

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

Electrical Energy Management
at
MWRDGC

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- **Presented at R&D Seminar on
May 19, 2006**

- **By**
 - **Sanjay Patel, PE, CEM, CMRP**

Overview

- **Electrical Energy Expenditures**
- **Supply Side Management**
- **Demand Side Management**
- **Review of Bills**
- **Impact of Deregulation**
- **Sources of Information**

Electrical Energy

- **Why Manage Electrical Energy?**

Electrical Energy

- **Page 7 of Budget 2006**
- **Mission Statement and Operational Goals**
- **To Keep Pollution out of Lake Michigan**
- ...
- ...
- **To Keep Energy Costs to a Minimum**

Electrical Energy

- **2004 Actual Expenditure - \$27 million**
- **About 16% of M&O Budget**

- **MWRDGC – one of top 10 large users in Chicago Area**
- **Usage – 560,000,000 kwh per year**
- **Enough to power 115,000 homes for a year**

Electrical Energy

- **Top 5 District Facilities**
- **Stickney WRP – 40%**
- **Calumet WRP – 15%**
- **Northside WRP – 12%**
- **Mainstream PS – 7%**
- **Kirie WRP – 6%**

Electrical Energy

- **Energy Expenditures held constant over last 10 years in spite of facility expansions**
- **Who manages electrical energy?**
- **How?**

Electrical Energy

- **Stickney Treatment Plant**
- **Service Period 10/31/05 to 11/30/05**

- **Charges**

• Monthly Customer Charge				\$862.11
• Demand Charge	10,000	x	12.85	128,500.00
• Second Step Demand Charge			24862 x 5.03	125,057.87
• Redelivered Demand Credit			1509 x -7.17	-10,821.82
• Peak Energy Charge			7747290 x 0.05022	389,069.90
• Off Peak Energy Charge	13445874	x	0.02123	285,455.91
• Redelivered Energy Credit	1096663	x	-0.03183	-34,906.78
• Rental Charges				8,297.27
• Rider 11 Credit				-3,534.35
• Decommissioning Adjustment				14,469.48
• Total				\$902,448.59

Electrical Energy

- **Stickney WRP**
- **21,193,164 kwh * \$0.04258 / kwh = \$902,448.59**
- **Usage * Unit Cost = Total Cost**

Electrical Energy Management

$$\text{Usage} * \text{Unit Cost} = \text{Total Cost}$$

Goal is to lower the Total Cost.

Lower the unit cost (Supply Side Management)

**Lower the usage (Demand Side Management aka
Energy Conservation)**

Adjust Operations to “exploit” the rate

Supply Side Management

- Evaluate different rates available
- Rider 32
- Rate 24
- Self Assessment of Taxes

Rider 32

- **Curtailable Service Cooperative**
- **ComEd defers the need for new plants**
- **Customers receive \$ based on load reductions**

Rider 32

- Applied to 3 large plants in 1997
- Load committed 2,500 kw
- Actual load curtailed 6,800 kw (between Rider 32 and VRS)
- Compensation \$178,000.00

Rider 32

- Expanded to total six facilities in 1998
- Raised the committed load to 6,500 kw in 1999
- Raised the committed load to 10,500 kw in 2001

Rider 32

- **Total Compensation so far (1997 to 2005) is \$2,800,500.00**
- **2006 – we will continue to participate**
- **Future**

Sources of Information

- **Northern Illinois Energy Users**
(www.progressiveenergyllc.com/neu)
- **Illinois Commerce Commission**
(www.icc.illinois.gov)
- www.peoplesenergy.net
- www.exeloncorp.com

Rate 24

- **Rate 24 made available to District's pumping facilities in 1995**
- **No demand charges**

Rate 24

- **Evaluated the rate**
- **Applied it to 34 facilities**
- **Annual savings - \$95,000.00**
- **Future**

Self Assessment - Taxes

- **New state tax structure as a result of Deregulation**
- **Per kwh state tax instead of % of electric bill**

Self Assessment - Taxes

- Reviewed the impact
- Would result in \$80k more in annual state taxes for SWRP and MSPS
- Elected to self-assess state tax
- Avoided higher state tax

Demand Side Management

- **DO Control**
- **VFDs**
- **Energy Efficient Motors**
- **Lighting**

Demand Side Management

- **SWRP Annual Bill - \$11,000,000.00**
- **Top 5**
- **Aeration Blowers – 50%**
- **Main Sewage Pumps – 25%**
- **Pre Dig Centrifuges – 5%**
- **Digesters – 5%**
- **Post Dig Centrifuges – 3%**

