Utility Bills 101

Typical Electric Bills Regulated Utilities
- Energy & Demand in kWh; kW
- Billed, Actual, Contract, Excess Demand, Coincident Peak
- Time of Use; On Peak, Off Peak, Seasonal Date & Times
- Power Factor; kVA; Correction strategies
- Hidden costs in rates (Riders); find your rate schedules; OPTions
- Interval Data; how to get it, what it can do for you

Nat Gas Billing:
- Read your bills, contracts; seasonal strategies
- Purchasing Contract Nat. Gas

Water and Sewer
- Water billing; units, gal., 1,000 gal, CCF, sewer, stormwater fees

Case Studies
- Municipal Electric Utility: Power Factor Penalty due to meter error
- Negative Power Factor Penalty due to Overcorrection
- Demand Response: Contract Peak Load Reduction Not Applicable
- Demand Response: Shared Savings with third party not necessary
- Rate Savings Opportunities working with Utility companies, OPTions for credits
- Third Party Billing Services: Process bills and get data
- Ratchet reset due to equipment failure
- New construction ratchet transformer changeout
**Difference in Energy and Demand**

**Electricity** is like water – it flows like water in a pipe.
- Electric “Current” is flow of electrons in wires

**Demand** – How fast is the Flow Rate? Gallons per minute? (GPM).
- How many Watts turned on?
- Typically measured in kilowatts (kW).

**Energy** – How many gallons used over a period of time?
- How many Watts x run hours?
- Typically measured in kilowatt-hours (kWh)
Electric Bill Energy Costs

**Energy** measured or billed in **kWh** (typically)
Also called **Usage** or **Consumption**

Energy = Work (to run a motor, light a bulb) over time
- How much electric Work did you do in a month?
- How many kWh did you consume?

1. Energy = kW x hours = kWh
   (kilowatt-hour)

OR

2. Energy = KVA x hours = KVAh
   (kilovolt-amp-hour)
**KW, KVA = “Demand” for Power Electric “Power” Company**

Power = Watts = Volts x Amps = VA = W

Power = Work/time = Energy per hour

How fast is energy flowing? At what rate?

1000 W microwave cooks faster than 500 W.

Measured in 15 or 30 minute *intervals*,
averaged over time, depends on meter

Think: How big (how many watts) is your light bulb?

1. Billed as: **Demand kW** (kilowatt) = 1,000 W
   
   1000 W = 10 x 100 W light bulbs = 1 kW

**OR**

2. Billed as **Demand KVA** (kilovolt-amp) = 1,000 x VA

   KVA includes Power Factor Penalty! (more to come)
Typical Electric Bill

Monthly Facilities Charge
- $12 to $500 (based on rate “class”)
- Fixed monthly fee to provide electric service
- Based on size of equipment, transformers, 1 or 3 phases

Energy Charge
- kWh x $ per kWh (energy rate)
- ~ $0.10 per kWh
- Rate may vary based on Time of Day, Month

Demand Cost
- kW x $ per kW (demand rate)
- ~ $10 per kW
Typical Electric Rates
Rate Classifications

General Service (GS) Rates

• Rate “class” based on annual Peak Demand kW
  • How much load or power needed
  • More power requires more costly equipment, i.e., larger transformers
• Small (less than 30 kW)
• Medium (30 kW to 1000 kW)
• Large (over 1000 kW)
• Commercial
• Industrial
• One phase or three phase power
• Brackets (size by kW) vary by utility company
Typical LGS (Large General Service)

MONTHLY RATE

I. Basic Customer Charge: $154.85

II. kW Demand Charge: (Stepped)
   $11.23 per kW for the first 5,000 kW of Billing Demand
   $10.26 per kW for the next 5,000 kW of Billing Demand
   $ 9.29 per kW for all over 10,000 kW of Billing Demand

III. kWh Energy Charge: 5.575¢ per kWh
Voltage Distribution Industrial Rates

Low Voltage is 480V; 3 phase power
- Most expensive
- Utility provides & maintains step-down transformers

Distribution Service 2 kV to 50 kV (Varies)
- Customer usually supplies and maintains transformers

Transmission Service greater than 50 kV (Varies)
- Least expensive
- Customer supplies and maintains transformers

Where is meter located?
- If meter on load side of customer transformer, rate may include transformer loss calculation
Types of Billing Demand

**CONTRACT DEMAND**
- The KW of demand specified in the “Service Agreement” (Where?)
- Estimated from Design Peak Load when new service is established.

