



www.unisonenergy.com

Maximizing Energy Cost Reduction

*Project Options, Technology Selection, Accurately Forecasting Savings, Emissions,
Financing Considerations & Options, Typical PPA/ESA*

Maximizing Energy Cost Reduction



- **Energy Cost Reduction Projects**
- **Technology Selection**
- **Accurately Forecasting Savings**
- **Emission Impact**
- **Financing Options**
- **Power Purchase Agreement/Energy Services Agreement**

Maximizing Energy Cost Reduction



- **Energy Cost Reduction Projects**

- Reduce Consumption
- Improve Efficiency
- Reduce or Shift Demand

Maximizing Energy Cost Reduction



• Energy Cost Reduction Projects

• Reduce Consumption

- Combined Heat and Power (Cogeneration)
- Shut off unnecessary equipment (BMS system is a good way)
- Solar PV
- Solar Thermal

• Improve Efficiency

- Combined Heat & Power (Cogeneration)
- LED lighting
- High Efficiency Chillers
- High Efficiency Boilers
- VFD drives
- High Efficiency Cooling Towers

Maximizing Energy Cost Reduction



• Energy Cost Reduction Projects (continued)

- **Reduce or Shift Demand (“exploit the tariffs”)**
 - Battery Storage (charge when cheap, discharge when expensive)
 - Thermal Storage (make ice at night, chill cold water loop during day)
 - Shift operations from day to night
 - Demand Response (shut stuff off when rates are very high)

Maximizing Energy Cost Reduction



• **Technology Selection – *Risk Mitigation***

- Be wary of the latest intriguing new technology
- Be wary of anything “too good to be true”
- Always safe to focus on proven technology from proven company
- Always consider risks
 - Business Failure
 - Financial Stability/Strong Balance Sheet
 - Technology Failure
 - Technology Obsolescence
- Always ask for references
- Always ask if there a technology that provides better benefits?

Maximizing Energy Cost Reduction



• **Technology Selection – *Some Typical Options***

- On site generation – gas engine with heat recovery
- On site generation – gas fuel cell with heat recovery
- On site generation – gas turbine with heat recovery
- Any on site generation without heat recovery (seldom the best choice)
- Solar PV and Solar Thermal
- Battery Storage
- Ice Storage
- Hot Water Storage
- Building Management Systems
- All high energy efficiency substitutes for low efficiency existing technology
- LED lighting

Maximizing Energy Cost Reduction



• Technology Selection “*Watch Outs*”

- Technology provider is not profitable
- Technology provider has not been around for several years
- Technology service provider has not been around for several years
- Limited trained service personnel
- No trained service personnel locally
- Limited spare parts storage locally
- There is little or no field experience to base service, overhaul or replacement cost experience on to back up total cost of ownership financial assumptions
- Limited long term emissions compliance experience
- None of your personnel are knowledgeable on how to maintain the technology
- Limited or no alternatives should technology provider go out of business
- Others have left the market (IE: A major corporation left the micro turbine and fuel cell businesses)

Maximizing Energy Cost Reduction



• **Technology Selection – *Positive Attributes***

- Technology supported by major company
- Technology provider in business for several years
- Hundreds of installations worldwide, many in USA
- Low cost per kilowatt installed cost
- Low cost per kilowatt hour operating cost
- High overall efficiency compared to competing technologies
- Proven technology with multiple providers
- Back up power, reliability, dependability, redundancy, resiliency and power quality enhancements provided

Maximizing Energy Cost Reduction



• **How To Accurately Forecast Cost Savings**

- Know your usage (Electric and Natural Gas)
- Know when you use it (time of day, month and year)
- Know how much you pay
- Know how your bill is calculated – study the tariff details
- Know what you have planned in the future that will make usage go up or down and when it will be implemented
- Use all of the details in your analysis
 - 12 months of actual Billing data (gas and electric)
 - 15 minute interval data (electric)
 - Actual tariff formulas and billing details (electric)

