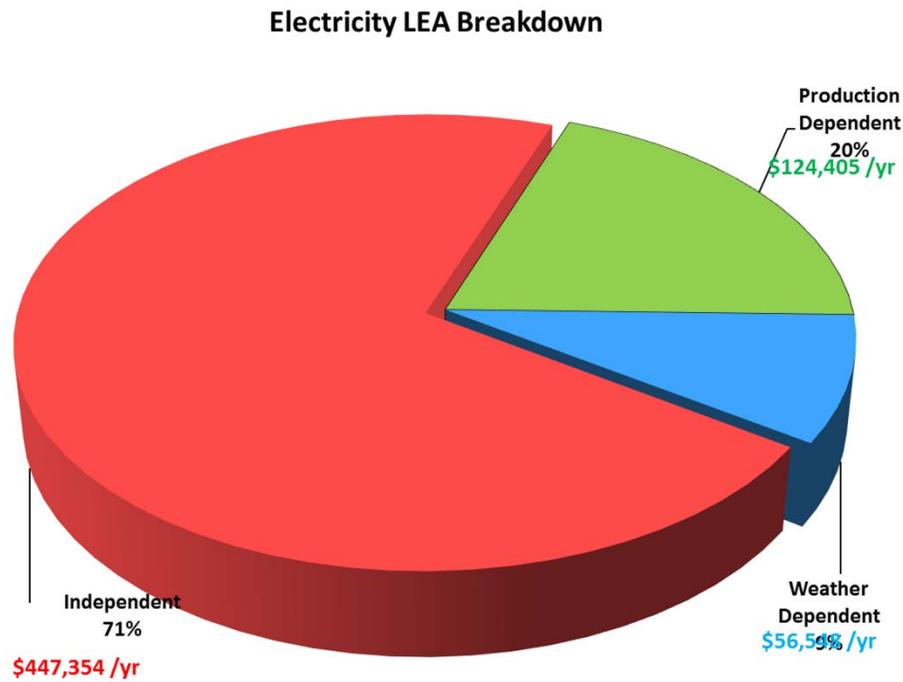


# VARIATION OF ELECTRICITY USE WITH PRODUCTION