**ACTUAL DEMAND**
- 15 or 30 min. average KW (as measured or calculated by demand meter)
- Peak Demand = maximum measured in a month

**BILLED DEMAND** - See Rate or Tariff Definition (next page!)
- May not be ACTUAL
- “Ratchet”
“The **Billing Demand** shall be the **maximum kW** registered or computed, by or from Company's metering facilities, during any **15-minute interval** within the current billing month.

**However**, the Billing Demand **shall not be less than the greater of**:

1. **80%** of the maximum monthly 15-minute demand during the billing months of **July through October** of the preceding 11 billing months (Summer Peaking)

2. **60%** of the maximum monthly 15-minute demand during the billing months of **November through June** of the preceding 11 billing months (Winter Peaking)

3. **75%** of the **Contract Demand** until such time as the Billing Demand first equals or exceeds the effective Contract Demand, or

4. **1,000 kW**.

**Billing Demand is your Minimum Demand Billing**

Courtesy Duke Energy Progress LGS Rate
# Find kWh Usage, $ and KW Demand, $

## Customer Bill

- **Account number**: 9860
- **Total due**: $1,904.39
- **Current charges past due after**: Feb 4
- **Thank you for your payment**: Jan 2 / $2,113.30
- **Usage period**: Dec 18 - Jan 20
- **This bill was mailed on**: January 21, 2004

### Usage
- **Meter number**: TA3536
- **Readings**: Jan 20 9787, Dec 18 9588
- **Meter constant**: x 120
- **kWh usage**: 23880
- **Days in period**: 33
- **Average kWh per day**: 724

**Actual kW Demand**: 80.40

### Billing

<table>
<thead>
<tr>
<th>MGS rate</th>
<th>33 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic customer charge</strong></td>
<td>12.00</td>
</tr>
<tr>
<td><strong>Energy charge</strong></td>
<td>23,880 kWh x $0.05132</td>
</tr>
<tr>
<td><strong>Demand charge</strong></td>
<td>(80% of 132.00 kw (09/03))</td>
</tr>
<tr>
<td><strong>Three phase service charge</strong></td>
<td>9.00</td>
</tr>
</tbody>
</table>

### ALS rate

- **Metal halide light, 160 kwh, 40000 lumens, flood**
  - Area lighting
  - 1 Light x $25.63 = 25.63
  - Wood pole charge
  - 1 Pole x $2.16 = 2.16

- **High Pressure Sodium light, 46 kwh, 9500 lumens, flood**
  - Area lighting
  - 1 Light x $11.15 = 11.15

- **High Pressure Sodium lights, 109 kwh, 28500 lumens, flood**
  - Area lighting
  - 3 Lights x $15.69 = 47.07

### 3% North Carolina sales tax
- **Total due**: $1,904.39

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*Please detach here. Turn over for helpful phone numbers and customer service tips.*
Coincident Peak

- Customers of Municipal Power Companies or other utilities who buy wholesale power, or Deregulated utilities (other states)
- Coincident peak is your demand kW measured when the hourly IOU system monthly peak occurs
- Highest costs for kW during generation company peak demand for the system total as set by their customers
- Up to $35 per kW during coincident peak
- Some municipal utilities install peaking generation
- Demand-side Management (DSM) programs pay $
- Load shedding, shaving or curtailment
- Notification programs when Peak is to occur
- Weather dependent; can be winter peak for heat pumps
- ERCOT (TX) or PJM (Northeast) deregulated markets have historical data online; typically 4 to 5 pm
- Shut down early in summer; work 3am to noon Alabama
Time of Use (TOU) Rates

Higher rates during “peak” times
- Summer afternoons, Winter mornings

Lower rates charged “off-peak” to encourage:
- peak shifting (scheduling)
- peak shaving (turn some things off)

Some utilities have very long duration summer “peaks”
6 am to 4 pm; 10 am to 10 pm; 6 am to 12 am

- Read the rates and watch for seasonal changes, especially if occurring over the weekend
- Need to reset manual timers or digital controls setpoints unless Astronomical Time Clock w/DST
Load Factor

What percentage of maximum possible energy (kWh) did you use in a month?

