Farm Energy IQ

Farms Today Securing Our Energy Future

Buying Electricity in a Time Differentiated Market

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Buying Electricity in a Time Differentiated Market

Introductions

Buying Electricity in a Time Differentiated Market

Topics for today's discussion:

1. Definition of a *time differentiated market*
2. Deregulation background information
3. Electricity bill components
4. Identifying energy intensive applications
5. Methods of shifting energy use during the day
6. Estimating potential energy savings

Buying Electricity in a Time Differentiated Market

Learning Objectives:

1. Describe why electricity prices vary with time
2. Understand how electricity supply came to be deregulated
3. Understand day ahead pricing
4. Know how to monitor your farm electricity use

First, Some History

To help understand the present electricity market, we will take a quick peek into the past.

- Electric companies started out with a generator in a building in town
- They ran wires to whoever wanted electricity
- They bought fuel, operated generators, ran wires, metered electricity use, and sent bills; thereby providing "bundled" electric service to customers

More History

As electric service availability expanded, electric companies competed for new customers. The average cost to provide electric service rose as duplicate distribution facilities were built by the competitors. In an effort to control the cost of electric service, companies were granted exclusive service territories if they agreed to be regulated. Regulation of electric service was born!

Deregulation

Generally speaking, unregulated markets are more economically efficient than regulated markets. We still don't want duplicate facilities though. They are expensive. To minimize costs, therefore, transmission and distribution remain regulated. Only the generation or supply is deregulated and treated as a "commodity" (in some states).

Buying Electricity in a Time Differentiated Market

- Electric deregulation unbundled (separated) the components of electric service and deregulated the generation (supply) component.
- A deregulated electric distribution company (EDC) does not own generation
- The EDC purchases electricity from suppliers and passes the cost directly to the end user

Electric Bill Components

Prior to deregulation, electric bill charges were "bundled". That is, there was one energy charge on the bill which included energy charges related to electrical distribution, transmission, and generation. Demand charges were handled similarly.

When deregulation was implemented, billing components had to be separated or "unbundled" so that customers could be billed correctly regardless of where they purchased their generation (supply).

Billing Changes due to Deregulation

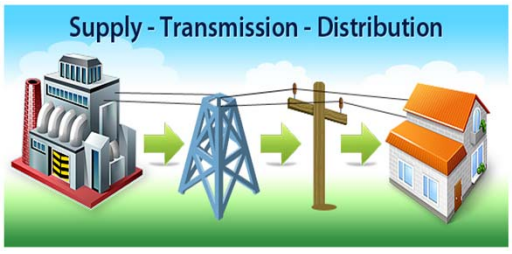
Bundled Billing

- Customer charge
- Demand charge (if applicable)
- Energy charge

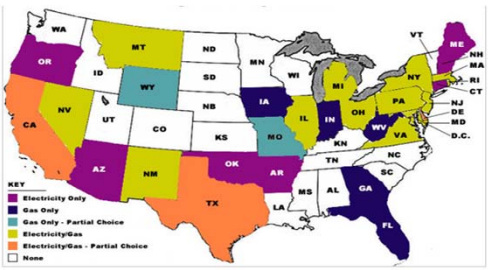
Unbundled Billing

- Customer charge
- Distribution charges
  - Demand
  - Energy
- Transmission charges
  - Demand
  - Energy
- Generation charges
  - Demand
  - Energy

Electric System



Status of Utility Deregulation by State



Map courtesy of QuantumGas.com

Deregulation

Legislative goals

- Lower electric prices relative to regulated rates
- Create a competitive market with real choices of suppliers (generators)
- Encourage the availability of new products and services

Buying Energy in a Time Differentiated Market

Time Differentiated Market:

"(Time-based pricing) is a pricing strategy where the provider of a service or supplier of a commodity, may vary the price depending on the time-of-day when the service is provided or the commodity is delivered. The rationale of time-based pricing is the expected or observed change of the supply and demand balance over time."

