

DIY and professional energy and water audits

Presenters

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- ▶ Jim Riggins
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Agenda

- ▶ Energy Definitions and Costs
- ▶ DIY Energy Analysis
- ▶ Professional Energy and Water Audits
- ▶ Q & A

Energy

Energy is a measurable quantity of heat, work or light

- ▶ Kilowatt-hour (kWh)
- ▶ British thermal unit (BTU)
- ▶ Therm (100,000 BTUs)

LED light bulb on 24 hour X 30 days

8,640 watt-hours

8.64 kWh



Power

Power is the rate work is done or heat is released

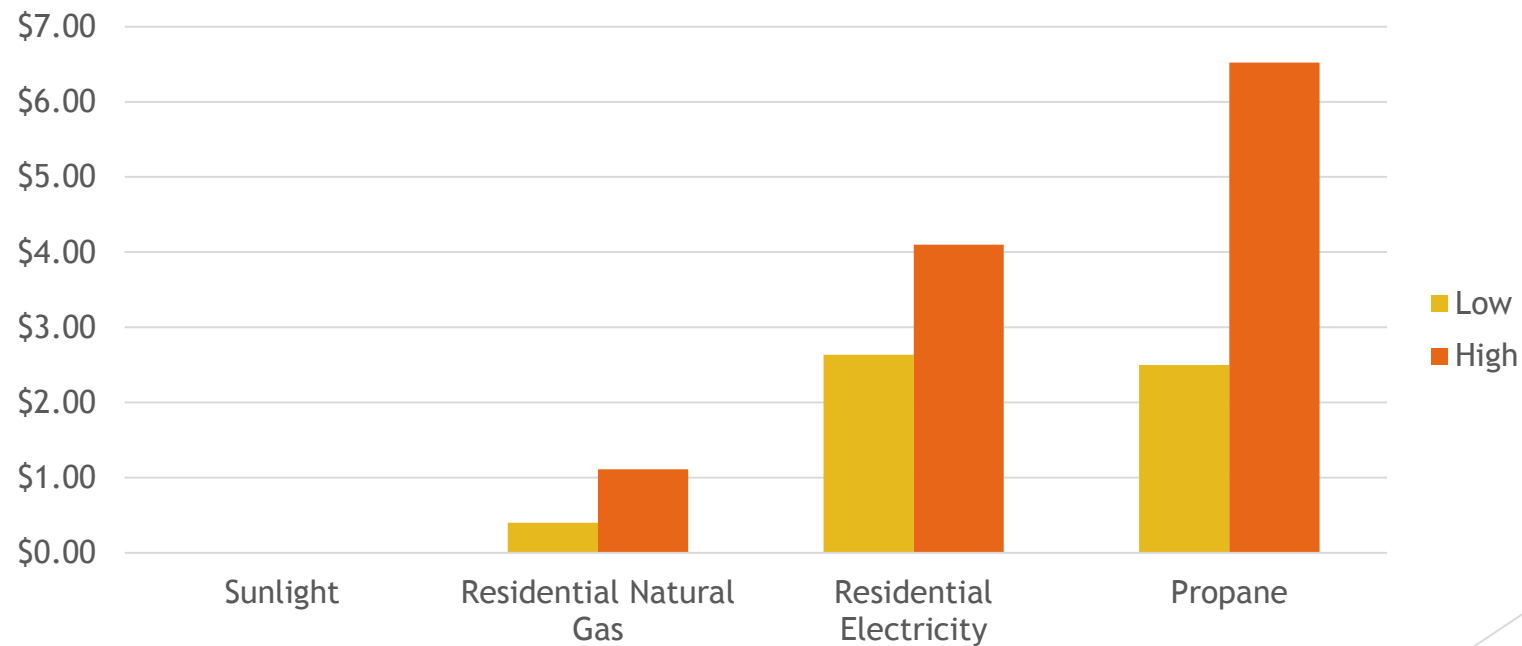
- ▶ Watt (W)
- ▶ Kilowatt = 1,000 W (kW)
- ▶ BTU/hour