$$R^2 = 0.29$$

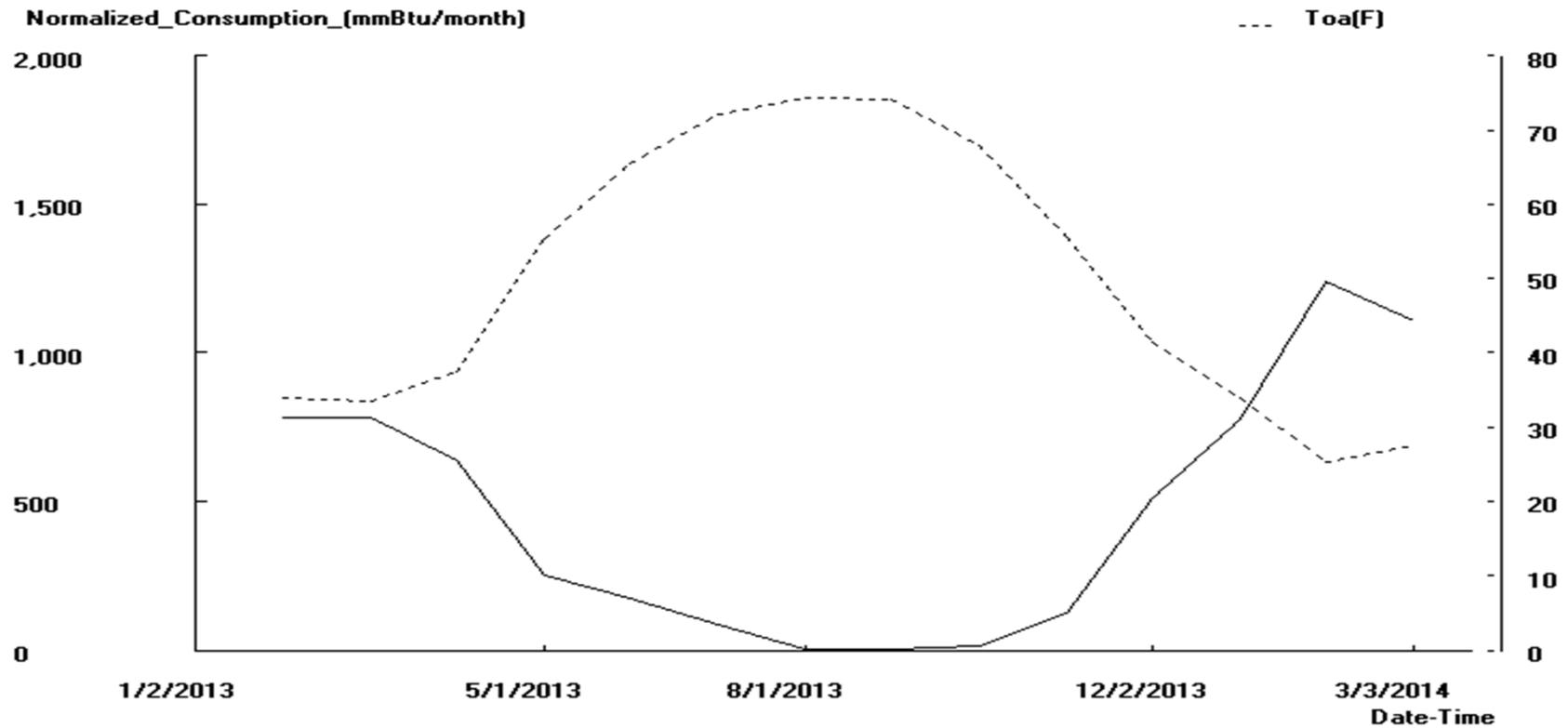
# ELECTRICITY BREAKDOWN