Source: http://en.wikipedia.org/wiki/Time-based_pricing

The Language of Large Electric Use

- Generally, when you receive your electric bill, the electric load (demand) is expressed in kilowatts (kW)
- Your energy use is expressed in kilowatt-hours (kWh)
- For your electric company's total load, megawatts (MW) are used (1,000 kW = 1 MW)
- For your electric company's total energy, megawatt-hours (MWh) are used (1,000 kWh = 1 MWh)

The Billing Calculation for Real Time Pricing

West Penn Power (PA) Tariff, Page 36-1:

HP Energy Charge per kWh:

$$HP_{Energy\ Charge} = \sum_{t=1}^{n} [kWh_t \times (LMP_t + HP_{Anc}) \times HP_{Loss\ Multipliers}]$$

Where:

n = Total number of hours in the billing period

t = An hour in the billing period

LMP = the "Real Time" PJM load-weighted average Locational Marginal Price for the APS Transmission Zone

HP_{Anc} = $0.00200 per kWh for ancillary services

$HP_{Loss\ Multipliers}$:

Rates 20, 22, 23, 24, and 30 (small)	1.0899
Rate 30 (large)	1.0678
Rates 40, 41, 44, 46, and 86	1.0356

HP means Hourly Pricing. PJM is the Independent System Operator (ISO) for **P**ennsylvania, New **J**ersey, and **M**aryland

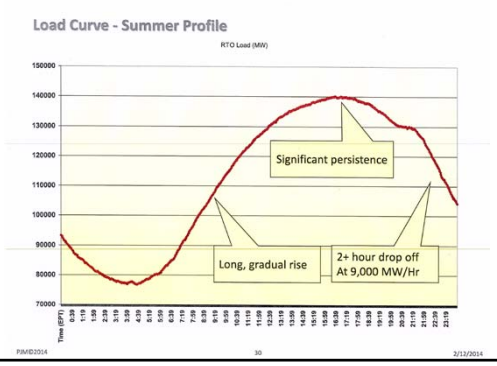
The Billing Calculation

- Billing is not as complicated as it looks
- For hourly pricing, your electric meter keeps track of your usage for each time period (hour)
- The EDC then calculates the supplier charges for each hour of the billing period and totals those charges. Customer, distribution and transmission charges (monthly charges) are added then added to the bill.

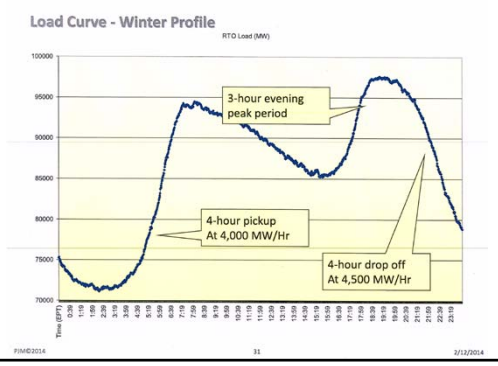
Buying Energy in a Time Differentiated Market

- Total electric load varies with time
- The price of electricity varies with load
- The next two slides show the load variation: one for a summer day; and one for a winter day
- The slide after that shows how the price of generating electricity varies with load

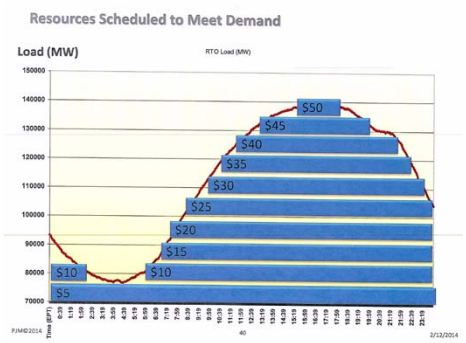
Electric Load Varies with Time (Summer)



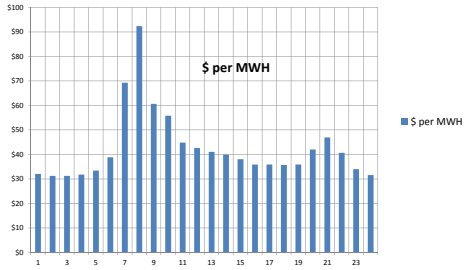
Electric Load Varies with Time (Winter)