- Maximum hours in a month:
  \[24\text{hr} \times 30\text{d} = 720 \text{ hrs per month}\]
- Max kWh = Monthly Peak Demand (kW) x hrs
- 500 KW Peak x 720 hours = 36,000 kWhs
- If monthly metered usage = 20,000 kWhs

\[\text{Load Factor} = \frac{20,000}{36,000} = 0.56 \text{ LF}\]

Load Factor less than 40%: one shift operations
Load Factor greater than 70%: 3 shifts

Electric Utilities prefer higher load factors

High LF with 1 shift = opportunity to turn things off
Power Factor Penalty

- kVA = Utility delivered power to meter
- kW = power used by customer to do work
- kVA x Power Factor = kW or PF = kW/kVA
- Power Factor = Reactive losses in motors, magnetic windings
  - Power factor reduces “usable” power
  - Losses measured in KVAR (kilovolt-amps reactive)
  - Electric Resistance heat has PF = 1.0 (No losses)
- Utilities set PF targets = 80-90% w/penalties if below target
- Example: Penalty for PF below 90%; actual PF = 82%
  - KW billed = KW actual x 90/actual PF
  - KW billed = 200 KW x 90/82 = 220 KW; added 20 KW

Do I have a Power Factor Penalty?
- If billed in KVA; includes PF penalty built in!
- If billed in KW, may have a line item for PF Penalty
  - Easiest to spot!
- If little or no penalty, don’t need PF Correction!
Power Factor Penalties

SAMPLE POWER FACTOR ADJUSTMENT CLAUSE

“When the power factor in the current billing month is less than 85%, the monthly bill will be increased by a sum equal to $0.34 multiplied by the difference between the maximum reactive kilovolt-amperes (kVAr) registered by a demand meter suitable for measuring the demands used during a 15-minute interval and 62% of the maximum kW demand registered in the current billing month.”

Duke Energy Progress

- Penalties usually greatest for municipal power companies who buy wholesale power
- Low power factor increases current, heat, maintenance, I²R losses
- Low power factor means more kVA power required to be generated

Solutions?: Power Factor Correction

- Line Capacitors installed by Utilities; request assistance
- Stepped Capacitor Banks correctly sized by power quality measurements at the equipment Motor Control Center or at Transformer
- Watch for harmonics
Other Monthly Charges

Fuel Cost Adjustment- usually in Rate or Rider
  • Passed through as allowed by utility commissions
  • Natural gas yields credits from fuel switching

Renewable Energy &/or Demand Side Management program charges- usually in Rate or Rider
  • May be opt out provision; check rate schedules
  • Ask utility account manager

Lighting: Area lights leased monthly by type and pole
  • Pole audit; only pay for poles on your property
  • Are your poles metered (pay for kWh)? Change to LED

Taxes
  • State, Municipal, Gross Receipts; Varies by State
  • Based on meter location; check for exemptions

Additional Facilities (do you know what this is for?)

Municipal Utility Bills may include all utilities; water, wastewater, waste management, telecom, etc.
Large Utilities: Many Rates

- Riders/Billing Adjustment (RE, EE & DSM programs)
- All Electric
- Churches
- Seasonal (sports lighting)
- Mining
- Real-Time Pricing
- Interruptible (Demand-side Management)
- Co-generation, Thermal Storage
- Renewable/Solar
- Experimental
- Economic Development
- Special Requests! Negotiate with utility
- RATES CHANGE FREQUENTLY!
**Interval Meter Data: Load Profile**

How many Intervals in a month? 15 min. interval meter is most common

4 avg. kW/hour x 24 hours = 96 intervals/day

96 intervals x 30 days = **2,880** readings per mo.

*Graph it* = Demand Profile  KW vs. Time

Utilities offer as fee service: monthly, daily, real time
May provide historical data annually at no cost
How to Estimate Energy Savings for Projects?