LED light bulb

12 W

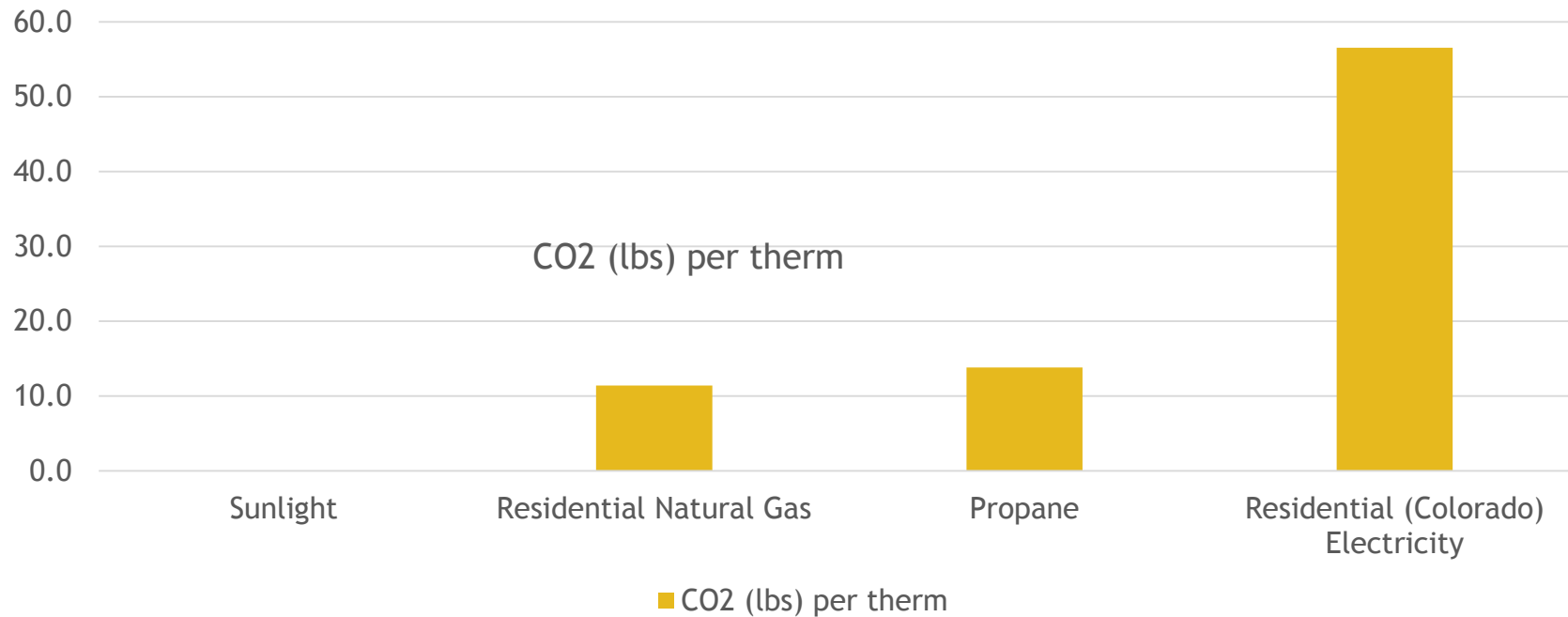
Dollar Costs per Energy Unit

- ▶ Different energy sources have different cost per unit of energy
- ▶ Costs vary by geographic region and over time
- ▶ Consider the cost of **one therm (=100,000 BTU or 29 kWh)** in Colorado



External Costs per Energy Unit

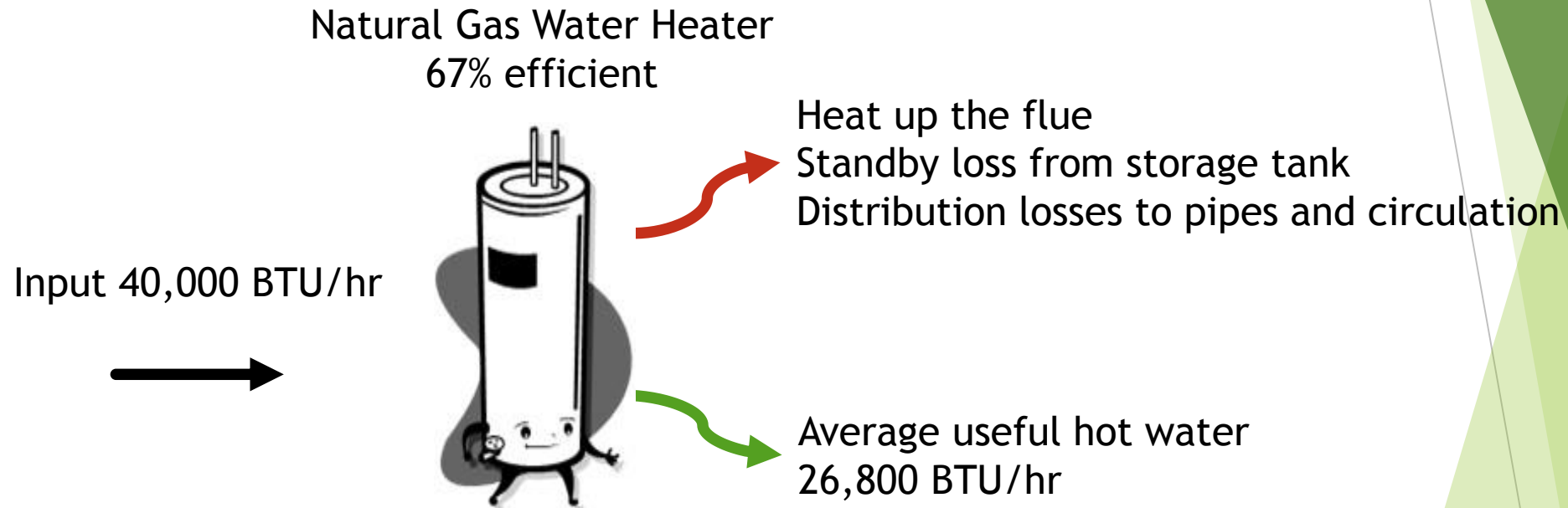
- ▶ Fossil fuel based energy sources have costs not reflected in the price
- ▶ Carbon dioxide (CO₂) emissions are one such cost
 - ▶ Residential electricity depends on the fuel mix - Colorado used here
- ▶ Consider the CO₂ emissions from **one therm (=100,000 BTU or 29 kWh)**