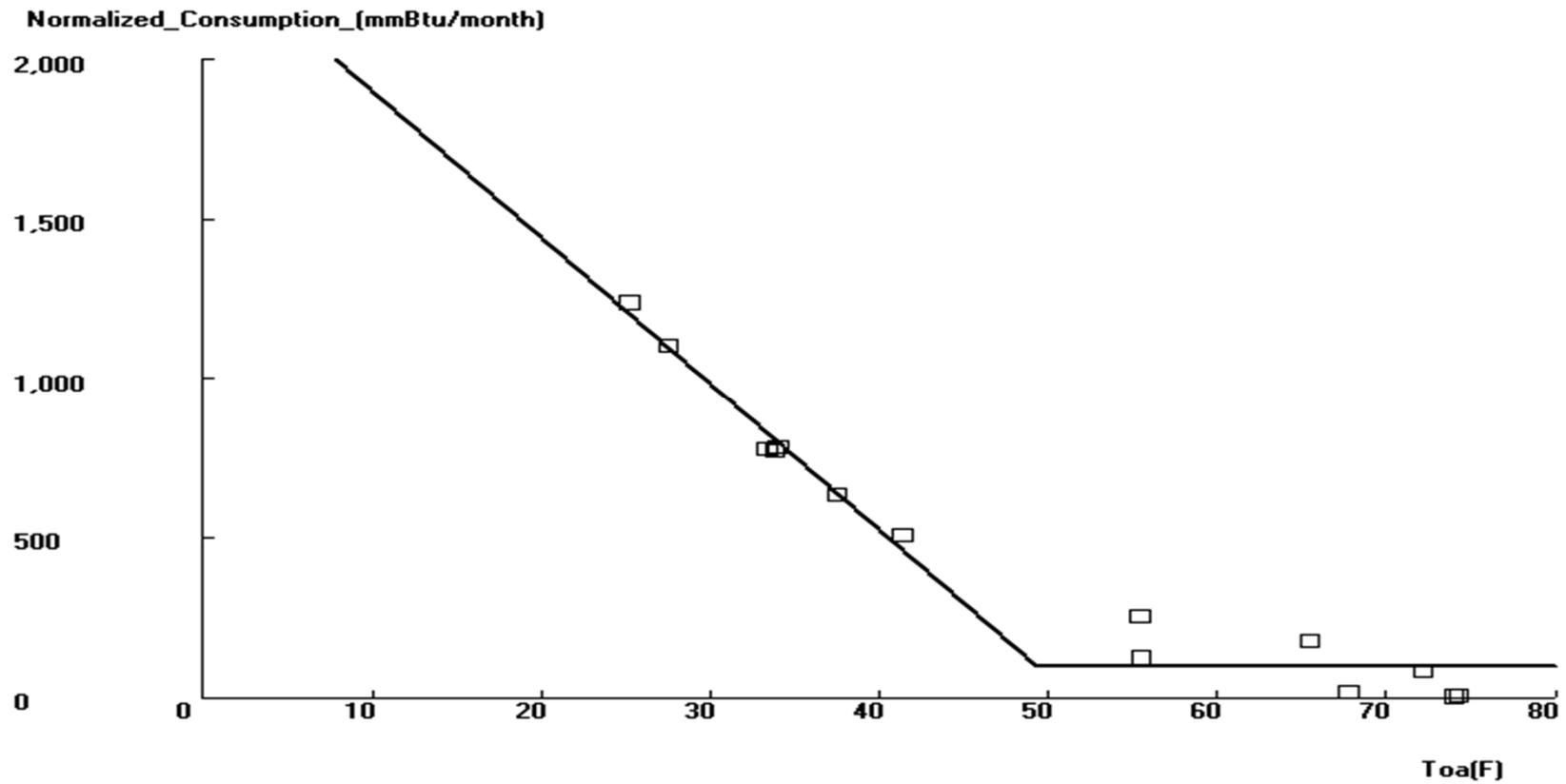
$$R^2 = 0.71$$

- *Actionable Info*: Identify “wasted energy”