Maximizing Energy Cost Reduction



• **How To Accurately Forecast Cost Savings (cont.)**

- Consider all technology options
- Obtain historical data on O&M costs
- Obtain historical data on total cost of ownership
- Use a comprehensive modeling tool that integrates billing, tariff and consumption details when forecasting savings
- Use realistic escalation and future cost forecasting assumptions
- Use past trend analysis to double check future cost forecasts
- Use a tool that can accurately incorporate future energy use forecasts and energy cost forecasts

Maximizing Energy Cost Reduction



- **Emissions (where applicable)**

- Technology must meet local permitting requirements
- Technology must maintain compliance over useful life
- Consider total emissions impact when comparing technologies (at the site and at the generation source)
- If two (2) technologies are financially near equal during the savings analysis and forecasting, one should consider both the various risk factors and emissions reduction when making a final selection
- Be objective vs. emotional when comparing emissions

Maximizing Energy Cost Reduction



• **Financing Considerations & Options**

- “Your Money” – *typical finance officer considerations:*
 - Annual Savings
 - Payback Period
 - Internal Rate of Return
 - Discretionary Capital and Budget Funds Available
- “Other People’s Money” – *rent, lease or PPA/ESA*
 - Credit Worthy Customer
 - Maximum overall savings to customer drives technology selection
 - Both quantitative and qualitative benefits provided to the customer
 - With a PPA/ESA there is no payback period, no CAPX (hence no IRR), no budget and no manpower impact. “If it does not run you pay nothing”.

