Utility Bills 101

MSU-IAC Training

1/28/22

Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

MISSISSIPPI STATE UNIVERSITY
INDUSTRIAL ASSESSMENT CENTER

Outline

- Basics of electricity
- Energy vs. Demand
- Example electric bills
- Basics of natural gas
- Example natural gas bills
- Importance of utility bill analysis

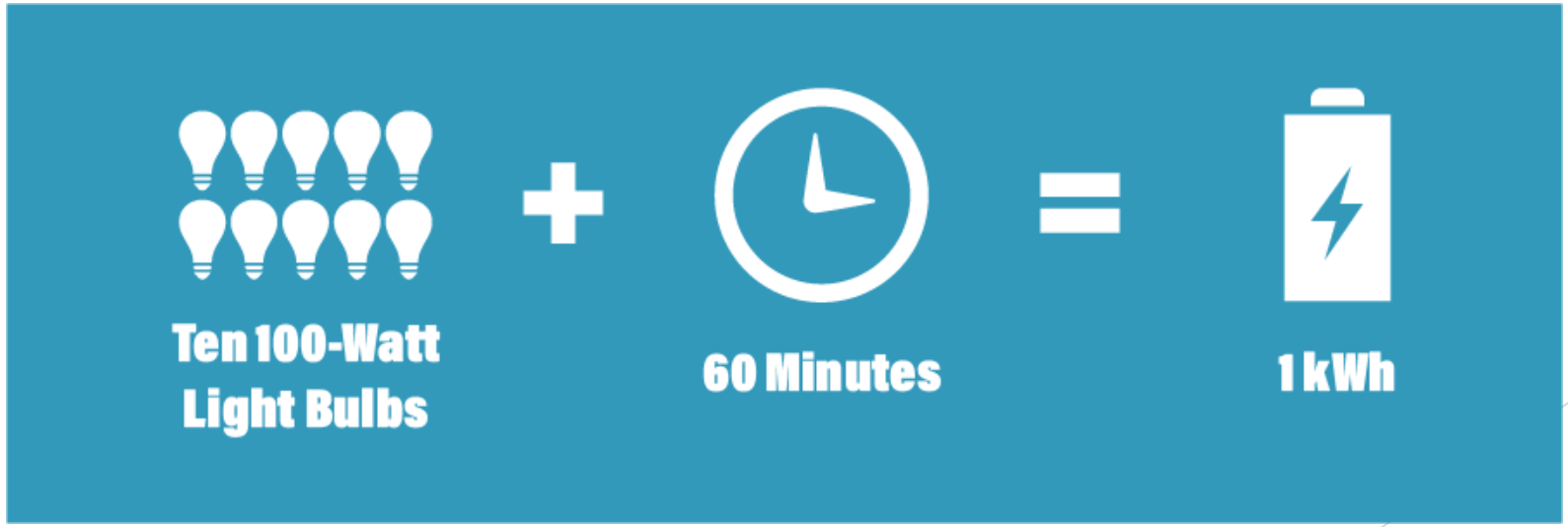
Electrical Consumption & Demand

Basics of electricity bills

kWh vs. kW…What's the difference?

- **kWh:** The basic unit of **energy** – it is equivalent to one kilowatt used over one hour.
- **kW:** The basic unit of **demand** – it is equivalent to 1,000 W of power.

kWh is measured **over time** while kW is measured **instantaneously**



Units of electricity

- 1 kW = 1,000 W
- 1 MWh = 1,000 kWh
- 1 kWh = 3,412 Btu
- 1 HP = 746 W = 0.746 kW

Example:

A coffee maker is rated at 1,000 W. If it takes 6 mins to brew a full pot of coffee, find the:

1. kW rating
2. kWh used

Solution:

$$\frac{\text{wattage of appliance}}{1000} \times \text{number of hours}$$

1. 1 kW = 1000 W... The coffee maker is rated at 1 kW.

2. The coffee maker takes 6 mins = 0.1 hour to brew a full pot...
1 kW * 0.1 hr. = 0.1 kWh.

Energy Usage Patterns

There are several factors that affect energy usage in commercial & industrial facilities…