- ▶ Health and environmental external costs are also significant and generally are proportional to CO₂ emissions

Energy Efficiency

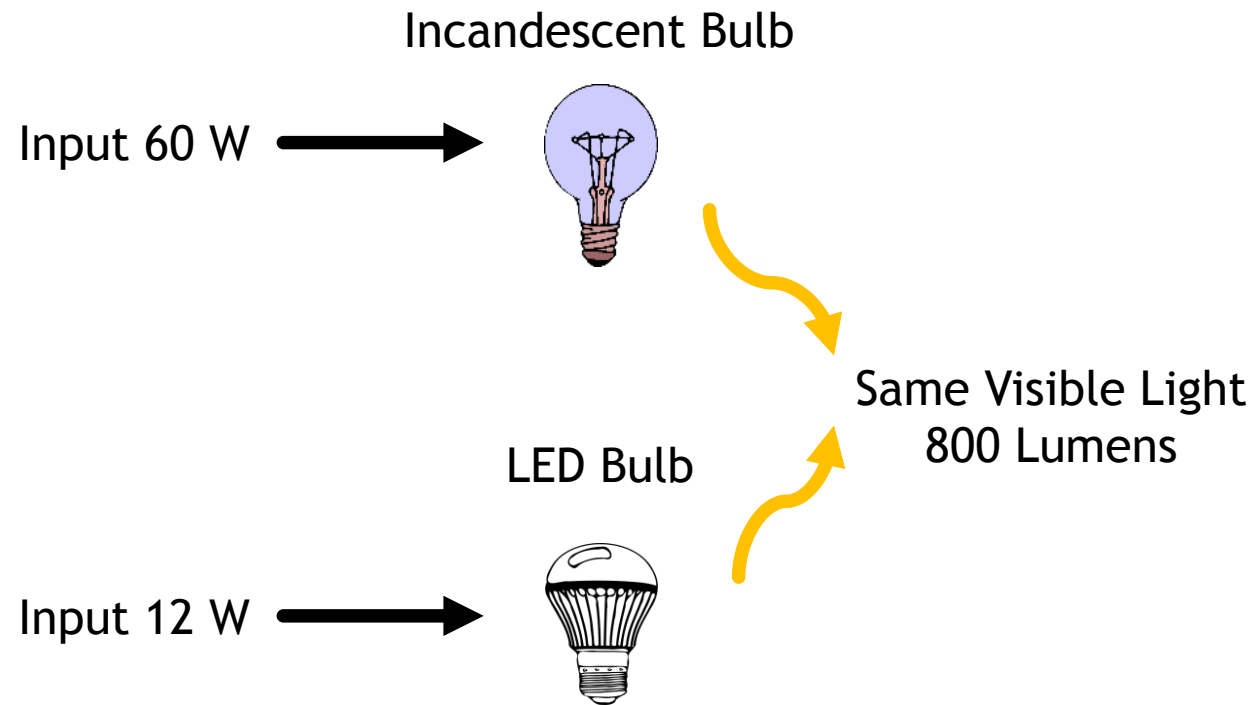
Ratio of useful output to input energy or power