Aeration Blowers

- **System is made up of**
 - **Motors**
 - **Blowers**
 - **Piping**
 - **Diffuser Plates**

Aeration Blowers

- **Motors**
 - **VFDs (for 480v or less)**
 - **Energy Efficient Motors**
 - **PM of Motors**
 - **PM of Cooling Coils**

Aeration Blowers

- **Blowers**
- **DO Control (using Inlet Vanes)**
- **High Wire Balancing Act**
- **Less Aeration – Violate NPDES Permit and/or Upset Plant Operations**
- **Too Much Aeration – Higher Electricity Expenditures**

Aeration Blowers

- **Blowers**
 - **PM of Blowers**
 - **Oil Analysis / Replacement**

Aeration Blowers

- **Piping**
 - **Leak Detection and Repairs**

Aeration Blowers

- **Diffuser Plates**
 - **Inspection / Repairs**
 - **Coarse / Fine Bubble Diffusers**
 - **Placement of Diffusers**

Main Sewage Pumps

- **System is made up of**
 - **Motors**
 - **Pumps**
 - **Piping**

Main Sewage Pumps

- **Pumps**
 - **Maintenance of Impeller**
 - **Alignment**
 - **Bearings**



Centrifuges

- **PM of Bowl**
- **PM of Motors**



VFD

- **Variable Frequency Drives**
- **Uses**
- **Energy Conservation**
- **Process Control**
- **Start up of Large Inertia Load**
- **Minimize Water Hammer Problems**

VFD

- **Relationship between Power and Speed**
- **HP proportional to Cube of RPM**
- **When speed is cut in half, power requirement is cut to 1/8th.**

VFD

- **Low Voltage VFD – Proven Technology**
- **Applied to**
- **Small Main Sewage Pumps**
- **Biosolid Pumps**
- **Centrifuge Main Drives**
- **Centrifuge Back Drives**
- **Air Handling Units**
- **Polymer Pumps**

VFD

- **Medium Voltage VFD**
- **Carefully Evaluate Applications for Design, Installation and Maintenance Issues**



Sources of Information

- www.drivesmag.com
- www.energy.gov



Motors – Energy Efficient

- Higher the efficiency – lower the kw
- 10 HP, 1800 RPM, 3 PHASE, TEFC
- Motor 1 – Lazy Lilly - 89.5 %
- Motor 2 – Efficient Emily - 92.4 %

Motors – Energy Efficient

- **Cost to run Lazy Lilly, 6000 Hours a Year, Unit Cost of Electricity 5.4 Cents/kwh**
- **$((10 \text{ HP} * 0.746)/0.895) * 6000 \text{ Hrs} * \$0.054/\text{kwh}$**
- **\$2,700**

Motors – Energy Efficient

- **Cost to run Efficient Emily, 6000 Hours a Year, Unit Cost of Electricity 5.4 Cents/kwh**
- **$((10 \text{ HP} * 0.746)/0.924) * 6000 \text{ Hrs} * \$0.054/\text{kwh}$**
- **\$2,615**
- **A Savings of \$85 / year**

Motors – Energy Efficient

- **Lazy Lilly List Price - \$930**
- **Efficient Emily List Price - \$1060**
- **Simple Payback = $(1060-930) / 85$**
- **1.5 Years**
- **Motor Master Software from DOE**

Motors – Energy Efficient

- **Standard Efficiency**
- **Premium Efficiency**
- **NEMA Premium Efficiency**
- **EPACT Efficiency**

- **Jan 2003**
- **SWRP' Stock of 165 Motors**
- **Inserted nominal efficiency ratings in the specs**

Sources of Information

- www.motorsmatter.gov
- www.eebestpractices.com
- www.nema.org

Lighting

- **Replaced Incandescent Lamps with HPS / Fluorescent Lamps**
- **Replaced Magnetic Ballasts with Electronic Ballasts**
- **Replaced T12 Lamps with T8s**



Lighting

- **Timers**
- **Photo Sensors**
- **Motion Sensors**



Adjust Usage

- **Adjust Operations to “exploit” the rate**
- **Lower Off Peak Rate**
 - **Increase Off Peak Usage**

Review of Bills

- **Energy (kwh) Usage**
- **Demand (kw)**
- **Credits**
- **Taxes**

Review of Bills

- **Mainstream PS – March 06 Bill**
- **Noticed higher demand charges**
- **Billing Demand (kw) – 6,200**
- **Total Bill - \$240,000**
- **Actual Demand (kw) – 3,100**
- **New Bill - \$180,000**
- **Error - \$60,000**
- **Salary of an Associate EE**