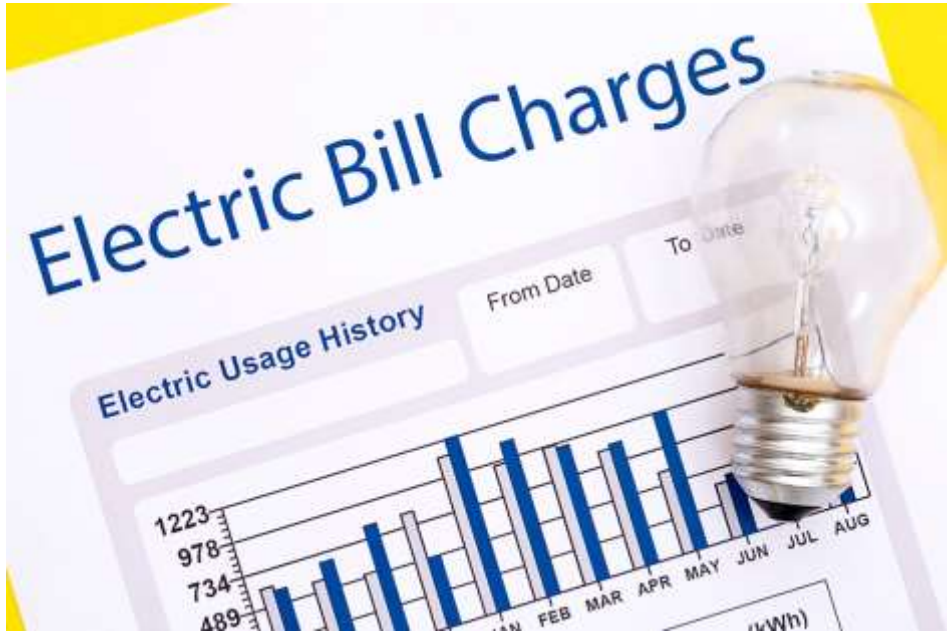
- Productivity
- Manufacturing processes
- Time of Day
- Weather

It is important for facilities to both CONSERVE and MANAGE energy AND demand in order to reduce utility bill costs.

Ways to reduce electric costs

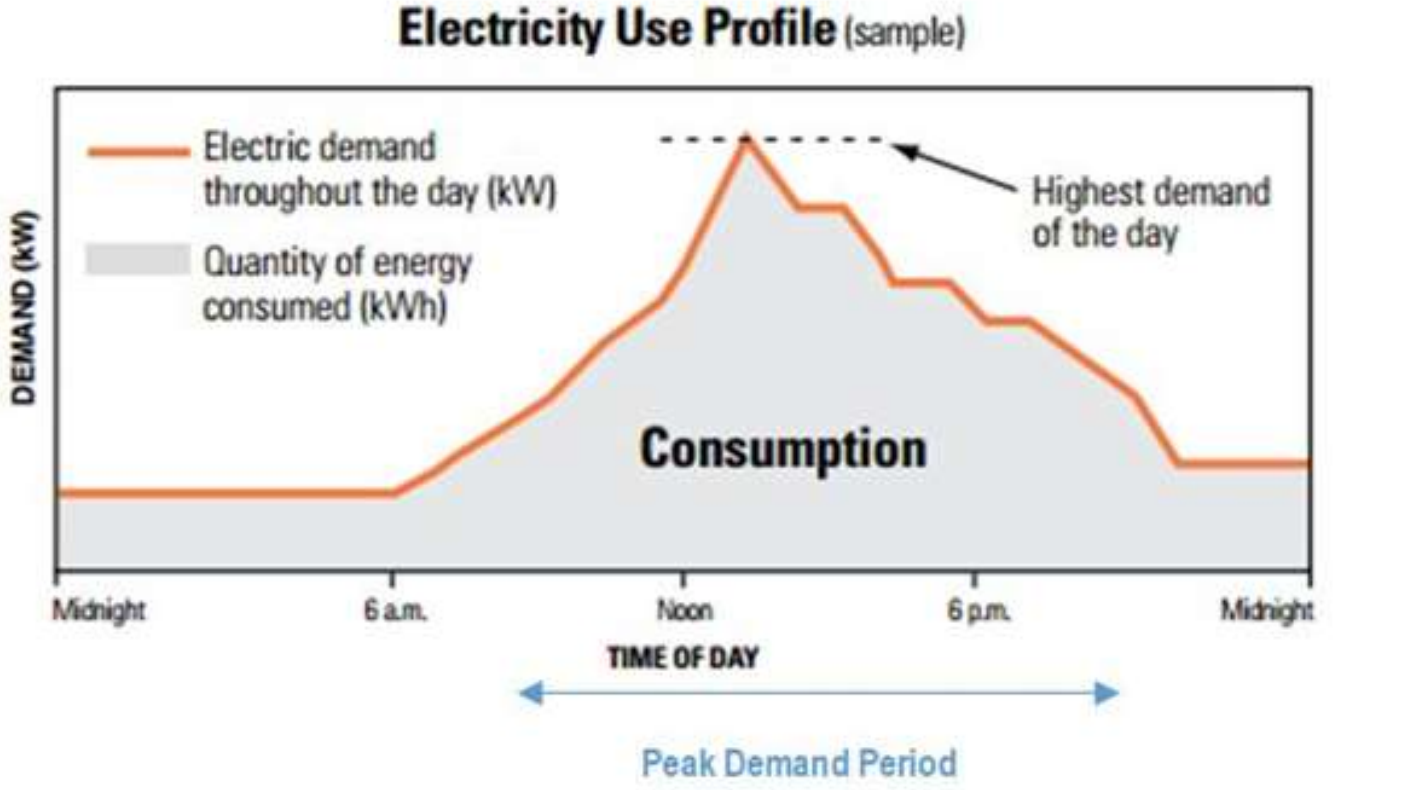
The simplest way to reduce electric costs is to reduce electrical use.

