# Managing Electrical Energy Costs

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# Presentation Outline

- Our company history
- Why we developed a cost control strategy and status of our project
- Developing a cost control strategy
- Questions and hopefully some answers

# The A. Johnson Co., LLC

- Founded in 1908 by our grandfather and great grandfather. Located in NY, NH and VT, settling in Bristol in time for the 1938 flood
- Was a softwood mill and building supply
- Now a hardwood mill and kilns with retail sales of soft and hard woods
- Fourth generation of owner/managers

# Why we developed an electrical energy cost control strategy

- While planning to install a gasifier upgrade for our kiln boiler, we considered co-generation (required boiler replacement).
- We analyzed one year's worth of 15 minute interval demand data (35,000+ rows of Excel spreadsheet data).
- Conclusion: Cogeneration would replace the cheapest power we buy!

# Steps for developing a strategy

- Understand your utility's rate structures
- Understand your loads and your demand profiles
- Develop cost control options that you can live with
- Understand the impact of load reduction choices
- Implement, monitor and modify

# Utility Rate Structure (part 1)

- Obtain rate documentation from your utility. We buy power on Central Vermont Public Service Corp's Rate 4 at 12,470 V. Current rate details:
- *Rate 4 is divided into Peak and Off-peak hours. Peak hours shall be the period between the hours of 6 a.m. and 10 p.m. each day excluding Saturday and Sunday. All other hours shall be designated as off-peak hours. For billing purposes, demand during peak hours shall not be less than 100 KW. There is no minimum demand during off-peak hours.*

# Utility Rate Structure (part 2)

- *Demand charges are divided into the portion relating to power production charges and those relating to transmission and distribution-related charges. The transmission and distribution-related charge for both the peak and off-peak hours has a minimum billing feature: the customer is billed for the maximum demand established during the current period (during both peak and off-peak hours) or any one of the prior 11 months, whichever is greater. In addition, production-related demand charges will be applied to the current monthly peak and off-peak demands.*
- *When the customer's average lagging power factor for any month is below 85 percent, there shall be an additional charge.*

# Utility Rate Structure (part 3)

- *Service Charge* *$11.197*
- *DayTransmission/Distribution Demand Charge*
  - *Peak hours* *$ 6.071/KW*
  - *Off-peak hours - First "B" kWh (1)* *$0.02651k/kWh*
- *Production Demand Charge*
  - *Peak hours* *$7.474/KW*
- *Energy Charge*
  - *Peak hours* *$ 0.05199/kWh*
  - *Off-peak hours - First "C" kWh (2)* *$ 0.06525/kWh*
  - *All additional kWh* *$ 0.04120/kWh*

# Utility rate structure (part 4)

- *Power factor charge per KW of added capacity* *$ 18.028*
- *(1) "B" = 3 kWh X (off-peak ratcheted KW) X (days in billing period).*
- *(2) "C" = 3 kWh X (off-peak current-month KW) X (days in billing period).*

# Rate Essentials

- Demand periods (peak and off-peak hours)
- Demand interval  details: interval length, is the demand interval sliding or fixed, is the demand ratcheted, minimum demand level
- Charges for demand, transmission, power factor penalty, energy, taxes, other

# Cost for last kW of Peak Demand

- 1 kW of peak period demand in one demand interval for 1 rolling year = 1/4 kWH of energy consumed in 15 minutes
- Demand charge $6.071/kW * 12 months = $72.852
- Production Demand Charge = $7.474
- Energy charge $.05199/kWH * ¼ kWH = $0.013
- Total cost paid over 12 months = $80.339
- Cost per kWH = $321.356
- (Sales tax and energy efficiency charges not included)