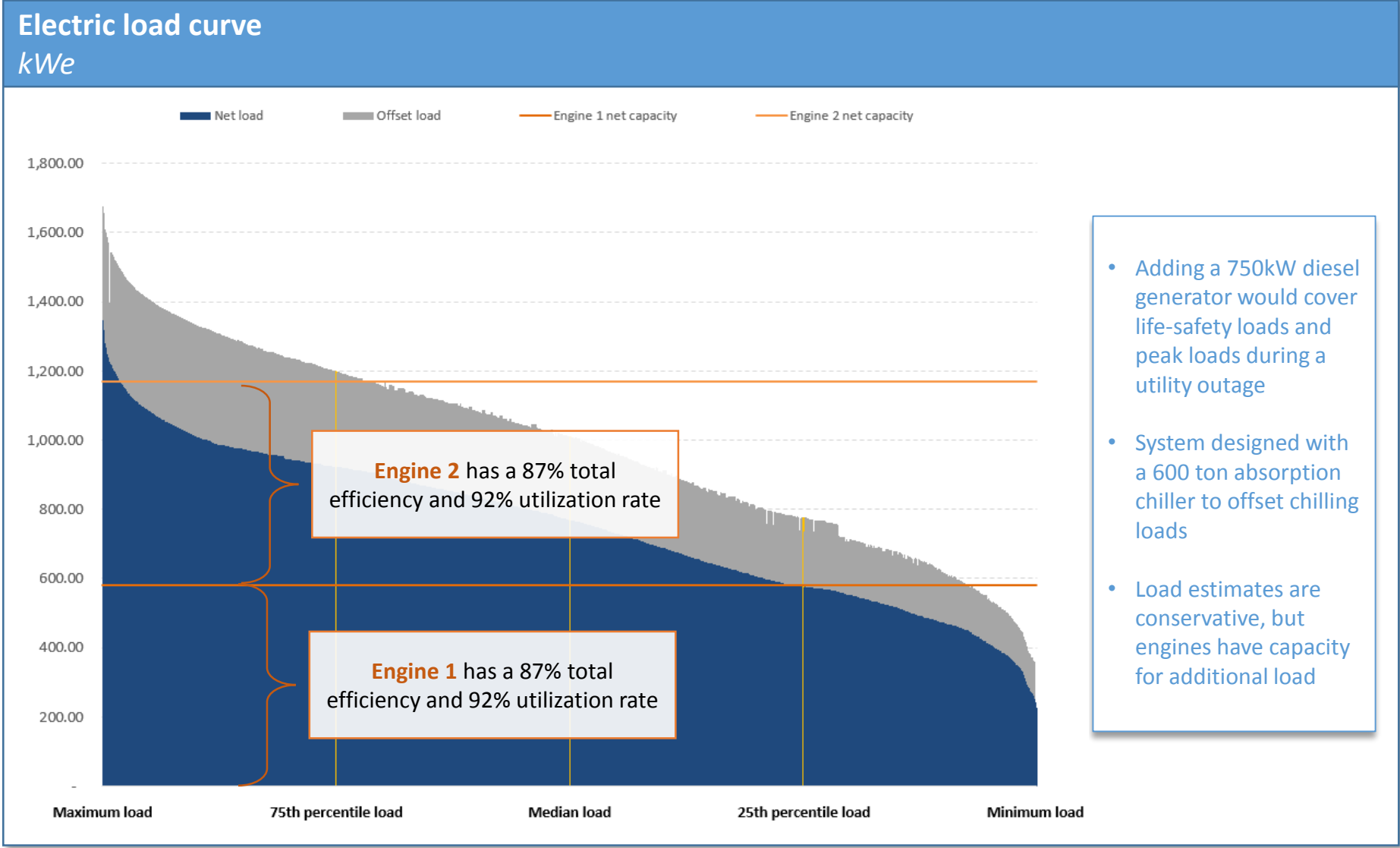
Maximizing Energy Cost Reduction



• **Financing Considerations & Options (cont.)**

- Power Purchase Agreement (PPA) or Energy Services Agreement (ESA)
 - Typically PPA/ESA provider charges for electricity (and heat) at a discount over what is being paid today
 - Combined gas and electric bill can be reduced 10%-20% with optimum technology selection, integration design and service provider selection
 - Equipment, design, installation and O&M costs are the responsibility of the PPA/ESA provider – absolutely no cost to customer
 - The PPA/ESA provider becomes basically an alternative to purchasing gas and/or electricity from the local utility provider.

The proposed cogeneration system would use (2) 600 kW engines capable of offsetting 96% of the facility's power consumption

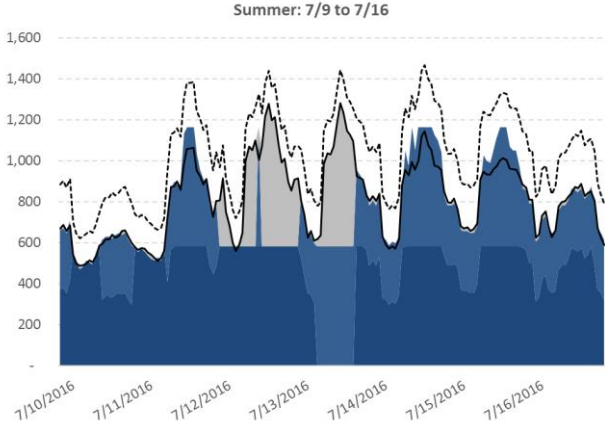


Example dispatch profiles by season

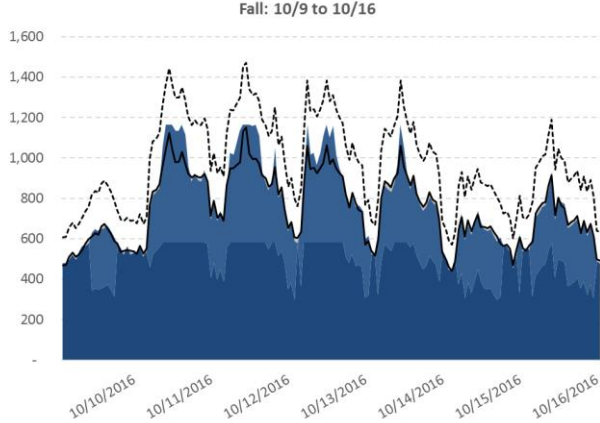
One week sample dispatch profile by season