# VARIATION OF NATURAL GAS USE WITH WEATHER

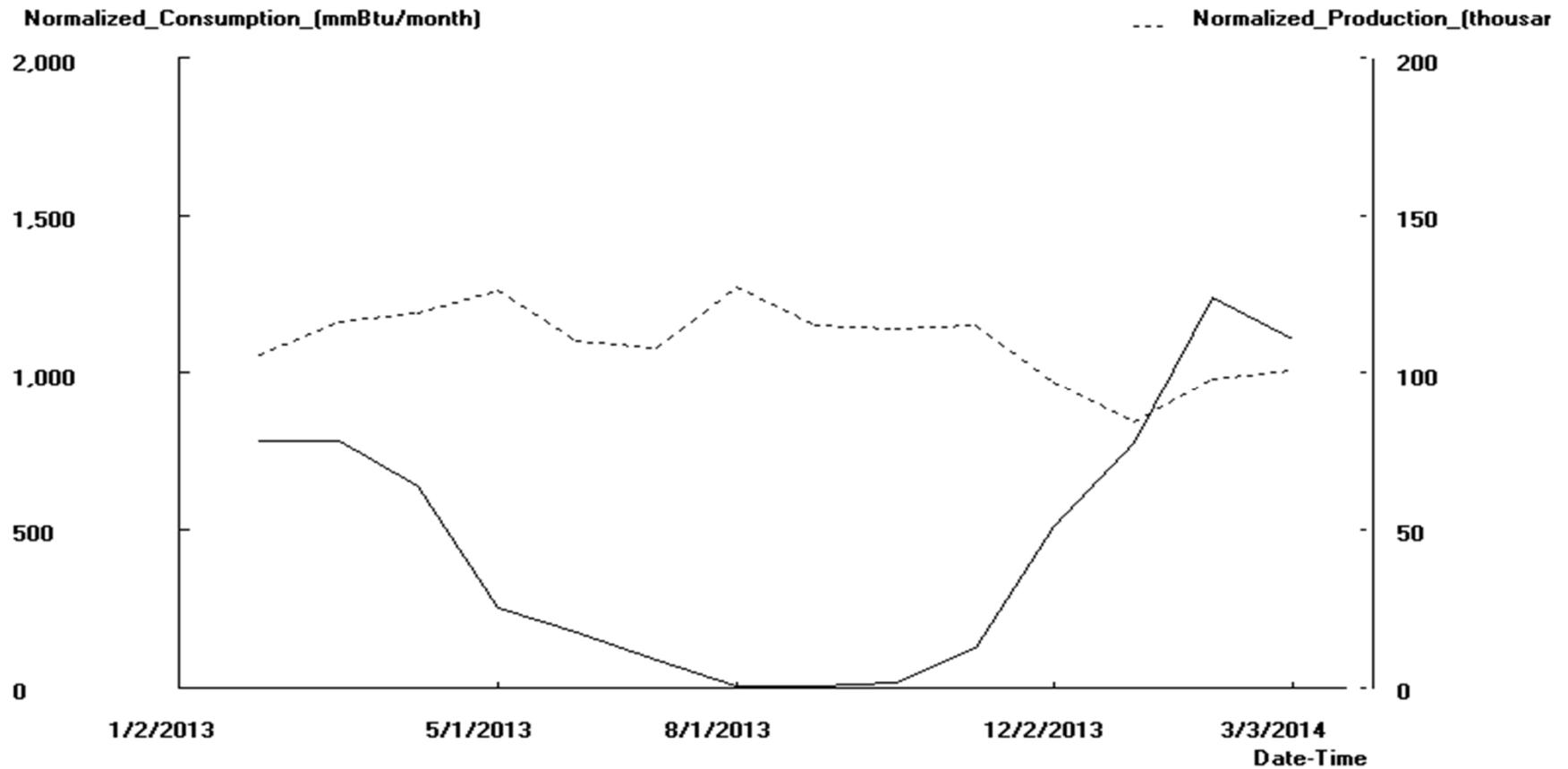


# VARIATION OF NATURAL GAS USE WITH WEATHER

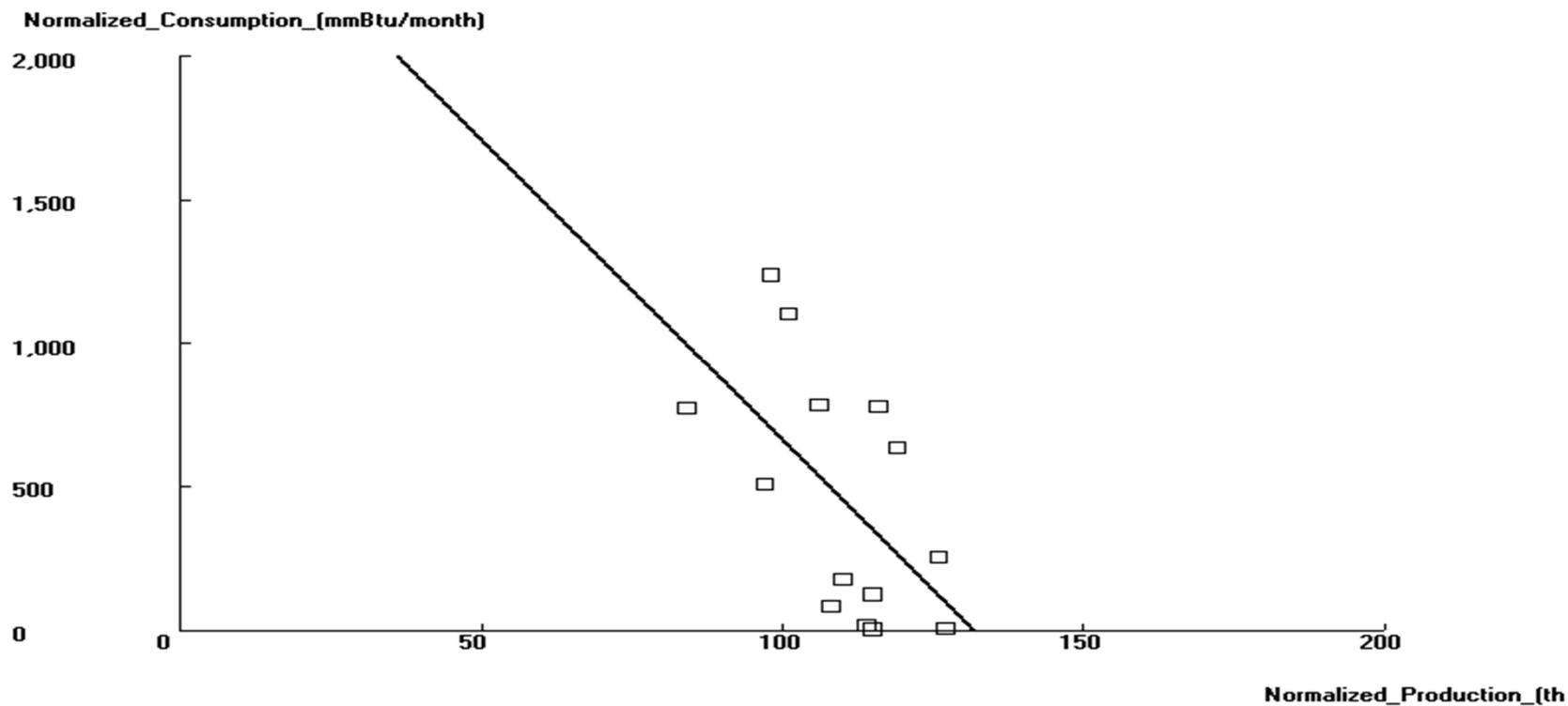


