

# 2014 Michigan Environmental Compliance Conference

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Energy Efficiency Cost Savings

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# Cost Savings Examples

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- Energy Bills

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- Lighting

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- Energy Bills
- Lighting
- Motors
- Air Compressors
- HVAC
- Case Studies

# Energy Bills

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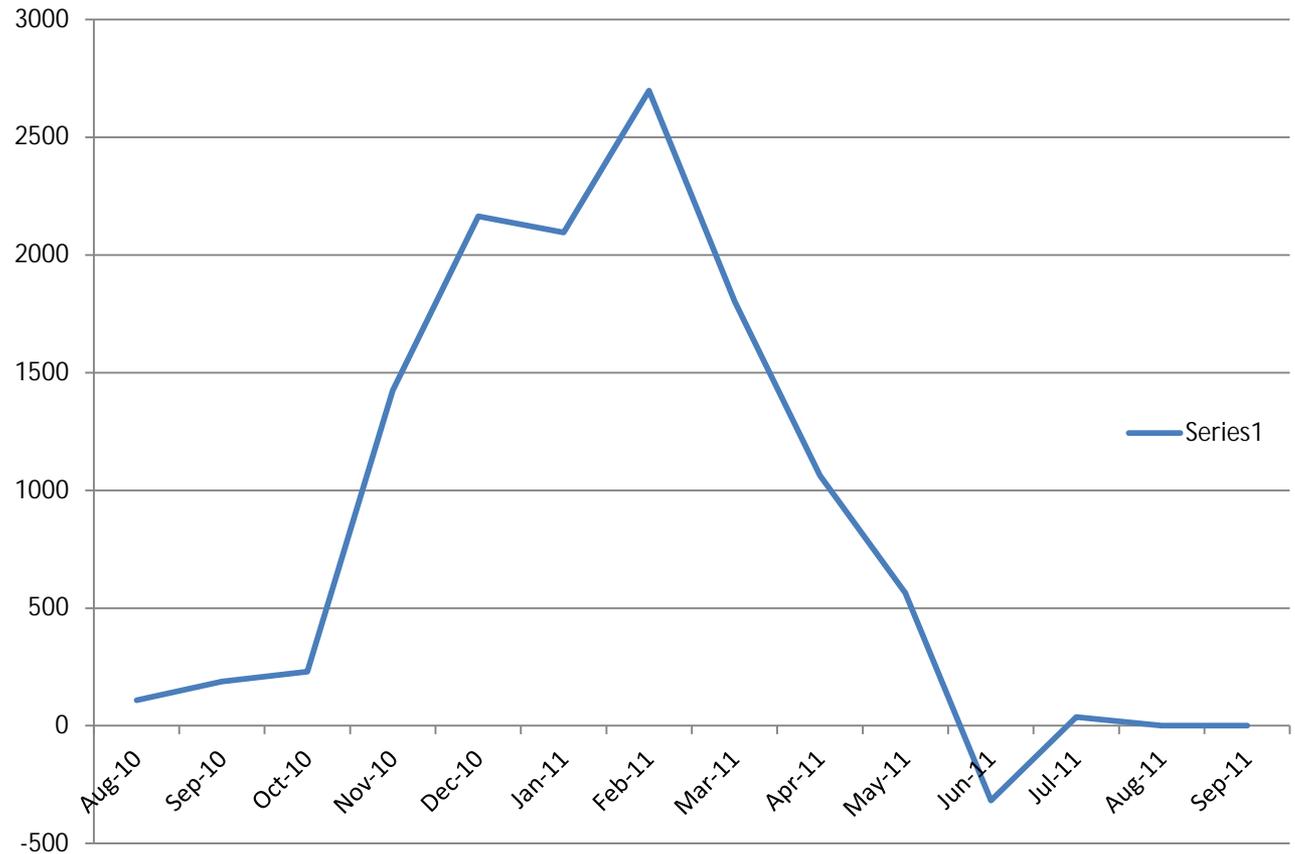
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  - Fixed Charge or Customer charge
  - Usage based on CCF, MCF, or Therms
  - Sales Tax
  - Commodity cost may be listed separately