- Reduced electrical use = reduced ENERGY consumption
  - Lower heating and cooling loads
  - Turn off equipment and lights when not in use
  - Upgrade old equipment to energy-efficient equipment
  - Use equipment at part load
  - Install sensors to monitor and control energy-intensive equipment and lighting



What is Peak Demand?

- **Peak demand** is the highest electrical power demand (kW) for a given month over a short time interval of 15-30 minutes.
- For the facility's load profile to the right → the peak demand is around 2 p.m.



Mississippi's Peak Period

- In Mississippi, electricity is most expensive during summer weekday afternoons – this is the utility's **peak period.**
- **It is important when a facility uses electricity**

- Managing peak demand is one of the most important ways to reduce utility bill costs.
  - Oftentimes, there are high charges on utility bills for having a high peak demand.

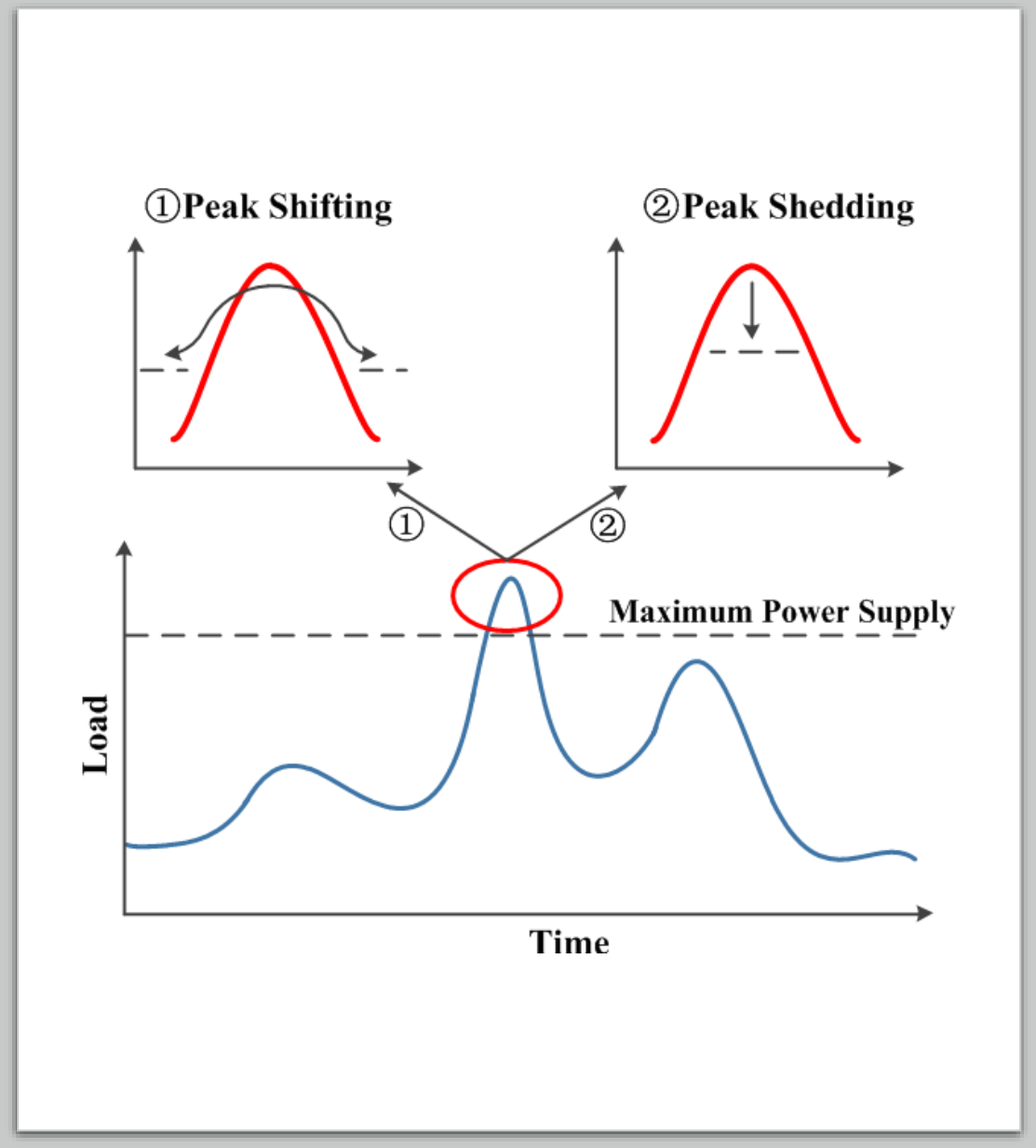
Ways to manage peak demand

Demand *shifting*:

- Stagger start-up loads
- Reschedule energy-intensive activities to off-peak times of the day

Demand *shedding*:

- Scale down production for a short period during peak period
- Increase on-site electricity generation
- Utilize a battery storage system
- Install automatic demand control



Mississippi Electric Utilities

1. Two major investor-owned utilities (IOUs):
- Mississippi Power (southern MS/MS cost)
- Entergy (Central MS)

Mississippi Power

Entergy
WE POWER LIFE℠

2. 26 cooperatives (co-ops):
- Cooperative Energy (11 co-ops)
- Co-ops of TVA (ex. Starkville Utilities)

Cooperative ENERGY

TVA

Example Utility Bill

Georgia Power

Please Pay By	Aug 10, 2020
Total Due	$ 51,568.26

Current Electric Service - Fixed Pricing Alternative/Commercial

1 Service Period	2 Meter #	Reading Type	Meter Reading Current	- Previous	x Constant	= Usage
Jun 25 - Jul 24	EB2845	Tot kWh				503,488.8
		Pk kW				1,748.4
		Onpk kWh				101,279.8
		Offpk kWh				402,209
	5	Pk-kVar				263.2

Billing Period
June 25, 2020 - July 24, 2020

Rate Contract
Energy Rate - Contracted Rate .037077

Current Service	$ 40,275.28
Reactive Demand	0.00