$$R^2 = 0.97$$

# VARIATION OF NATURAL GAS USE WITH PRODUCTION

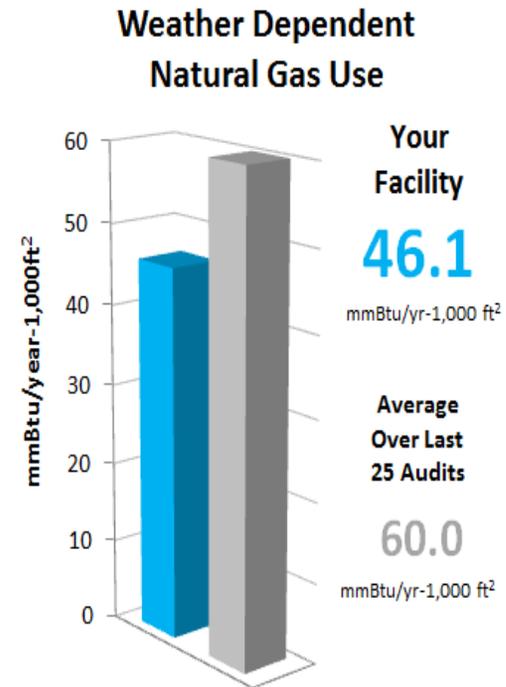
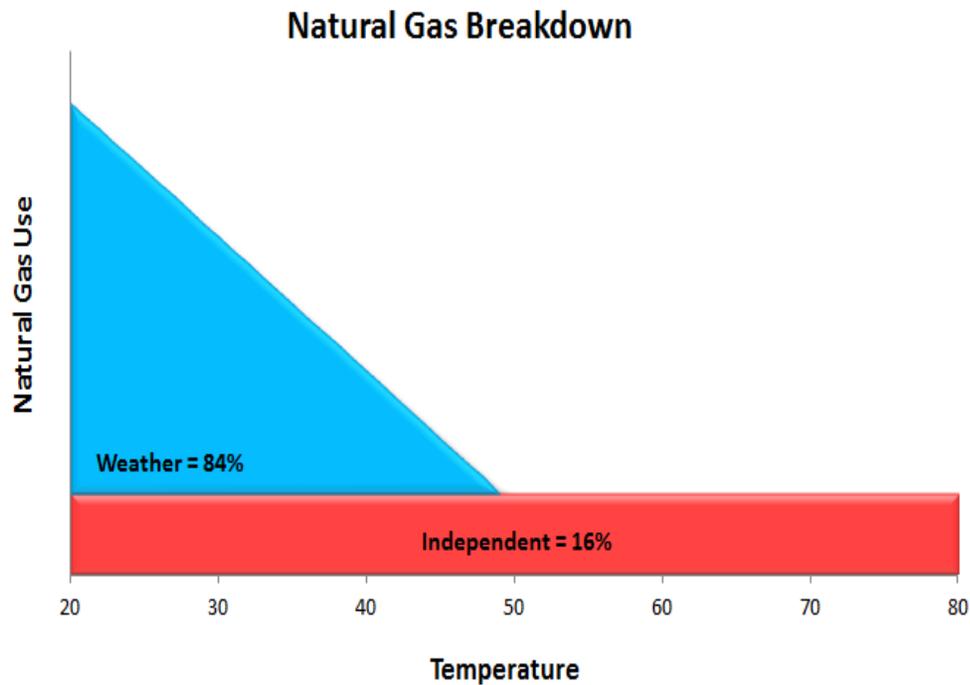