# Gas Bill analysis

MONTH	DAYS BILLED	Reading Type A or E	UNITS USED Therms	Customer Chgs	Total chg	Sales Tax	Cost/Th m	Var Cost/Th m
Aug-10	30	A	109.08	\$167.23	\$320.73	\$9.16	\$2.94	\$1.41
Sep-10	32	A	187.674	\$167.23	\$384.02	\$10.97	\$2.05	\$1.16
Oct-10	29	A	230.052	\$167.23	\$407.49	\$11.64	\$1.77	\$1.04
Nov-10	31	A	1423.7	\$167.23	\$1,240.10	\$35.42	\$0.87	\$0.75
Dec-10	33	A	2164.18	\$167.99	\$1,682.14	\$48.04	\$0.78	\$0.70
Jan-11	28	A	2095.69	\$172.23	\$1,489.37	\$39.68	\$0.71	\$0.63
Feb-11	29	A	2698.09	\$172.23	\$1,732.23	\$49.47	\$0.64	\$0.58
Mar-11	31	A	1803.39	\$172.23	\$1,290.86	\$36.87	\$0.72	\$0.62
Apr-11	30	A	1062.23	\$172.23	\$900.37	\$25.71	\$0.85	\$0.69
May-11	29	E	563.805	\$172.23	\$560.92	\$16.02	\$0.99	\$0.69
Jun-11	33	E	-318.15	\$169.17	-\$45.15	-\$1.29	\$0.14	\$0.67
Jul-11	29	A	36.396	\$169.17	\$198.83	\$5.68	\$5.46	\$0.81
Aug-11	30	A	1.011	\$169.17	\$174.83	\$4.99	\$172.93	\$5.60
Sep-11	32	A	0	\$171.06	\$171.06	\$1.89	NA	NA
12 Mo Tot			11760.4	\$2,042.17	\$9,803.05	\$274.12	\$0.83	\$0.66

# Gas Bill analysis Cont'd



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- Use Bill to Determine Heating Btu's

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- May have a third party provider



# What is Demand?

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- It's the cost paid for electricity you don't use

## Example of Demand

- 100 incandescent bulb on 15 minutes/month
- Demand cost is \$1 at \$10/KW
- On 12 hours/day, 5 days/week, 264 hours/mo.
- Kilowatt-hour charge is \$2 at \$0.08/kWh
- Total cost is \$3, one-third is demand

# Electrical Bill Analysis

kW	kWh	kWh	kWh	LOAD	DEMAND	USAGE	TOTAL	SALES	UNIT	POWER	PF
BILLED	ON-PEAK	OFF-PEAK	TOTAL	FACTOR	COST	COST	COST	TAX	COST	FACTOR	PENALTY
1534	209210	537533	746743	63.38%	\$26,143.34	\$44,301.54	\$75,279.73	\$404.33	\$0.101	0.71	\$3,313.94
1613	217977	514276	732253	65.23%	\$22,731.62	\$39,730.81	\$65,445.96	\$351.51	\$0.089	0.75	\$1,515.44
1570	222938	503171	726109	62.16%	\$19,529.23	\$41,167.16	\$63,180.16	\$339.34	\$0.087	0.76	\$1,027.85
1492	208034	501942	709976	60.08%	\$18,770.40	\$38,790.64	\$59,729.74	\$320.81	\$0.084	0.77	\$731.31
1476	172009	404141	576150	49.29%	\$18,594.88	\$33,363.87	\$53,721.92	\$288.54	\$0.093	0.79	\$235.38
1512	200940	500955	701895	69.08%	\$18,989.80	\$41,954.36	\$62,474.96	\$335.55	\$0.089	0.81	
1460	200649	487641	688290	67.73%	\$18,419.36	\$41,528.86	\$61,473.65	\$330.18	\$0.089	0.81	
1345	146583	358134	504717	53.92%	\$17,157.81	\$30,416.14	\$49,032.55	\$263.35	\$0.097	0.84	
1238	112786	284709	397495	44.59%	\$15,984.02	\$24,074.96	\$41,477.00	\$222.77	\$0.104	0.88	
1273	140333	333790	474123	48.50%	\$19,983.29	\$33,325.57	\$54,846.58	\$294.58	\$0.116	0.86	
1325	137907	305104	443011	46.44%	\$20,692.65	\$31,426.07	\$53,650.01	\$288.15	\$0.121	0.85	
1408	175685	398616	574301	58.60%	\$17,050.08	\$39,431.16	\$63,780.37	\$342.57	\$0.111	0.80	
1388	186531	469047	655578	61.50%	\$21,523.26	\$45,722.39	\$69,044.58	\$370.84	\$0.105	0.79	\$272.45
1425	2122372	5061526	7183898	57.55%	\$229,426.40	\$440,931.99	\$697,857.48	\$3,748.19	\$0.097	0.81	\$3,782.43
	29.5%	70.5%			32.9%	63.2%			\$/kWh		