Environmental Compliance Cost	3,713.99
Nuclear Construction Cost Recovery	1,720.55
Municipal Franchise Fee	1,396.02
Sales Tax	4,192.42
Total Current Electric Service	**$ 51,298.26**

Pulse Metering Service	$ 60.00
Pulse Metering Service	**$ 60.00**
Excess Facilities Ongoing Charge	$ 120.00
Excess Facilities Ongoing Charge	**$ 120.00**

Usage Information

3	Tot kWh	503,489
	On Pk kWh	101,280
	Off Pk kWh	402,209
4	Pk kW	1,748
	Excess Pk kVAR	0

Callout	Term	Description
1	Service Period	Period between bills and meter reading
2	Meter Number	Unique identifier associated with your electric meter
3	Total kWh	The difference between the current and previous meter reading
4	Peak kW	Current month actual demand or a % of the highest actual demand in the previous 11 months.
5	Peak kVAR	Peak reactive power

Rate Schedule

ENTERGY MISSISSIPPI, LLC

Date Filed: November 20, 2018
Date to be Effective: December 1, 2018
Docket No.: 2018-UA-39

MISSISSIPPI PUBLIC SERVICE COMMISSION
P.S.C. Schedule No. I-14
Revised Schedule No. 14, Date: December 1, 2018
Superseded Schedule No. 14, Date: January 30, 2015
Schedule Consists of: Three Pages

LARGE GENERAL SERVICE RATE SCHEDULE C-29

I. AVAILABILITY

At any point on Company's existing distribution lines of adequate capacity and suitable voltage.

II. APPLICATION

To all electric service for which no specific schedule is provided, supplied to customers contracting for not less than 1,000 kW, when all service required on the premises is supplied at one point of delivery and measured by one kilowatt-hour meter.

Entergy's Large General Service Rate is for companies with demand requirements **no less than 1,000 kW**.

Different Rate Schedules

- Time-of-Use (TOU):
  - The time that energy is used determines the price of that energy (on-peak/off-peak pricing).
- Critical peak pricing (CPP):
  - Electricity rates increase significantly during a peak event in exchange for a reduced rate during non-peak hours.
  - Customers reduce their electricity usage during peak times to avoid the extra cost.
- Real-Time pricing (RTP):
  - The price of electricity changes hourly in response to changes in weather, grid load, and other factors.