Cost Varies as the Load Varies



Day Ahead Prices for 3/31/2014



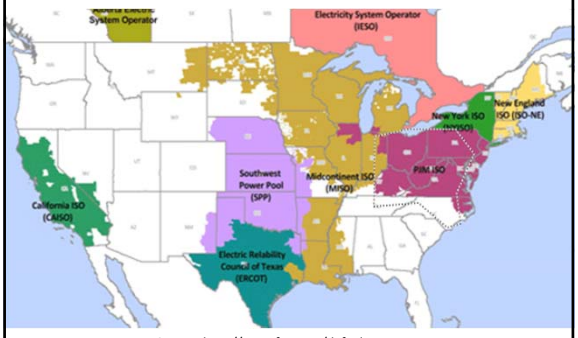
Peak was $92.42 for hour ended 8 a.m. The price applies to all energy metered in that hour.

Day Ahead Price Observations

- Yes, that is actual data from the Independent System Operator (ISO) for our region, PJM
- Links to data for New York and New England ISOs are on the references slide
- Our region is what used to be called Allegheny Power, now part of First Energy, consisting of West Penn Power, Monongahela Power and Potomac Edison
- For the example day in the previous slide, 7 a.m. to 10 a.m. is the most expensive period

JS2

Independent System Operators



Source: http://www.ferc.gov/default.asp

Slide 23

JS2 Suggest deleting this bullet point unless it is required to make a subsequent point.
Jeannie Sikora, 1/8/2015

Assessing Electric Usage

Now let's look at your electric meter:

- It works like the odometer in a car
- Read it now
- Read it again in an hour while keeping in mind what you are using electricity to operate in the mean time
- Subtract the first reading from the second and you will know how much electricity you used during that hour
- Keep a log of the information for future use
- Repeat for a day or two or when your electric use or the season changes

Sample Meter Log (Electric)

My electric data log (two days)

Date	Time ended	Reading	kWh Difference	kWh per hour	Notes for that date & time
25-Mar-14	3/25/14 12:00 AM	65432			
25-Mar-14	3/25/14 3:00 AM	65436	4	1.3	
25-Mar-14	3/25/14 6:00 AM	65450	14	4.7	Milking
25-Mar-14	3/25/14 9:00 AM	65459	9	3.0	
25-Mar-14	3/25/14 12:00 PM	65468	9	3.0	Milking
25-Mar-14	3/25/14 3:00 PM	65477	9	3.0	Had tractor block heater plugged in
25-Mar-14	3/25/14 6:00 PM	65493	16	5.3	Milking. Heated water for cleaning
25-Mar-14	3/25/14 9:00 PM	65505	12	4.0	
26-Mar-14	3/26/14 12:00 AM	65514	9	3.0	Pumped water to water troughs
26-Mar-14	3/26/14 3:00 AM	65518	4	1.3	
26-Mar-14	3/26/14 6:00 AM	65532	14	4.7	Milking
26-Mar-14	3/26/14 9:00 AM	65541	9	3.0	Had tractor block heater plugged in
26-Mar-14	3/26/14 12:00 PM	65550	9	3.0	Milking
26-Mar-14	3/26/14 3:00 PM	65559	9	3.0	
26-Mar-14	3/26/14 6:00 PM	65575	16	5.3	Milking. Heated water for cleaning
26-Mar-14	3/26/14 9:00 PM	65587	12	4.0	Pumped water to water troughs
27-Mar-14	3/27/14 12:00 AM	65596	9	3.0	
	Total electric usage - two days		164 kWh		
	Average kWh per day		82 kWh		

Electric Usage and Variable Pricing

- With (hourly) electric meter readings in hand, we can now combine the "when" and "how much" parts with the variable pricing effects for a meaningful comparison
- The example coming up is for one day. To do the calculation for an entire month is just more of the same.
- Once you get onto the comparison process, it isn't very difficult

Strategies to Reduce Your Bill

Comparison of fixed and variable generation pricing for one (1) day.