- **Load Factor:**
  - $\text{kWh for the period} / \text{Peak kW} \times \text{total hours in the period}$
  - Ideally 80% for three shift operation

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- **No sales tax** on manufacturing usage

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- Reduce Demand Peaks
  - Off Peak Operation of Large Motors
  - Alternate Large Motor Operation
  - Start Heating Processes Off Peak

# LIGHTING

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- Example: Replace Metal Halide with Fluorescent or LED Fixtures



Metal Halide:  
460 watts / fixture  
23,500 Mean Lumens  
15 Minute Warm-up

## LIGHTING (CONT'D)



Fluorescent:  
T5 or T8 Fluorescent  
225 Watts / Fixture  
6 lamps 21,250 lumens  
Instant On  
24,000 HOUR LIFE

## LIGHTING (CONT'D)



LED REPLACEMENT

120 WATTS/FIXTURE

EQUIVALENT  
FOOTCANDLES

50,000 HOUR LIFE

INSTANT ON

## LIGHTING (CONT'D)

Calculated Savings Fluorescent: Assume-

- 16 hours/day, 5 days /week
- \$0.10/kWh
- 100 Fixtures, one for one replacement

Savings=

- $100 \text{ Fixtures} \times (460-225) \text{ watts} \times 16 \text{ hr/day} \times 5 \text{ days/wk} \times 52 \text{ wk/yr} \times \text{kW}/1000\text{Watts} \times \$0.10 = \$9776.$
- Typical Payback: One to Two years
- Often Use Motion Sensors & Light Harvesting

## LIGHTING (CONT'D)

Calculated Savings LED: Assume-

- 16 hours/day, 5 days /week
- \$0.10/kWh
- 100 Fixtures, one for one replacement

Savings=

- $100 \text{ Fixtures} \times (460-120) \text{ watts} \times 16 \text{ hr/day} \times 5 \text{ days/wk} \times 52 \text{ wk/yr} \times \text{kW}/1000\text{Watts} \times \$0.10 = \$14,144.$
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# Electrical Motors



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- Easily adaptable to VFDs

- How to determine cost of motor operation
  - Horsepower
  - Loading
  - Operating Hours
  - Efficiency
$$\text{kW} = \text{HP} \times .746\text{kW/HP} \times \text{Motor Loading} / \text{Efficiency}$$
$$\text{kWh} = \text{kW} \times \text{Annual Operating Hours}$$



# Motor Cost Savings Opportunities

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- Payback can be two years or less

## Motor Cost Savings Opportunities (cont'd)

- Install variable frequency drive
  - Now solid state devices
  - Uses existing induction motors
  - At 80% speed, uses 50% of kW
  - At 70% speed, uses 34% of kW
  - Must have a variable load
  - Often one-year payback or less

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“Your Most Expensive Utility”

7 to 8 HP of Electricity to Produce 1 HP Air

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- Recover Exhaust Heat

# Heating and Ventilation

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- Heat Pumps

## Types of Heating

- Hydronic- water/steam (Boilers)
- Forced Air furnaces
- Radiant
- Heat Pumps

# Types of Boilers

- Fire Tube

# Fire Tube Boiler



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- Fire Tube
- Water Tube

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- Modular condensing water tube

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# Boiler Control Changes

- Variable Hydronic Heating Temperature
  - Control by Outside Air Temperature

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- Variable Hydronic Heating Temperature
  - Control by Outside Air Temperature
- Variable Hydronic Heating Flow
  - VFD Pump
  - Control by Outside Air Temperature