All three of these rate schedules encourage customers to use electricity during off-peak periods to help manage high-grid demand conditions!

Peak Demand

CUSTOMER'S DEMAND

The average kW supplied during the fifteen-minute period of Customer's greatest use in the Day Hours (Day Load) of the current month plus 25% (for Primary Service) or 33 1/3% (in all other cases) of the amount by which the average kW supplied during the fifteen-minute period of Customer's greatest use in the Night Hours (Night Load) of the current month exceeds the Day Load, but not less than the highest of the following:

(1) 80% of the highest kW so established in the prior eleven months, or

(2) the minimum kW provided in the Agreement for Service, or

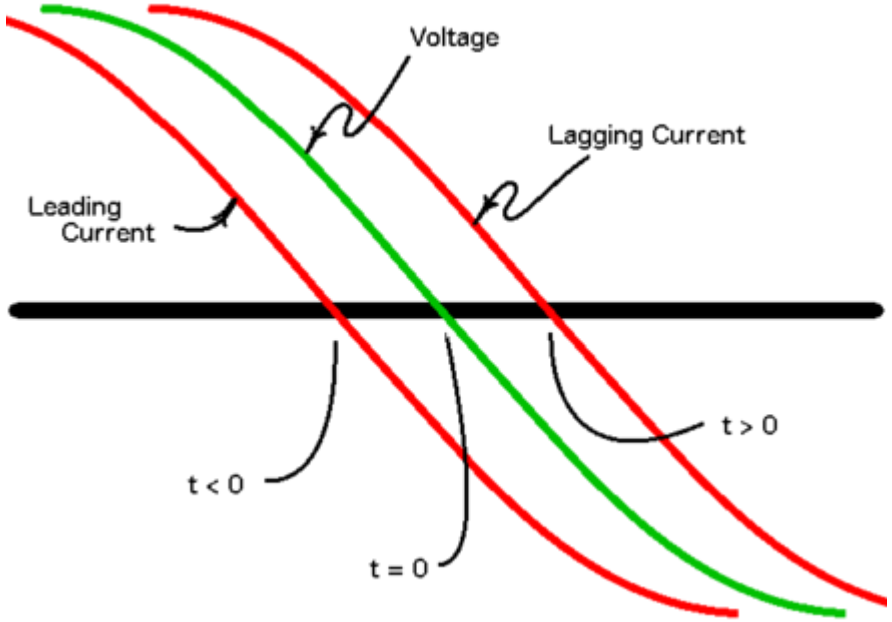
(3) 1,000 kW.

If the instantaneous load exceeds the highest average fifteen-minute load by an unusual amount, such instantaneous load may be taken as the demand used for billing.

Entergy's Peak Demand Requirements:

Highest 15 min demand reading during the day of the current month IF is greater than...

Power Formulas



Single Phase Power (1ϕ)

Residential / Commercial

$P = I \times V \times PF / 1{,}000$[1]

$V = 120\text{-}240\ V$

Three Phase Power (3ϕ)

Commercial / Industrial

$P = \sqrt{3} \times I \times V \times PF / 1{,}000$[1]

$V = 480\text{-}600\ V$

Lagging current: Inductive loads

Leading current: Capacitive loads

In-phase current: Resistive loads

[1] Power in kW, Voltage in Volts, Current in Amps

kW, kVA, kVAR...?

- kW: *working or actual power:* actual power used for the equipment to perform useful *work*.
- kVAR: *reactive power:* power that is either generated or absorbed by electric generators to maintain a constant voltage level
- kVA: *apparent power:* "vectorial sum" of kVAR and kW.

$$KVA = \sqrt{KW^2 + KVAR^2}$$

kW, kVA, kVAR…?

$$P.F. = \frac{KW}{KW + KVAR}$$

$$P.F. = \frac{Beer}{Beer + Foam}$$

- The lower a facility's kW (actual power)… the lower the power factor.
- Facilities want their power factor to be closest to 1 (little to no kVAR…all kW).
- Utility companies penalize facilities with an extra charge if the power factor falls below 85-90%.

Power Factor

VI. EXCESS KVAR

The average KVAR supplied during the 15-minute period of greatest KVAR use during the current month in excess of 60% of Customer's Demand for the current month. A KVAR meter will be installed where tests indicate a power factor less than 85%.