► Might also be called energy factor

Energy Efficiency

Light Bulb Example

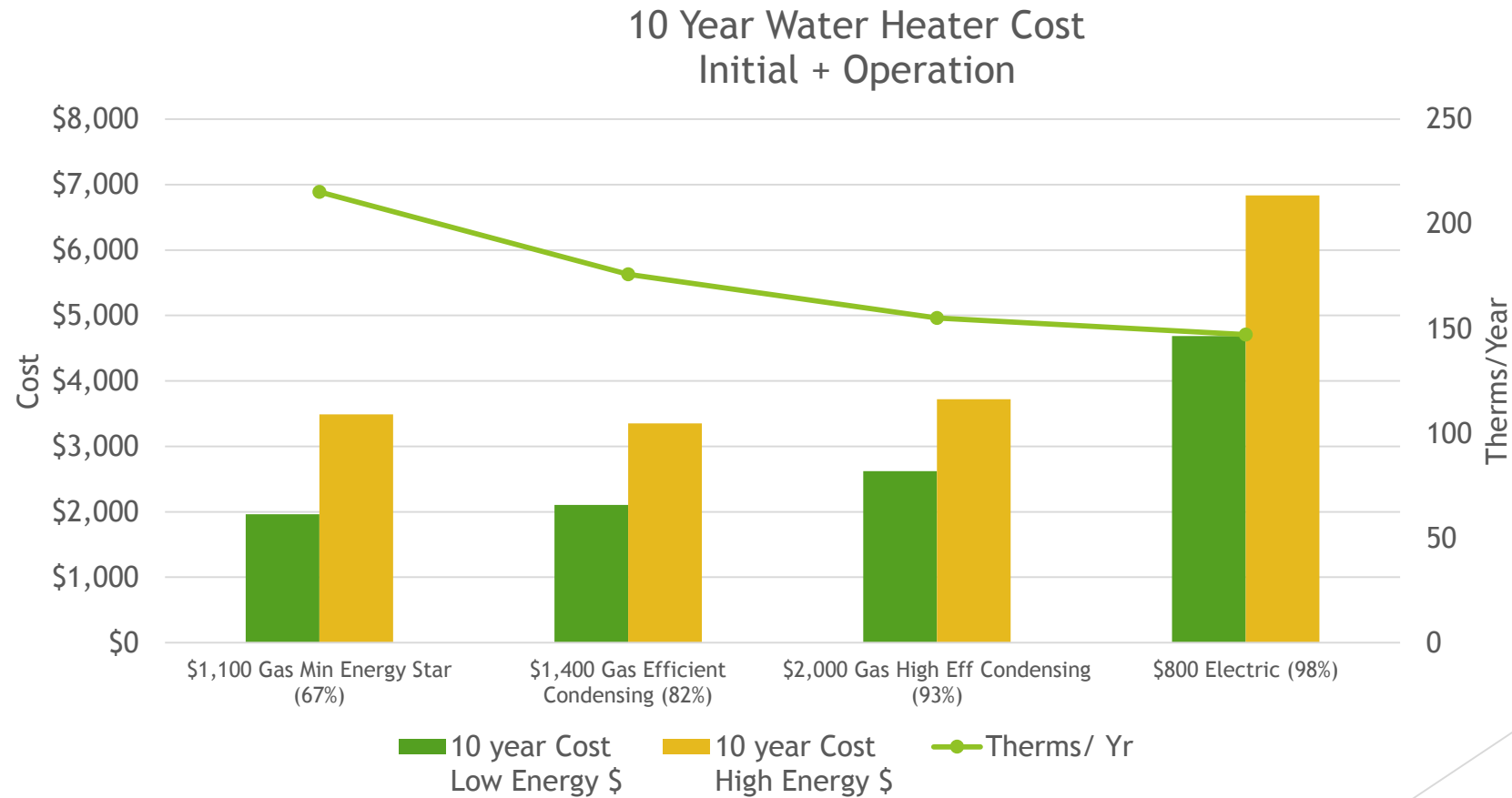


- ▶ LED bulb uses $1/5^{\text{th}}$ the input power and is 5 times as efficient

Energy Efficiency

Bringing purchase price into the picture

GAS WATER HEATER USES 277 THERMS/YEAR AND MUST BE REPLACED. SHOULD I GET THE 67%, 82% OR 93% EFFICIENT REPLACEMENT OR SWITCH TO ELECTRIC?



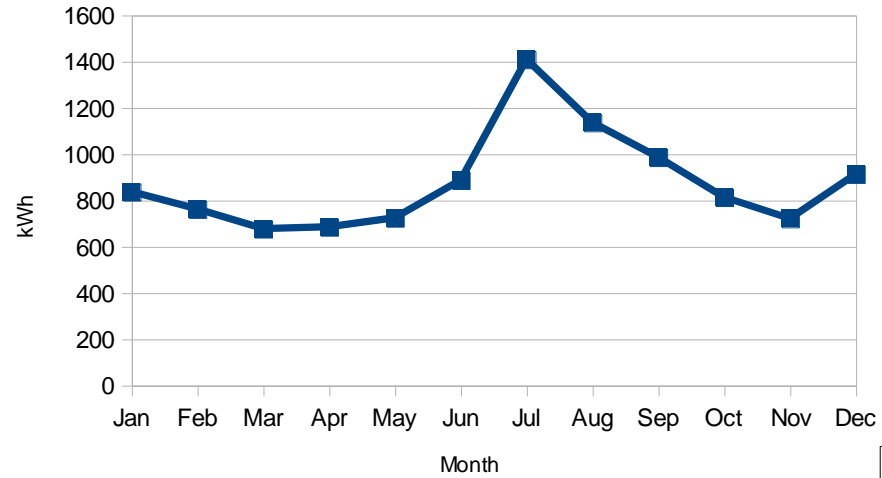
Wait a Minute

HOW DO I KNOW I USE 277 THERMS OF GAS PER YEAR FOR WATER HEATING?