kWe

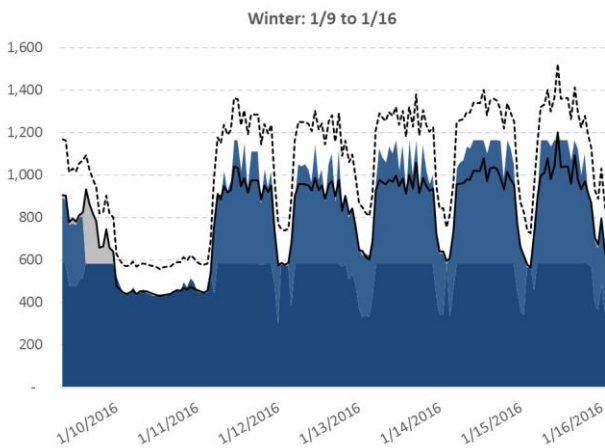
Summer (August)



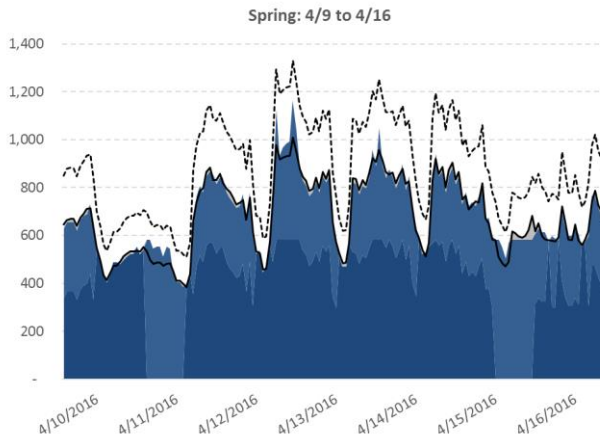
Fall (October)



Winter (January)



Spring (April)