# Other HVAC Control Changes

- Variable Air Makeup
  - Use CO2 Occupancy Sensor
  - Timer

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- Variable Air Makeup
  - Use CO2 Occupancy Sensor
  - Timer
- Time of Day Thermostat or Central Control

# Charlevoix County Courthouse

- May 2011 Energy Savings Project of the Year Award from Engineering Society of Detroit
- Replaced five old boilers with two 1MBtu/hr Modular Condensing Boilers
- Resulted in a 45% decrease in Fuel Costs
- A Reduction of 75.6 Metric Tons of CO<sub>2</sub>

## Air Conditioning / Heat Pumps

- Efficiency Ratings in SEER and EER:  
Seasonal Energy Efficiency Rating  
Energy Efficiency Rating
- $SEER/EER = BTU/Hr \text{ (cooling)}/Watt$

# Typical Efficiency Ratings

## Air Conditioner

- 15 to 20 year old AC: 8 to 10 SEER
- New Energy Star AC: up to 21 SEER

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### Heat Pump

- Air Source: up to 17 SEER
- Water Source: up to 28 SEER??

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- Ensure Regular Cleaning and Maintenance
- Use Setback Thermostats

# Case Studies

Linn Products, Charlotte, MI

Kenwal Steel, Dearborn, MI

# Energy Assessments Success Stories

- RETAP Helps Linn Products Save Nearly \$180,000 Annually
- Located in Charlotte, Michigan
- RETAP completed the on-site pollution prevention assessment in November, 2010
- Made 35 recommendations, total \$100,000

# Linn Projects

- Upgraded old fluorescent lighting and replaced MH with T8 fluorescents saving \$31,900 annually
- Upgraded air system, new compressors, piping and instituted leak detection saving \$44,300 annually
- Replaced small air circulators with large ceiling fans saving \$19,500 annually (maintenance, gas, elect.)
- Replaced large press motors with VFD's saving \$18,500 annually
- Replaced air make-up and scrubber motors with VFD high efficiency motors saving \$55,000 in gas and electric

## Kenwal Steel, Dearborn, MI

- Supply flat rolled steel products
- RETAP Assessment April 2011, with 40 recommendations, \$51,000 total savings
- Implemented many recommendations
- Annual savings of \$185,000

# Kenwal Steel (contd)

- Received \$20,000 in energy rebates
- Removed oil from waste water saving \$7100 in disposal costs per year
- Replaced MH with LED light fixtures saving over \$80,000 per year
- Preventive maintenance on air system saving \$5000 per year
- Then reduced compressors \$37,000/yr

# Kenwal Steel (contd)

- Upgraded the office HVAC System equipment and controls saving \$32,000 per year

# Energy Assessment Programs

Government or non-profit programs providing free or low cost energy efficiency assistance to small businesses:

Clean Energy Coalition – fee based – (734) 585-5720 ext.18

Delta Institute – fee based – (312) 554-0900

EcoWorks – fee based – (313) 894-1030

Green Lodging Michigan – no cost – (517) 241-6224

Industrial Assessment Center – no cost – (734) 647-4790

Michigan Energy Options – fee based – (517) 337-0422

Michigan Farm Energy Audit Program – \$500 – (517) 353-3232

Michigan Industrial Energy Center – no cost – (734) 763-7470

Michigan Economic Development Corporation (888)522-0103

Michigan Manufacturing Technology Center – fee based – (888) 414-6682

Rebuild Michigan – no cost – (517) 241-6281

Retired Engineer Technical Assistance Program – no cost – (517) 284-6863

# RETAP

- Onsite Pollution Prevention & Energy Conservation Assessments Conducted by Teams of Retired Engineers
- Free
- Confidential
- Non-Regulatory
- No Obligations
- Objective



# How can companies contact RETAP or get more Info?



**David Herb**

**800-662-9278**

**517-284-6863 (direct)**

**herbd@michigan.gov**

**Retired Engineer  
Technical Assistance  
Foundation**

**888-749-7886**

**248-478-8192 (fax)**

**[www.michigan.gov/retap](http://www.michigan.gov/retap)**