# VARIATION OF NATURAL GAS USE WITH PRODUCTION



$$R^2 = 0.33$$

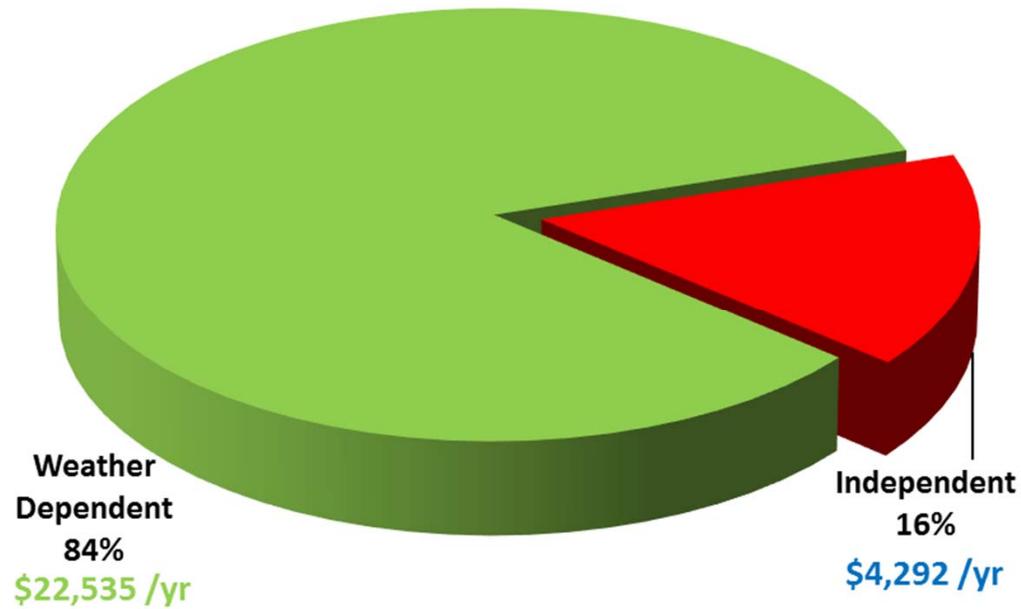
# Normalized Weather-Dependent Natural Gas Use