Unison Energy Tariff Database

Cogen Case SDG&E Customer Bill – with 600 ton chiller

From actual 2016 interval data

| Unison Case Customer Bill | | | | | | | | | | | | | | |
|--|----------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Bill end date | Bill end date | 01/31/2016 | 02/29/2016 | 03/31/2016 | 04/30/2016 | 05/31/2016 | 06/30/2016 | 07/31/2016 | 08/31/2016 | 09/30/2016 | 10/31/2016 | 11/30/2016 | 12/30/2016 | Total |
| | MaxAnnualDemand | 465.74 | 465.74 | 465.74 | 465.74 | 465.74 | 465.74 | 465.74 | 465.74 | 465.74 | 465.74 | 465.74 | 465.74 | 5,588.88 |
| Demand - Non-Coincident - Transm | Non-CoincidentDemand | 7,808.30 | 7,808.30 | 7,808.30 | 7,808.30 | 7,808.30 | 7,808.30 | 7,808.30 | 7,808.30 | 7,808.30 | 7,808.30 | 7,808.30 | 7,808.30 | 93,699.60 |
| Demand - Non-Coincident - Distr | Non-CoincidentDemand | 7,746.11 | 7,746.11 | 7,746.11 | 7,746.11 | 7,746.11 | 7,746.11 | 7,746.11 | 7,746.11 | 7,932.68 | 7,932.68 | 7,932.68 | 7,932.68 | 93,886.17 |
| Demand - Non-Coincident - RS | Non-CoincidentDemand | 27.64 | 27.64 | 27.64 | 27.64 | 27.64 | 27.64 | 27.64 | 27.64 | 27.64 | 27.64 | 27.64 | 27.64 | 331.68 |
| Summer On-Peak Demand - Transm | On-PeakDemand | - | - | - | - | 1,012.97 | 1,492.05 | 1,569.19 | 217.21 | 1,615.88 | - | - | - | 5,907.30 |
| Summer On-Peak Demand - Distr | On-PeakDemand | - | - | - | - | 3,657.67 | 5,387.55 | 5,666.09 | 803.57 | 5,977.96 | - | - | - | 21,492.84 |
| Winter On-Peak Demand - Transm | On-PeakDemand | 309.88 | 364.17 | 222.04 | 115.90 | - | - | - | - | - | 842.41 | 289.75 | 14.64 | 2,158.79 |
| Winter On-Peak Demand - Distr | On-PeakDemand | 3,175.00 | 3,731.25 | 2,275.00 | 1,187.50 | - | - | - | - | - | 8,838.40 | 3,040.00 | 153.60 | 22,400.75 |
| Power Factor - Distr | PowerFactor | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Energy - Transm | TotalkWh | (230.56) | (394.41) | (202.81) | (266.76) | (160.69) | (352.42) | (411.62) | (125.60) | (405.26) | (721.30) | (216.25) | (147.56) | (3,635.24) |
| Energy - PPP | TotalkWh | 300.15 | 513.44 | 264.01 | 347.27 | 209.19 | 458.77 | 535.84 | 163.51 | 527.57 | 938.98 | 281.52 | 192.10 | 4,732.35 |
| Energy - ND | TotalkWh | 12.60 | 21.56 | 11.08 | 14.58 | 8.78 | 19.27 | 22.50 | (0.52) | (1.70) | (3.03) | (0.90) | (0.62) | 103.60 |
| Energy - RS | TotalkWh | 0.24 | 0.41 | 0.21 | 0.28 | 0.16 | 0.37 | 0.43 | 0.13 | 0.42 | 0.75 | 0.22 | 0.15 | 3.77 |
| Energy - On-Peak Summer-Distr | On-PeakkWh | - | - | - | - | 16.50 | 37.25 | 52.49 | 1.82 | 52.59 | - | - | - | 160.65 |
| Energy - On-Peak Summer-CTC | On-PeakkWh | - | - | - | - | 9.04 | 20.41 | 28.77 | 1.00 | 29.03 | - | - | - | 88.25 |
| Energy Semi-Peak Summer-Distr | Semi-PeakkWh | - | - | - | - | 19.69 | 38.33 | 48.32 | 8.02 | 46.99 | - | - | - | 161.35 |
| Energy Semi-Peak Summer-CTC | Semi-PeakkWh | - | - | - | - | 10.79 | 21.00 | 26.48 | 4.43 | 25.94 | - | - | - | 88.64 |
| Energy Off-Peak-Summer-Distr | Off-PeakkWh | - | - | - | - | 11.28 | 28.54 | 20.79 | 26.99 | 19.29 | - | - | - | 106.89 |
| Energy Off-Peak-Summer-CTC | Off-PeakkWh | - | - | - | - | 6.18 | 15.64 | 11.39 | 14.90 | 10.65 | - | - | - | 58.76 |
| Energy - On-Peak-Winter-Distr | On-PeakkWh | 6.90 | 12.84 | 6.45 | 3.45 | - | - | - | - | - | 78.55 | 7.90 | 1.83 | 117.92 |