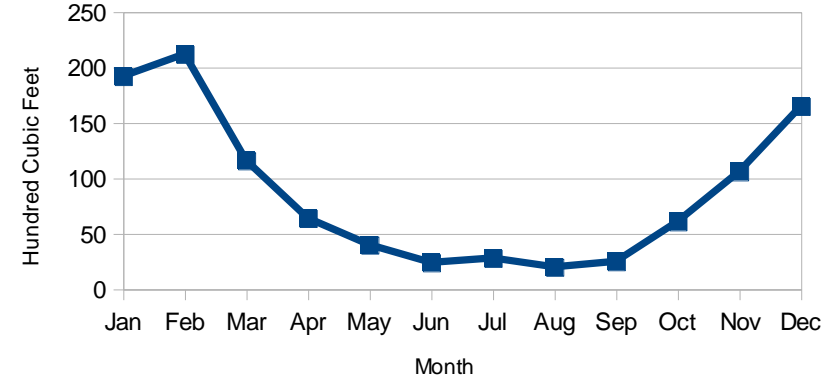
- ▶ In a home with a gas furnace (boiler) and gas water heater, look at the months without the furnace running.
 - ▶ Average 3 lowest month's therms/month and multiply by 12
- ▶ Colorado State University Extension eBAM!
 - ▶ Energy Bill Analysis and More
 - ▶ FREE Spreadsheet
 - ▶ See eBAM! link at <http://www.ext.colostate.edu/energy/home.html>

Actual Utility Data (CSU Customer)

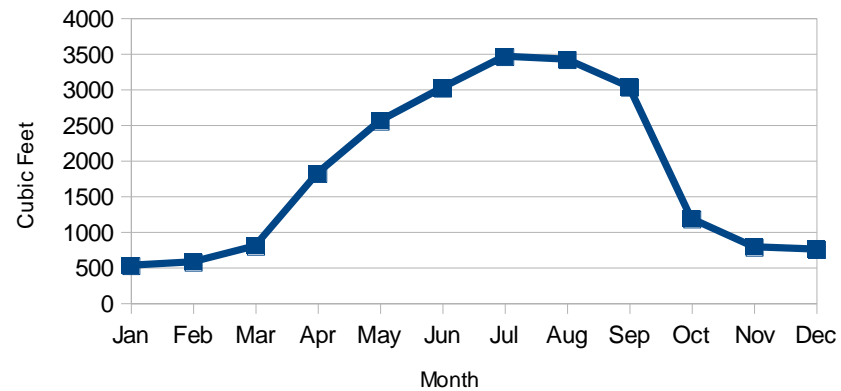
Electric Usage



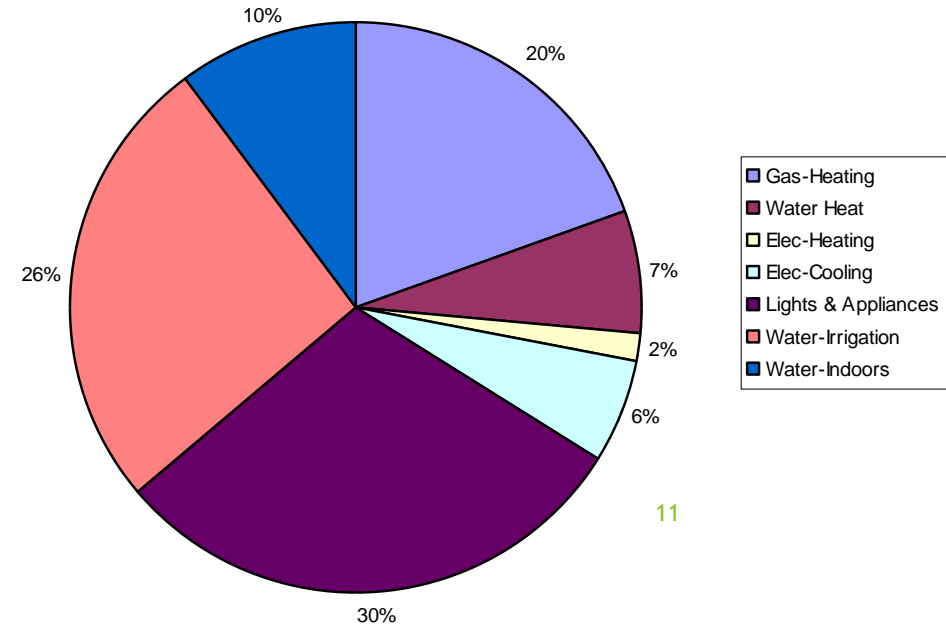
Gas Use



Water Use



Annual Utility Costs



CSU Bill: Electric and Gas

Electric Residential Service (E1R)