$$R^2 = 0.97$$

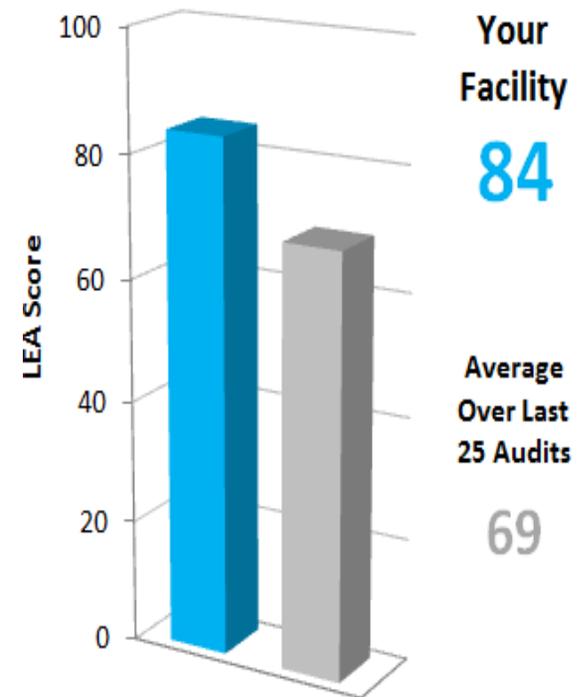
# NATURAL GAS BREAKDOWN

### Natural Gas LEA Breakdown



$$R^2 = 0.97$$

### Natural Gas LEA Score



# QUESTIONS?



## **Industrial Assessment Center**

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*A U.S. Department of Energy Sponsored Program*

Contact us:

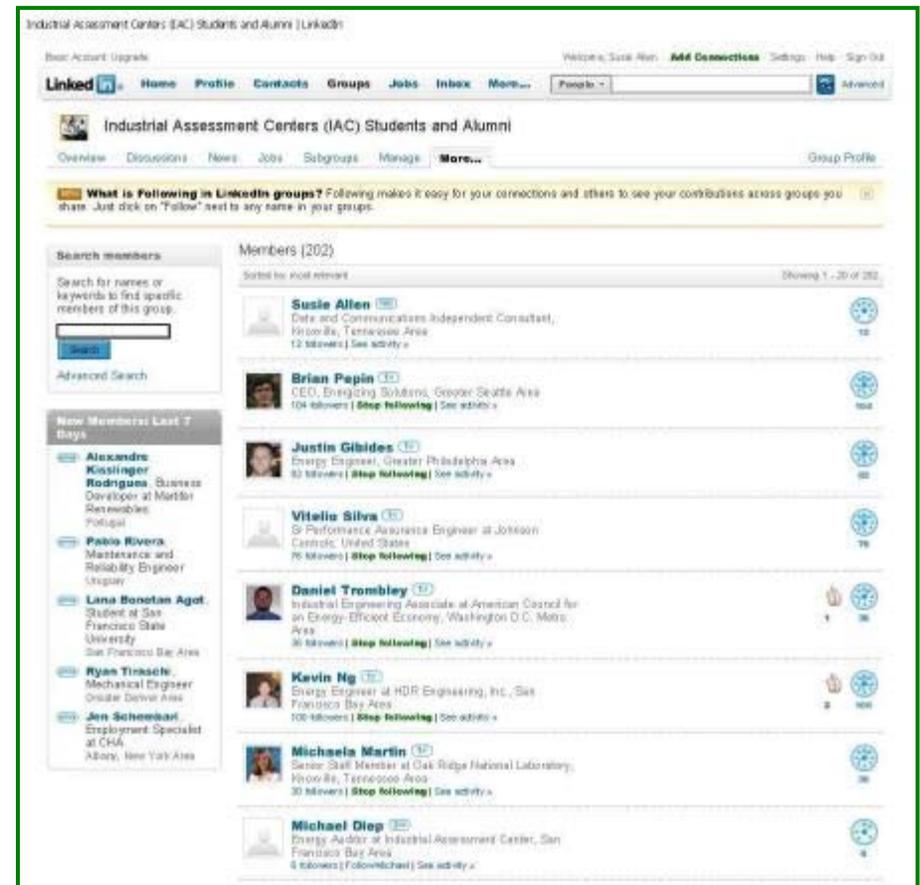
(937) 229-3343

[udayton.iac@gmail.com](mailto:udayton.iac@gmail.com)

[www.udayton.edu/engineering/industrial\\_assessment/](http://www.udayton.edu/engineering/industrial_assessment/)

# LinkedIn IAC Group

- Established in year 2008
- Professional networking site for IAC students and alumni
- 520+ members
- News items, professional profiles, discussions
- **Want to utilize more heavily for ongoing collaboration**



**IAC FORUM**  
A Website for Students and Alumni of  
DOE's Industrial Assessment Center

OAK RIDGE  
National Laboratory  
About Site Map Login Search

Registry Exchange Careers Resources Contacts Sponsor: USDOE Advanced Manufacturing Office

**COLLEGE OF ENGINEERING**  
Student Research Awards  
and 2013 Center of  
Excellence Announced  
See more IAC news

**LinkedIn**  
The IAC Forum manages a [LinkedIn Group](#) with over 500 members.

**IAC Website of the Month**  
 BOISE STATE UNIVERSITY

**News**

- Energy Department Announces \$5 Million for Residential Building Energy Efficiency Research and University-Industry Partnerships
- ACEEE Summer Study on Energy Efficiency in Industry August 4-6, 2015
- IETC June 2-5, 2015 in New Orleans

[More news...](#)

**Metrics**

Year	Participating	Certificates
2004	400	50
2005	400	50
2006	350	50
2007	300	50
2008	300	50
2009	350	50
2010	350	50
2011	400	50
2012	500	50
2013	450	50
2014	400	50

Metrics page...

# Student Registry and Exit Interviews

U.S. DEPARTMENT OF  
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## ➤ Lead Student Responsibilities

- Ensure all students complete registry entry
- Ensure all students complete exit interview
- Ensure that lead/active/inactive status is current

## ➤ Exit Interviews

- Identify new lead students
- Update contact information for alumni
- Capture alumni career data



The screenshot shows the IAC Forum website with a navigation menu including Registry, Exchange, Careers, Resources, and Contacts. A large red arrow points to the 'Registry' link. The main content area features a banner with wind turbines and a text box stating: 'New students must create a registry record; alumni are asked to maintain the registry information'. Below the banner are sections for LinkedIn, News, and Metrics.

Year	Participating	Certificates
2004	450	100
2005	400	100
2006	350	100
2007	300	100
2008	350	100
2009	300	100
2010	350	100
2011	450	100
2012	400	100
2013	350	100
2014	300	100
2015	250	100

<http://www.iacforum.org/>

# Student Certificates

- On-line requests are processed through the certificates link on [www.iacforum.org](http://www.iacforum.org)
- **Students and alumni must be in the IAC registry to receive certificates**
- Deadlines occur 3 times per year:
  - October 1, March 1, and July 1
- Certificate process
  - Student initiates request online,
  - Director/AD receives email notification with link
  - He/she completes the request online
  - Certificates arrive
- Certificates are mailed to the Directors within 30 days of deadline



- **Topic:** Training New IAC Students...
- **Who:** Syracuse University IAC
- **When:** Tuesday, March 24 @ 3pm EST



**SYRACUSE UNIVERSITY**

# Thank You!

**Thomas Wenning, PE**

IAC Student Activities Coordinator

Oak Ridge National Laboratory

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