| Energy - On-Peak-Winter-CTC | On-PeakkWh | 3.78 | 7.04 | 3.53 | 1.89 | - | - | - | - | - | 43.36 | 4.36 | 1.01 | 64.97 |
| Energy Semi-Peak Winter-Distr | Semi-PeakkWh | 42.37 | 86.12 | 22.15 | 43.54 | - | - | - | - | - | 63.51 | 42.34 | 31.97 | 332.00 |
| Energy Semi-Peak Winter-CTC | Semi-PeakkWh | 23.22 | 47.19 | 12.14 | 23.86 | - | - | - | - | - | 35.05 | 23.37 | 17.64 | 182.47 |
| Energy Off-Peak-Winter-Distr | Off-PeakkWh | 18.85 | 17.57 | 31.31 | 31.82 | - | - | - | - | - | 69.54 | 13.19 | 9.48 | 191.76 |
| Energy Off-Peak-Winter-CTC | Off-PeakkWh | 10.33 | 9.63 | 17.16 | 17.44 | - | - | - | - | - | 38.38 | 7.28 | 5.23 | 105.45 |
| Max. On-Peak Demand Summer | On-PeakDemand | - | - | - | - | 4,905.17 | 7,225.05 | 7,598.59 | 1,061.44 | 7,896.32 | - | - | - | 28,686.57 |
| On-Peak Energy Summer | On-PeakkWh | - | - | - | - | 624.83 | 1,410.67 | 1,987.95 | 70.33 | 2,024.43 | - | - | - | 6,118.21 |
| Semi-Peak Energy Summer | Semi-PeakkWh | - | - | - | - | 684.12 | 1,331.73 | 1,678.96 | 283.38 | 1,659.23 | - | - | - | 5,637.42 |
| Off-Peak Energy Summer | Off-PeakkWh | - | - | - | - | 285.76 | 722.71 | 526.57 | 694.71 | 496.49 | - | - | - | 2,726.24 |
| On-Peak Energy Winter | On-PeakkWh | 239.77 | 446.18 | 224.16 | 119.93 | - | - | - | - | - | 2,773.08 | 279.02 | 64.60 | 4,146.74 |
| Semi-Peak Energy Winter | Semi-PeakkWh | 1,255.47 | 2,551.83 | 656.50 | 1,290.19 | - | - | - | - | - | 1,912.94 | 1,275.32 | 962.98 | 9,905.23 |
| Off-Peak Energy Winter | Off-PeakkWh | 426.28 | 397.37 | 708.02 | 719.65 | - | - | - | - | - | 1,598.25 | 303.28 | 218.07 | 4,370.92 |
| Department of Water Resources (DWR - BC) | TotalkWh | 130.68 | 223.54 | 114.94 | 151.19 | 91.08 | 199.74 | 233.29 | 71.19 | 229.69 | 408.81 | 122.56 | 83.63 | 2,060.34 |
| Contract Demand - Transm | ContractDemand | 2,524.50 | 2,524.50 | 2,524.50 | 2,524.50 | 2,524.50 | 2,524.50 | 2,524.50 | 2,524.50 | 2,524.50 | 2,524.50 | 2,524.50 | 2,524.50 | 30,294.00 |
| Franchise Fee | TotalkWh | 2,190.22 | 2,306.00 | 2,107.47 | 1,985.94 | 2,463.13 | 2,893.01 | 2,976.82 | 2,108.81 | 3,006.00 | 2,794.08 | 2,122.60 | 1,834.08 | 28,788.16 |
| Departing Load - DWRBC | NetGeneratorOutput | 3,041.67 | 2,949.40 | 3,020.55 | 2,566.56 | 2,763.55 | 2,989.60 | 2,962.66 | 3,368.87 | 2,944.51 | 2,826.33 | 2,778.85 | 2,436.76 | 34,649.31 |
| Departing Load - PCIA | NetGeneratorOutput | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Departing Load - PPP | NetGeneratorOutput | 6,986.26 | 6,774.32 | 6,937.73 | 5,895.00 | 6,347.44 | 6,866.66 | 6,804.79 | 7,737.79 | 6,763.10 | 6,491.65 | 6,382.59 | 5,596.87 | 79,584.20 |
| Departing Load - ND | NetGeneratorOutput | 293.44 | 284.54 | 291.40 | 247.60 | 266.61 | 288.42 | 285.82 | (25.00) | (21.85) | (20.97) | (20.62) | (18.08) | 1,851.31 |
| Energy - LGC | TotalkWh | 7.51 | 12.85 | 6.61 | 8.69 | 5.23 | 11.48 | 13.41 | 4.09 | 13.21 | 23.51 | 7.04 | 4.81 | 118.44 |
| Total\$ | Total\$ | 40,083.35 | 42,202.13 | 38,568.94 | 36,344.81 | 45,077.77 | 52,945.12 | 54,478.82 | 38,593.43 | 55,012.85 | 51,134.64 | 38,845.78 | 33,565.55 | 526,853.19 |
| \$/kWh | \$/kWh | 1.65 | 1.02 | 1.81 | 1.30 | 2.67 | 1.43 | 1.26 | 2.92 | 1.29 | 0.67 | 1.71 | 2.16 | 1.38 |