Entergy's kVAR Requirements:

-Power factor at least 85%

Ways to improve power factor:

- Install a power factor correction capacitor which can decrease the reactive power (kVAR)
- Operate inductive loads, such as motors, closest to full load

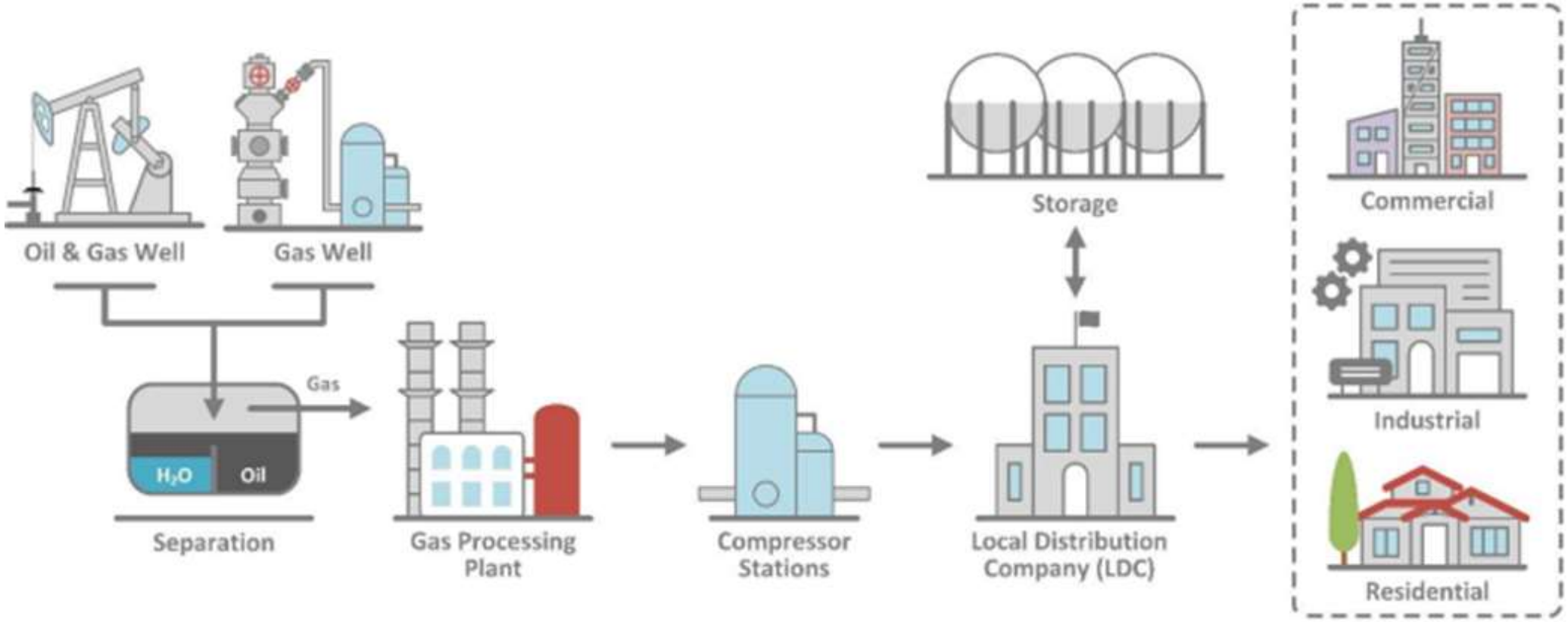
Natural Gas Consumption

Basics of natural gas bills

What is natural gas?

- Natural gas is a fossil fuel comprised mostly of methane (CH_4).
- Natural gas is considered a cleaner fossil fuel than coal and oil.
- When NG is burned, it produces CO_2, water vapor, and nitrogen oxide.
- Not as clean as electricity or renewables
- NG is popular in industry for its:
  - Ease of availability,
  - Cleaner burning properties
  - Market deregulation
  - Increased domestic production

Schematic of Natural Gas Extraction to End-Use



Units of natural gas

- 1 cubic foot (cf) = 1,000 Btu
- 100 cf = 1 ccf= 1 therm = 100,000 Btus
- 1,000 cf = 1 mcf = 10 therm = 1,000,000 Btu