# Lowest Peak Period Cost

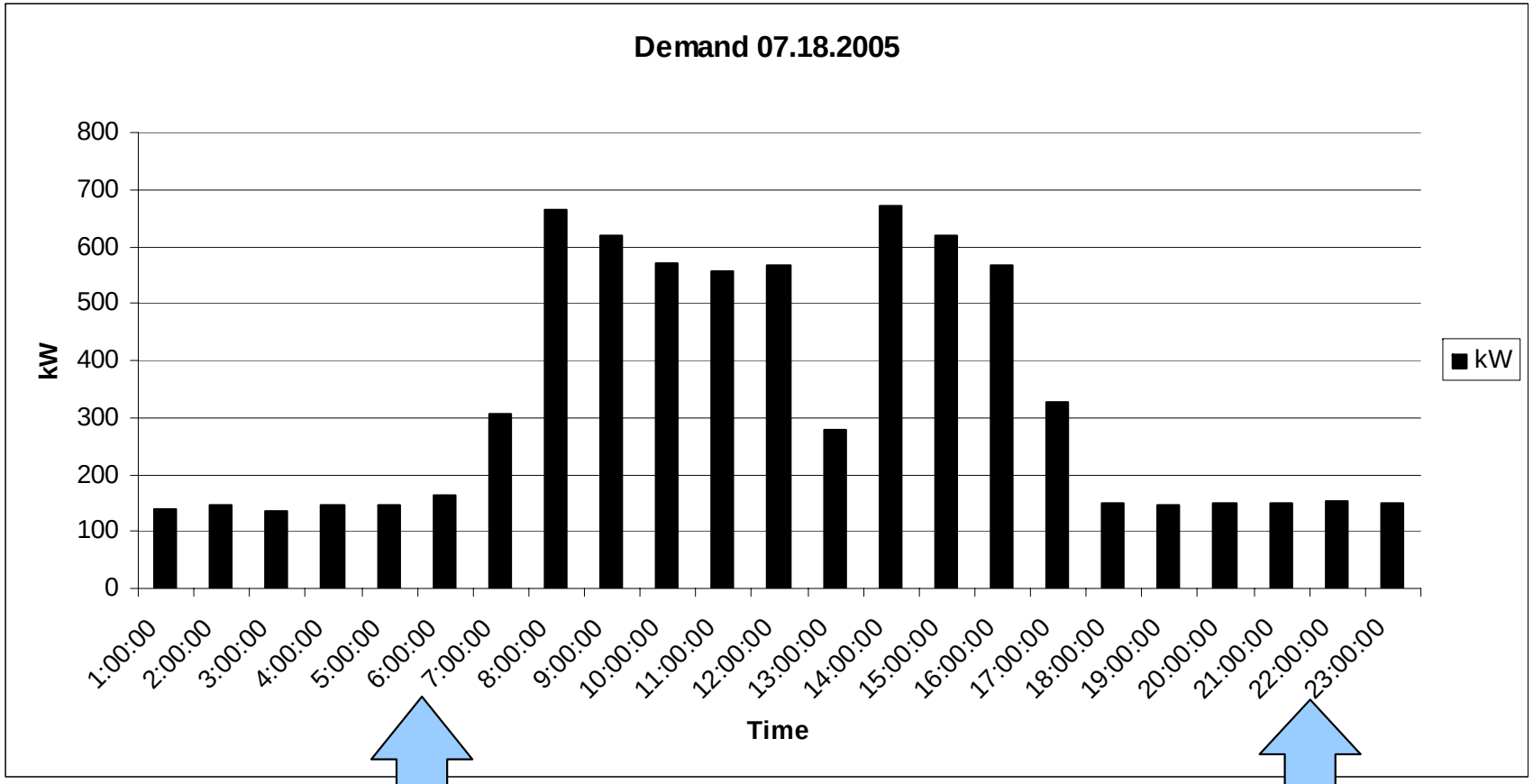
- Base load 16 hours/day, 22 days/month
- Demand charge = $6.071
- Production demand charge = $7.474
- Energy charge:
  352 kWH x $0.05199/kWH = $18.300
- Total cost/month = $31.846
- Cost per kWH = $0.091

# Peak Period Costs for July 2005

- Demand, 846.4/709.6 kW $10,442.04
- Energy, 132,018 kWH $6,863.62
- Total costs $17,305.66
- $/kWH $0.1311