Deregulation in Illinois

- **Timeline**
 - **Dec 1997 - The Deregulation Act enacted**
 - **Oct 1999 - Open Access to customers > 4 MW**
 - **Dec 31, 2000 - Open Access to all customers**
 - **Dec 31, 2006 - Transition period ends**

Deregulation in Illinois

- **No fixed price rate for large customers from ComEd**
- **Rate 6L going away**
- **Options Post 2006**
 - **ARES**
 - **ComEd Rates are being replaced based on current proceedings to ICC**

Deregulation in Illinois

- **List of ICC Certified ARES**
 - **Ameren Energy Marketing Co.**
 - **Bluestar Energy Services, Inc.**
 - **Cinergy Retail Sales, LLC**
 - **Constellation NewEnergy**
 - **Direct Energy Services, LLC**
 - **EnerStar Power Corp.**

Deregulation in Illinois

- **List of ICC Certified ARES (cont.)**
 - **Exelon Energy Co.**
 - **Illinois Power Energy, Inc.**
 - **Lower Electric, LLC**
 - **MidAmerican Energy**
 - **Nordic Marketing of Illinois, LLC**
 - **Peoples Energy Services Corp.**

Deregulation in Illinois

- **List of ICC Certified ARES (cont.)**
 - **Pepco Energy Services, Inc.**
 - **Reliant Energy Solutions East, LLC**
 - **Sempra Energy Solutions**
 - **Sempra Energy Trading Corp.**
 - **Strategic Energy, LLC**
 - **SUEZ Energy Resources NA, Inc.**
 - **WPS Energy Services, Inc.**

MWRD Procurement Process

- **Defined goals with input from Technical, Law and Purchasing Dept**
- **Defined load profiles**
- **Prepared RFP**
- **RFP Advertised**

MWRD Procurement Process

- **RFP Highlights**
 - **Vendor Qualifications**
 - **Contractual Language**
 - **Financial Requirements**
 - **Legal Requirements**
 - **Technical Requirements**

MWRD Procurement Process

- **RFP Highlights**
 - **Pricing Structure**
 - **Generation (ARES)**
 - **Transmission and Distribution (ComEd)**

MWRD Procurement Process

- **RFP Highlights**
 - **Account Numbers, Meter Numbers**
 - **Historical Usage on CD**
 - **Contract Quantity & Deviations**
 - **Billing Options**
 - **Transition Strategy**

MWRD Procurement Process

- **RFP Highlights**
 - **Prebid Meeting**
 - **Evaluation and Selection Process**
 - **BAFO Turnaround Time**
 - **Draft Contract**
 - **“Marketable” RFP**

MWRD Procurement Process

- **Selected a Supplier on April 5, 2006**
- **Peoples Energy Service**
- **Electric Energy for 25 Facilities**
- **Beginning Dec 2006**
- **Contract – Three Years**
- **Rates are 31% higher than Current Rates**

ComEd Filings

- **Two Filings with ICC**
- **Competitive Procurement Process**
- **Tariff Revisions**

ComEd Filings

- **Competitive Procurement Process**
- **Filing Date – February 25, 2005**
- **ICC Ruled in Jan 2006**
- **Reverse Auction Process**
- **Higher Generation Charges**

ComEd Filings

- **Tariff Revisions**
- **Filing Date – August 31, 2005**
- **ICC to rule by July 2006**
- **Higher Distribution Charges**
- **Intervention**

Sources of Information

- **Illinois Commerce Commission**
(www.icc.illinois.gov)
- **Northern Illinois Energy Users**
(www.progressiveenergyllc.com/neu)
- **ComEd**
(www.comedpowerpath.com)
- **Exelon**
(www.exeloncorp.com)

Sources of Information

- **Price Newsletters from ARES**
- **www.pjm.com**
- **www.enerfaxdaily.com**

Sources of Information

- **US Department of Energy**
(www.energy.gov)
- **Association of Energy Engineers**
(www.aeecenter.org)
- **www.energyandpowermanagement.com**

Sources of Information

- www.eebestpractices.com
- www.eere.energy.gov
- www.epri.com
- www.nema.org
- www.drivesmag.com
- www.motorsmatter.gov

Acknowledgements

- **Sam Evans**
- **Barbara Egan, Jeff Majka**
- **Brian Perkovich, Aruch Poonsapaya,
Paul Wysocki**
- **Antonio Quintanilla, Osoth Jamjun**
- **Thomas Granato**

How to reach me

- **Sanjay Patel**
 - **Phone: (773) 256-3504**
 - **E-mail: sanjay.patel@mwrdd.org**

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Questions?

Thank You!