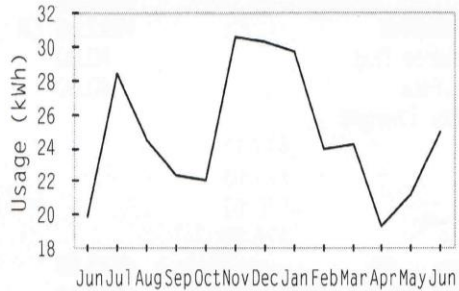
Meter Number: 302426

Reading 06/26/12 94054

Reading 05/29/12 93354

Your average daily usage was 700 Kilowatt Hours(KWH)
25 KWH

Average Daily Usage Trend



Access Chg: 2 days x \$0.35	\$0.70
Access Chg: 50 kWh x \$0.0649	\$3.25
Supply Chg: 50 kWh x \$0.0269	\$1.35
ECA: 50 kWh x \$0.004	\$0.20
Capacity Chg: 50 kWh x \$0.0014	\$0.07
Access Chg: 26 days x \$0.35	\$9.10
Access Chg: 650 kWh x \$0.0649	\$42.19
Supply Chg: 650 kWh x \$0.0269	\$17.49
ECA: 650 kWh x \$0.003	\$1.95
Capacity Chg: 650 kWh x \$0.0014	\$0.91

ECA = Electric Cost Adjustment
- Save three to five percent more energy for each degree your air conditioner is set above 78 degrees. Set it to 85 degrees or higher when you leave your home for more than four hours.

Total charge this service \$77.21

Gas Residential Service (G1R)

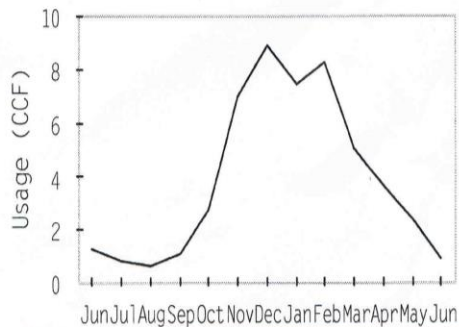
Meter Number: 214436

Reading 06/26/12 1650

Reading 05/29/12 1624

Your average daily usage was 26 Hundred Cubic Feet(CCF)
1 CCF

Average Daily Usage Trend



Access Chg: 28 days x \$0.3773	\$10.56
Access Chg: 26 CCF x \$0.1471	\$3.82
Gas Cost: 26 CCF x \$0.6034	\$15.69
GCA: 2 CCF x \$-0.07	\$0.14 CR
GCA: 24 CCF x \$-0.095	\$2.28 CR

- Barbecuing is for outdoors. Using a grill indoors or in a garage can cause deadly carbon monoxide poisoning. Safety tips at csu.org.

GCA = Gas Cost Adjustment
Total charge this service \$27.65

- KWh = kilowatt-hour
- CCF = hundred cubic feet
- ECA = Electric Cost Adjustment
- GCA = Gas Cost Adjustment
- Access1 charge per day
- Access2 charge per kWh (electric) or CCF (gas)
- Supply charge per kWh or CCF
- ECA per kWh
- GCA per CCF

$$\text{Elec Cost per kWh} = \frac{(\text{Supply} + \text{Access2} + \text{ECA})}{\# \text{ kWh}}$$

$$\text{Gas Cost per CCF} = \frac{(\text{Supply} + \text{Access2} + \text{GCA})}{\# \text{ CCF}}$$

1 CCF GAS = 1.02 THERMS OR ABOUT 1

CSU Bill: Water and Waste Water

Water Residential Service (W-R)

Meter Number: 227601

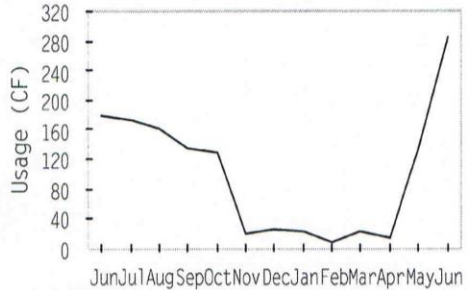
Reading 06/26/12 213632

Reading 05/29/12 205676

7956 Cubic Feet(CF)

Your average daily usage was 284.14 CF

Average Daily Usage Trend



Insd City Service Chg: 28 days x \$0.4244 \$11.88
 Cmdty Chg Blk 1: 999 CF x \$0.0281 \$28.07
 Cmdty Chg Blk 2: 1,500 CF x \$0.0522 \$78.30
 Cmdty Chg Blk 3: 5,457 CF x \$0.0774 \$422.37

To convert CF to gallons, multiply by 7.48
 -Spread a layer of organic mulch around plants to retain moisture and split your watering time into shorter periods to allow for better absorption. Save water, save money.