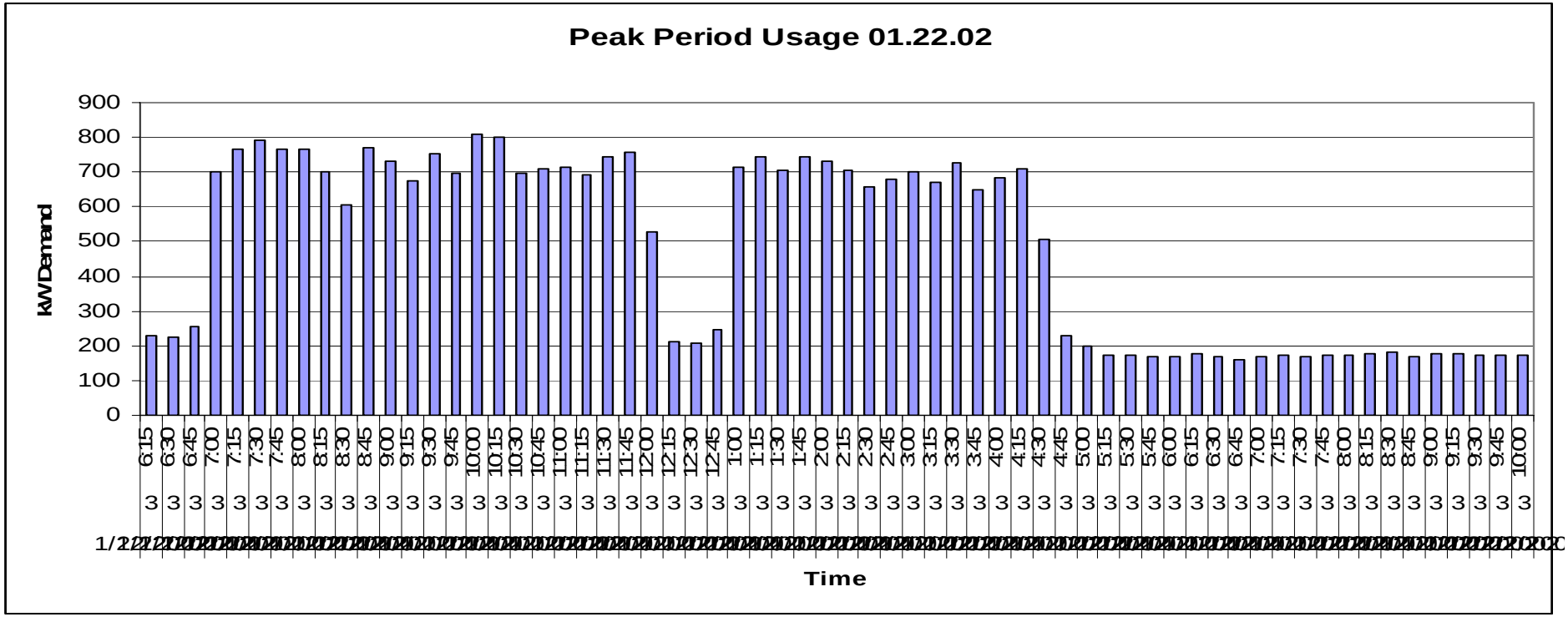
- Annual savings if demand was a flat 725 kW every month $8,844.23

# 07.18.2005 demand from utility website, 1 hour intervals




←Peak period 6 AM to 10 PM →

# Peak Period Demand for 01.22.2002, 15 minute intervals



# Our Electrical Load Types

- 24/7 base load (kilns, some lighting and heat). Relatively flat demand profile.
- Periodic (two mills that run one shift/day). Load variations due to production levels, species being sawn, season, volume produced, downtime.
- Intermittent (planers that operate 1 or 2 days a week). Partial demand step up.

# Our cost control strategy

- We moved our planers from utility power to our diesel generator, removing that demand from our profile.
- We considered on line peak shaving using our diesel generator. Cost to connect ($125,000 to $200,000) made this unattractive at this time.
- We designed a load management control system using variable speed drives on the fans in our nine kilns as controllable demand to minimize total costs (the incremental cost is for the energy at $0.05199/kWH).
- We installed a wireless transmitter to send demand pulses from the utility's meter at one side of our property to the control system in the boiler room at the other side.

# Our cost control strategy (part 2)

- The control system will be inserted between the individual kiln controls and their associated variable speed drives and heating valve transducers.
- Analog and digital inputs pass the desired fan speed, fan direction and heat valve commands to the control system that uses analog and digital outputs to control the drives and valves.
- A touch screen provides the kiln and energy managers with the tools to monitor and manage both electrical and steam (separate problem) demand.

# Our cost control strategy (part 3)

- The controls can start and load our kiln emergency generator if necessary to reduce total demand.
- Our utility will not provide a beginning of interval signal, hence we are essentially operating under a sliding demand interval rate.
- The system must provide “limp along” control ability in the event of equipment failure (ie loss of demand pulses from the meter).

# Our cost control strategy (part 4)

- The controls will adjust kiln fan loads (changing speed signals or turning fans on/off) to control peaks and fill in the valleys (maximize the energy purchased at each demand level).
- The program must prevent a peak that we will pay for the next 12 months. (Kiln fan loads can be shed instantaneously if necessary).
- Note: The power a fan consumes varies as the cube of the speed. ½ the speed requires 1/8 of the horsepower!

# Our cost control strategy (part 5)

- Plan includes rotating speed reductions and fan off periods between the kilns to minimize the drying time lost in each kiln and running fans at high speeds (where reasonable) during low demand periods of peak demand time to minimize energy costs.

# Our cost control strategy (part 6)

- Manual over rides, alarm paging, and load profiling information are needed for management purposes.
- The steam load management system will allocate steam based upon system pressure and kiln operator set dispatching priorities which are determined by species/value and moisture content.

# Status of our project

- Upgraded kiln service entrance in 2004.
- 7 of our 9 kilns have I-M fans with air speeds in the 225 – 250 FPM range. New fans, motors, bearings, drives required to fully use system capabilities. Other two kilns require new motors and drives.
- Transformer set must be replaced to fully achieve potential system savings.

# Summary

- Know your rates - know your loads – know your costs!
- Develop a cost control strategy that you can live with.
- Be sure that you understand the impact load changes may have on production throughput, product quality, customer service, etc.
- Modify the control strategy to improve the results and to fit your needs.