Source: Unison Energy Tariff Database; utility published tariffs

BASE CASE: Over the course of a 15-year Energy Services Agreement (“ESA”), the facility is expected to save approximately \$4.9 M

| Lifetime pro-forma, 15-year ESA | | | | | | | | | | | | | | | |
|--|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Nominal year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| PRO-FORMA: PROJECT LIFETIME | | | | | | | | | | | | | | | |
| Electric (incl. electric offsets) | | | | | | | | | | | | | | | |
| <i>Electricity - current</i> | | | | | | | | | | | | | | | |
| Current consumption (kWh) | 8,496,827 | 8,496,827 | 8,496,827 | 8,496,827 | 8,496,827 | 8,496,827 | 8,496,827 | 8,496,827 | 8,496,827 | 8,496,827 | 8,496,827 | 8,496,827 | 8,496,827 | 8,496,827 | 8,496,827 |
| Current cost (USD) | 1,726,181 | 1,786,597 | 1,849,128 | 1,913,847 | 1,980,832 | 2,050,161 | 2,121,917 | 2,196,184 | 2,273,050 | 2,352,607 | 2,434,948 | 2,520,171 | 2,608,377 | 2,699,671 | 2,794,159 |
| Current unit cost (USD/kWh) | 0.203 | 0.210 | 0.218 | 0.225 | 0.233 | 0.241 | 0.250 | 0.258 | 0.268 | 0.277 | 0.287 | 0.297 | 0.307 | 0.318 | 0.329 |
| <i>Electricity - new</i> | | | | | | | | | | | | | | | |
| New consumption (kWh) | 6,603,675 | 6,603,675 | 6,603,675 | 6,603,675 | 6,603,675 | 6,603,675 | 6,603,675 | 6,603,675 | 6,603,675 | 6,603,675 | 6,603,675 | 6,603,675 | 6,603,675 | 6,603,675 | 6,603,675 |
| New cost (USD) | 1,289,217 | 1,329,589 | 1,371,255 | 1,414,257 | 1,458,640 | 1,504,448 | 1,551,729 | 1,600,530 | 1,650,901 | 1,702,894 | 1,756,562 | 1,811,961 | 1,869,146 | 1,928,176 | 1,989,114 |
| New unit cost (USD/kWh) | 0.195 | 0.201 | 0.208 | 0.214 | 0.221 | 0.228 | 0.235 | 0.242 | 0.250 | 0.258 | 0.266 | 0.274 | 0.283 | 0.292 | 0.301 |
| <i>Chilling - new</i> | | | | | | | | | | | | | | | |
| New consumption - chilling (kWh) | 7,212,383 | 7,212,383 | 7,212,383 | 7,212,383 | 7,212,383 | 7,212,383 | 7,212,383 | 7,212,383 | 7,212,383 | 7,212,383 | 7,212,383 | 7,212,383 | 7,212,383 | 7,212,383 | 7,212,383 |
| New cost - chilling (USD) | 231,975 | 237,775 | 243,719 | 249,812 | 256,057 | 262,459 | 269,020 | 275,746 | 282,639 | 289,705 | 296,948 | 304,372 | 311,981 | 319,780 | 327,775 |
| New unit cost - chilling (USD/kWh) | 0.032 | 0.033 | 0.034 | 0.035 | 0.036 | 0.036 | 0.037 | 0.038 | 0.039 | 0.040 | 0.041 | 0.042 | 0.043 | 0.044 | 0.045 |
| Total electricity savings (USD) | 204,989 | 219,234 | 234,154 | 249,778 | 266,135 | 283,254 | 301,168 | 319,908 | 339,510 | 360,008 | 381,438 | 403,839 | 427,251 | 451,714 | 477,271 |

Lifetime savings: \$4,919,651



www.unisonenergy.com

Thank You ! (ask about our free analysis offer)

Paul Beck – Director Market Development and Sales

619-518-0447 paul.beck@unisonenergy.com