Total charge this service \$540.62

Wastewater Residential Service (S-R)

Your average daily winter usage 18.34 CF

Insd City Service Chg: 28 days x \$0.5092 \$14.26
 Cmdty Chg: 513 CF x \$0.0246 \$12.62

-Tree roots tend to grow more quickly when its dry and they are looking for water. Make sure your wastewater lines are root free by getting a regular inspection.

Total charge this service \$26.88

Your next scheduled Meter Reading date is 07/27/12

- CF= Cubic Feet (1 CF = 7.48 gallons)
- 3-Tiered rate structure
- Water Service Charge per day
- Wastewater Service Charge per day
- Wastewater Commodity Charge based on avg daily water use between Dec 1 and Feb 28

Accessing Your Utility Data



Utility	History	How do I compare?	URL
Colorado Springs Utilities	YES	Yes	https://www.csu.org/Pages/myusage-r.aspx
Black Hills	YES	Yes	https://bhcg.opower.com/ei/app/signin/index.html
XCEL Energy	YES	Yes	https://myaccount.xcelenergy.com/
Mountain View Electric	YES	No	https://mvea.smarthub.coop/Login.html

- ▶ **CAUTION When viewing comparison reports**
 - ▶ **Average has a LOT of room for improvement**

Next Steps

- ▶ Access your utility bill data and comparison reports.
- ▶ See Colorado State Extension resources on “Links and References” slide

**WOULD YOU BE INTERESTED IN A “BRING YOUR OWN LAPTOP AND UTILITY BILLS”
WORKSHOP?**

WE WILL ASK DURING Q&A

Links and References

- ▶ Colorado State University Extension Home energy efficiency resources
 - ▶ <http://www.ext.colostate.edu/energy/home.html>
- ▶ Energy Star
 - ▶ <https://www.energystar.gov/>
- ▶ “Residential Energy, Cost Savings and Comfort for Existing Buildings”
 - ▶ John Krigger
 - ▶ <https://www.srmi.biz/bookstore/books/bkre-residential-energy>