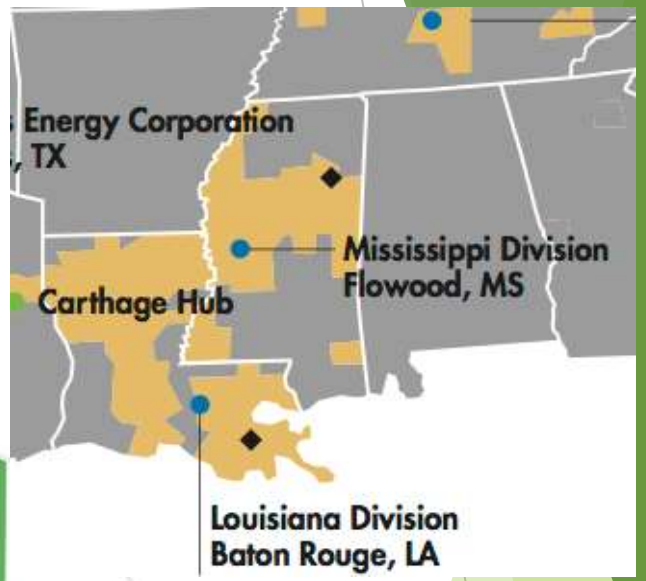
Mississippi Natural Gas Utilities

Three major NG distribution companies:

1. Atmos Energy

2. CenterPoint Energy

3. Spire Energy



Natural Gas Bill Charges

- **Customer charge:**
  - A fixed charge seen on every bill
  - Independent of NG consumption for the billing period
  - Typically, $/month charge
- **Natural gas commodity charge:** The cost of NG consumed at the facility (purchased gas cost)
- **Distribution charge:**
  - Charge from pipeline company for the transport of natural gas
  - Directly related to volume of NG delivered to facility

Natural Gas Bill Charges

- **Demand charge:**
  - Maximum daily quantity (MDQ)
  - The maximum NG quantity consumed by a customer in continuous 24-hour period.
- **Other charges:**
  - Storage charges
  - Environmental surcharge: cost of equipment and other expenses to comply with EPA regulations on power plant emissions.
  - Energy efficiency program surcharge: cost to recover the costs of energy efficiency programs

Rate Schedule

ATMOS ENERGY CORPORATION

MISSISSIPPI PUBLIC SERVICE COMMISSION
PSC Rate Schedule No. 308 (Second Revised)

Docket No. 05-UN-0503

Date Filed: March 1, 2019
Date Effective: April 1, 2019

Schedule consists of: Two Pages
Page 1 of 2

RATE SCHEDULE 308
LARGE VOLUME SERVICE

AVAILABILITY

At points on existing facilities of adequate capacity and suitable pressure when natural gas is obtained in sufficient quantities for all requirements of distribution by Company.

APPLICATION

For all gas service to a customer whose consumption (or estimated consumption in the case of a new customer) during any one day in the twelve months period preceding the last billing date is 1,000 Mcf or more. Gas service under this schedule is to be delivered at a single point of delivery and is for the exclusive use of the customer and shall not be resold or shared with others. Not for standby or supplementary service.

Atmos Energy's Large Volume Service Rate is for companies with max daily consumption of **1,000 mcf** within 12-month period.

Rate Schedule

Atmos Energy's Large Volume Service Rate

NET MONTHLY RATE	
Customer Charge:	$245.90
Demand Charge:	Charge Per Mcf of Contract Demand as Determined in Purchased Gas Adjustment
Distribution Charge For All Mcf:	$ .6561 Per Mcf
Monthly Minimum:	$245.90 Plus Contract Demand Charge

Table 2. Sample Natural Gas Bill for a Commercial Customer

Charges				**Rate - LVG**	1
Delivery					
Service Charge				$91.89	2
Distribution charge					
First	1000.000 therms	x	$0.0668400	66.84	3
Next	1316.286 therms	x	$0.0440400	57.97	
Demand	99.707 therms	x	$3.509082	349.88	4
Balancing charge	2205.920 therms	x	$0.09595540	211.67	5
Societal Benefits	2316.286 therms	x	$0.03879050	89.85	
Total Delivery				**$868.10**	6
Supply					
BGSS Commodity	2316.286 therms	x	$0.966873	2239.55	7
Total Supply				**$2239.55**	
Total gas charges				**$3107.65**	8

Usage	**Meter 123456789**		
Actual Reading Feb 1	17873		
Actual Reading Jan 1	15652		
Difference	2220		
Conversion to CCF	x 1.0120	*(CCF = One hundred cubic feet)*	
CCF Total	2246.640		
Conversion to therms	x 1.031		
Total therms	2316.286		8