1. Average cost per kWh for time period
   - Total cost/total kWh = avg. $/kWh
   - Blended rate includes demand “savings”
   - Project may not impact demand
   - Not typically the most accurate

2. Billed cost savings per rate schedule
   - Project demand savings x kW rate
   - Project energy savings x kWh rate
   - Time of Use Rates? Operating time of day?
   - Parking lot lighting only at night
   - Include monthly facilities charges x 12 for total $
**Natural Gas**

Units of billing and conversions:

- Therms (th) = 100,000 BTUs
- Dekatherm (dt) = 10 x therms = 1,000,000 BTUs
- CF = cubic feet = approx. 1000 BTUs
- CCF = 100 cubic feet = 1 therm
- BTU x Heat Rate Factor = therms
- BTUs British Thermal Unit
- 1 MMBTU = 1,000,000 BTUs

LDC Local Distribution Company delivers gas to end-users
PSNC, Piedmont (bought by Duke Energy)
Metered in CF; converted to therms

Transport Gas = Pipeline Gas; for large users (see LDC rates)
less $$ than from LDC
State Contract with Texican
You may receive two bills, so don’t double count units!
Water-Sewer Bill Tips

Units of Consumption: May or may not be on the bill
  • Gallons, 1,000 gallons, CF, CCF, “units”
  • Go to Utility Website: Municipal utilities

Sewer charges usually same utility; don’t double count usage!

Rates!
  • Sewer usually double water rate
  • City Limits? Are you in or out? May be higher rates OS (outside!)
  • Sewer deduct for water tower evaporation; add meter to makeup
  • Sewer deduct for irrigation
  • Fixed monthly fee based on meter size; can request smaller meters

Monitor monthly bills:
  Spikes = leaks, toilets running, broken line
  Zero consumption? Broken meter or no usage
  Request account to be closed, save on monthly fee

Stormwater fee = property tax?! Cost per sf impermeable area

Department of Environmental Quality
Lessons Learned

Power Factor Penalty $5,000 +
- Installed 1000 KVAR Capacitor Banks $$$
- No change to Power Factor Penalty
- Utility changed demand meter
- PF went from 0.62 to 0.85
- Reviewed daily demand meter data provided in spreadsheet from utility for 15 min. KW, KVAR
- Old PF meter programmed taking average every 15 min. instead of peak; very low PF at low loads at night

Power Factor Penalty for PF greater than 1
- approximately $500 per month for years
- Utility Company installed PF correction on incoming distribution lines
- Capacitors oversized; loads changed?
- PF over-corrected to Leading PF (vs. Lagging)
- Customer unable to fix; requested assistance from utility
Lessons Learned

$28,000 billing adjustment (refund) for broken equipment in July; reset peak to September (historical) and reduced ratchet and # months on ratchet
• Large contract demand 638 KW, rate MGS signed March 2015
• Rate changed to LGS for transformer size > 500 kW September 2015
• Cost per kw $11 to $17
• Utility changed transformer; new bill for 200 kW = $1,924
Lessons Learned Data Mgmt

3rd Party Bill Management Services
• Fixed fee per bill per month
• All billing data captured in database
• Bills routed to 3rd party
• Web-based reporting, graphs
• Bill Payment optional (can upload payment data)
• Exception reporting automated to spot errors, water leaks, controls issues
• Upload site data for KPIs (number students, widgets, prisoners)

Manual tracking of billed data in spreadsheets time-consuming plus possible data entry errors

Do-it-yourself: Portfolio Manager is FREE DOE tool
 upload spreadsheets, weather normalization option,
 soon to include kW tracking

Packaged Energy Management software; some with data-entry options

“Enterprise” accounting software- IT added field for Units
Steps to $ucce$$

• Read the bills; review all data and charges
• Meet with your Utility Account Manager
• Sign up for Utility websites for services, rates, tools, newsletters
• 1 to 2 year billing history by account; download or copy and paste
• Request rate reviews from utility annually
• Read the Rates and Tariffs for specifics on:
  • Demand kW tiers, Billing Demand, Ratchets,
  • Time-of-Use seasonal dates and times,
  • Power Factor calculations, Riders, etc.
• Request and read your utility contracts for service agreement, contract demand, voltage,
  • Transformer sizes, renewal and expiration dates
• Caught on Ratchet? Need to lower contract kW?
• Track the data and graph monthly to spot opportunities
• Typically 1-2% Savings from Utility Bill and Rate Reviews
• More savings with Demand Response programs!
“If you don’t ask, you don’t get!”

Questions?

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THANK YOU!