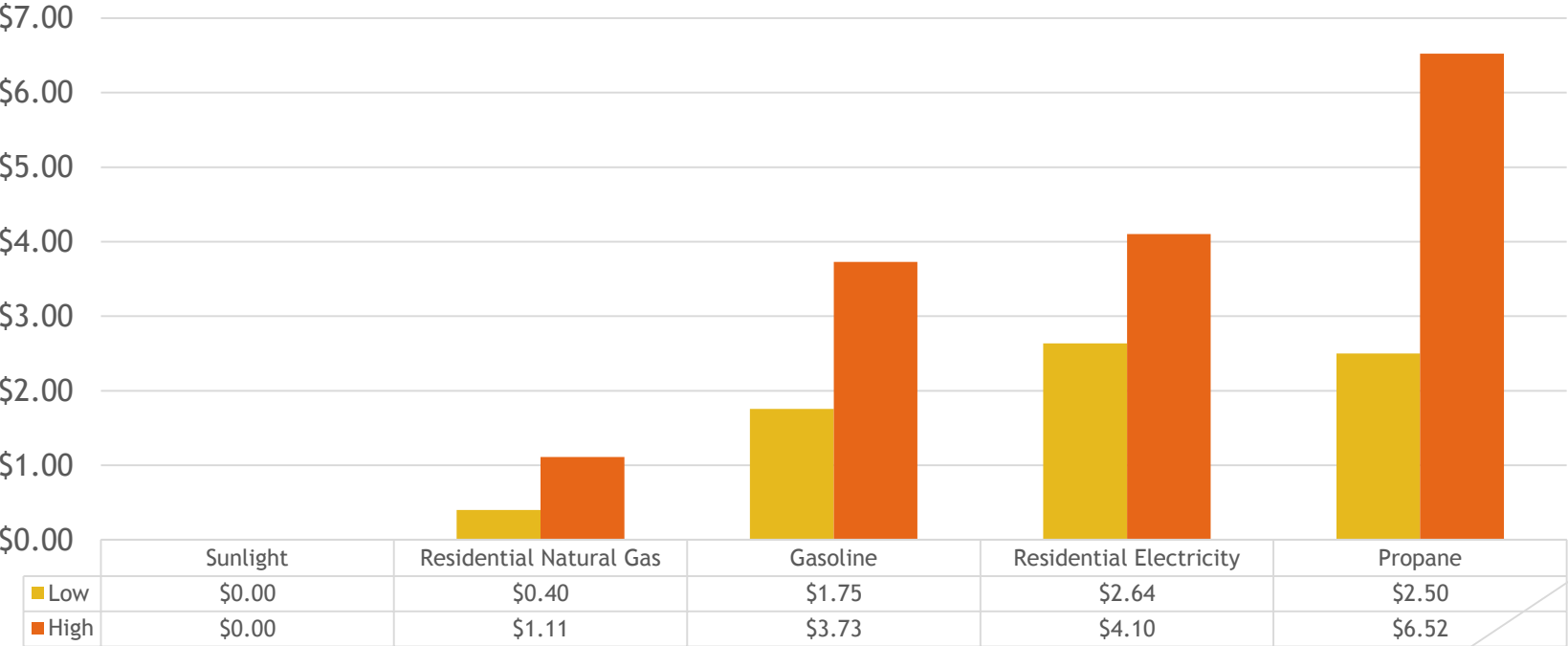
Reference Slides

Energy

Units		BTU equiv	kWh equiv
British Thermal Unit	BTU	1	0.0003
kilowatt-hour	kWh	3,414	1
Therm		100,000	29
Gallon Gas		114,000	33
Gallon Propane		92,000	27
Gallon Ethanol	E100	76,330	22
100 cubic feet Natural Gas	CCF	102,500	30
1 hour of sunlight at noon on 1 sq ft		319	0.093

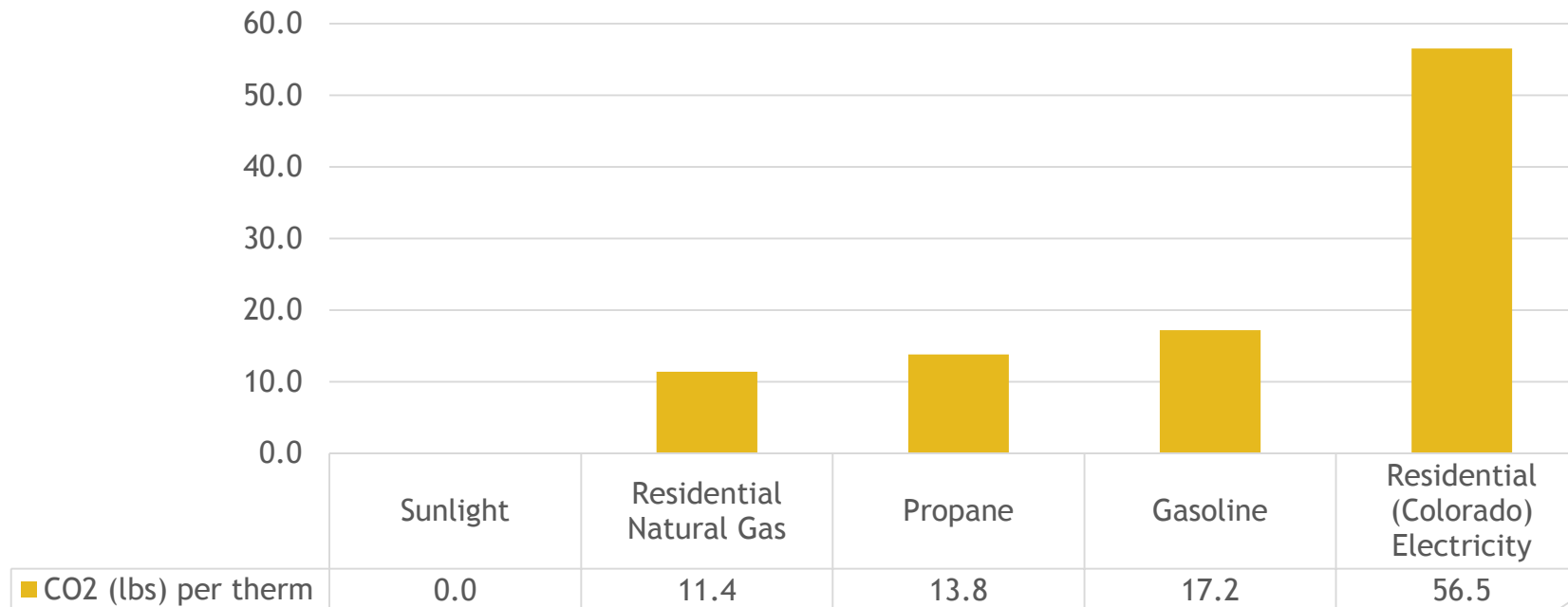
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Understanding Your Energy Bills

Devil in the Details

Electric Service - Account Summary

Invoice Number	[REDACTED]	Residential General	\$70.38
Meter No.	[REDACTED]	GREA	\$8.18
Rate	II Residential General	Air Quality Imp	\$2.43
Current Reading	5275 Actual 10/05/2009	Trans Cost Adj	\$5.03
Previous Reading	4857 Actual 09/03/2009	Elec Commodity Adj	\$12.91
Known-Hours Used	418	Demand Side Mgmt Cost	\$1.84
		Purch Cap Cost Adj	\$5.58
		Renew. Energy Std Adj	\$2.91
		Franchise Fee	\$1.40
		Sales Tax	\$1.91
		Subtotal	\$62.07

Colorado State
Extension

► <http://www.ext.colostate.edu/energytalk/home-energy-bills.html>

► CSU Extension