Hour ended	Actual Metered Use kWh[1]	Fixed Price per kWh[2]	Generation Cost for the hour	Variable Price per kWh[3]	Generation Cost for the hour	Hourly Savings
1:00 AM	2	$0.06	$0.12	$0.032	$0.06	$0.06
2:00 AM	1	$0.06	$0.06	$0.031	$0.03	$0.03
3:00 AM	1	$0.06	$0.06	$0.031	$0.03	$0.03
4:00 AM	1	$0.06	$0.06	$0.032	$0.03	$0.03
5:00 AM	2	$0.06	$0.12	$0.033	$0.07	$0.05
6:00 AM	5	$0.06	$0.30	$0.039	$0.20	$0.10
7:00 AM	7	$0.06	$0.42	$0.069	$0.48	-$0.06
8:00 AM	5	$0.06	$0.30	$0.092	$0.46	-$0.16
9:00 AM	2	$0.06	$0.12	$0.061	$0.12	$0.00
10:00 AM	2	$0.06	$0.12	$0.056	$0.11	$0.01
11:00 AM	2	$0.06	$0.12	$0.045	$0.09	$0.03
12:00 PM	2	$0.06	$0.12	$0.043	$0.09	$0.03
1:00 PM	5	$0.06	$0.30	$0.041	$0.21	$0.09
2:00 PM	7	$0.06	$0.42	$0.040	$0.28	$0.14
3:00 PM	5	$0.06	$0.30	$0.038	$0.19	$0.11
4:00 PM	3	$0.06	$0.18	$0.036	$0.11	$0.07
5:00 PM	3	$0.06	$0.18	$0.036	$0.11	$0.07
6:00 PM	3	$0.06	$0.18	$0.036	$0.11	$0.07
7:00 PM	3	$0.06	$0.18	$0.036	$0.11	$0.07
8:00 PM	5	$0.06	$0.30	$0.042	$0.21	$0.09
9:00 PM	7	$0.06	$0.42	$0.047	$0.33	$0.09
10:00 PM	5	$0.06	$0.30	$0.041	$0.21	$0.09
11:00 PM	2	$0.06	$0.12	$0.034	$0.07	$0.05
12:00 AM	2	$0.06	$0.12	$0.032	$0.06	$0.06
Total for day	82		$4.92		$3.77	$1.15
For 365 days	29,930		$1,796		$1,376	$420

Strategies to Reduce Your Bill

Notes from the bottom of the previous table:

Total for day	82		$4.92		$3.77	$1.15
For 365 days	29,930		$1,796		$1,376	$420
Notes from above:						
1. From your electric meter. Read it every hour and subtract the readings.						
2. Fixed price, from your electric bill. Also known as the price to compare (PTC).						
	http://www.papowerswitch.com/shop-for-electricity/shop-for-your-smallbusiness/by-distributor/allegheny-power/gs-20					
3. From the PJM website. Day ahead pricing.						
	http://www.pjm.com/markets-and-operations/energy/day-ahead/lmpda.aspx					

Strategies to Reduce Your Bill

- Know how and when you use electricity. Read your electric meter and record what equipment you used between readings.
- Check the day ahead electric prices periodically so you are aware of when prices are highest and lowest. This varies by season.
- Reschedule use of electric devices, where possible, to less expensive times of the day
- Keep in mind that peak price periods vary during the year

Strategies to Reduce Your Electric Bill

- In the above example, you want to avoid the pointy peak between about 6AM and 10 AM when the price per KWH is about three times the price per KWH for the rest of the day.
- Try to move your larger electric uses away from the peak periods.
- Take the time to do the research on your farm so you will know if shifting load is worth your while.

Summary

- Now you are aware of the hourly electricity market, how it came to be and when price peaks happen
- After doing an analysis of your own electric usage, with the help of your electric meter, you will know how much electricity you use when and for what purpose
- You can then compare your electric usage and peak prices to determine potential savings

References

PJM Day ahead prices: http://www.pjm.com/markets-and-operations/energy/day-ahead/lmpda.aspx

ISO New England Day ahead prices: http://www.iso-ne.com/markets-operations/markets/da-rt-energy-markets

New York ISO pricing data: http://www.nyiso.com/public/markets_operations/market_data/pricing_data/index.jsp

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Questions?