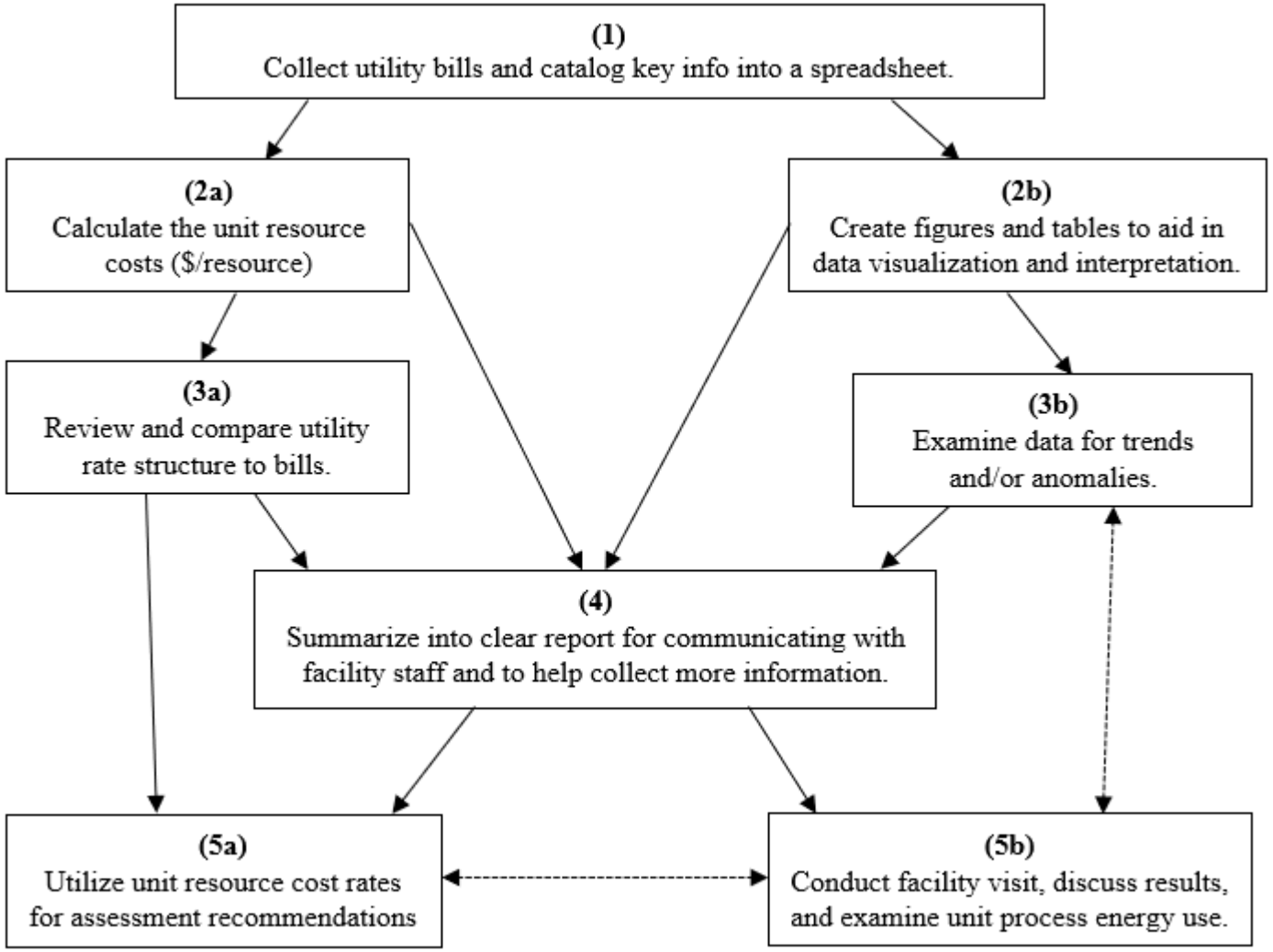
Callout	Term	Description
1	Rate Class	Large Volume Service
2	Customer Charge	Fixed monthly charge for being a customer
3	Distribution Charge	Charge for cost of delivering gas
4	Demand Charge	Average daily usage for winter month with maximum consumption
5	Balancing Charge	Adjustment to account for imbalance btwn summer and winter usage
6	Total delivery charge	
7	Commodity charge	$/unit natural gas consumed at facility
8	Total supply charge	

Importance of Utility Bill Analysis

Utility bill analysis is a useful metric for:

1. **Estimating** energy consumption and the per unit cost of energy
2. **Identifying** energy use patterns in the facility
3. **Determining** baseline usage of the facility
4. **Quantifying** savings of energy efficiency recommendations

Typical Methodology for Utility Bill Analysis



Optional materials for this module

- Review supplemental PDFs found here:
  https://betterbuildingssolutioncenter.energy.gov/better-plants/online-learning-for-industrial

1. The Basics of Energy
2. Understanding your Electric Bill
3. Understanding your Natural Gas Bill

- Read the "Utility Bill Analysis Methodology" (3-page word document)

Microsoft Word Document

- Review this article on Degree Days and Weather Normalization

Degree Days and Weather Normalization - Energy Forums

Questions?