LINCUS

ENERGY connection

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Insight and Expertise to Increase Energy Efficiency

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Delivering Proven Results in Energy-Efficiency Engineering

Lincus, Inc., delivers energy-engineering consulting services that maximize the value of your utility company's assets while improving end-use client's mechanical building systems design, construction, and operation. Since 1984, Lincus professionals have been servicing utility giants, major corporations, city planners, and medical institutions with proven results.

INTELLIGENT EVALUATIONS

ENERGY SAVINGS IN WATER DISTRIBUTION SYSTEMS

Water distribution and treatment systems consume a significant amount of electrical energy due to a variety of systems (storage, pumping, and transmission) required to transport water from various pressure zones within a water utility's service area. Lincus engineers concentrate on all parts of water treatment and transportation along with the needed controls to achieve as much as a 20% reduction in energy consumption.

The best place to start is to review the utility's 20-year water system master plan. This plan typically includes information about the service area, a summary of historical and future water demands, inventory of existing facilities such as wells, storage reservoirs, booster pumping stations and pipelines, as well as a summary of prioritized capital improvement programs.

The maximum daily water distribution system demand can be as much as 200% above average. This variation offers great opportunities to improve water systems through the installation of pump speed controls, resizing existing pumps, upgrading existing storage reservoirs, and/or increasing tank capacity. All energy-savings analysis are completed within the limitations provided by the master plan regarding projected hourly, monthly

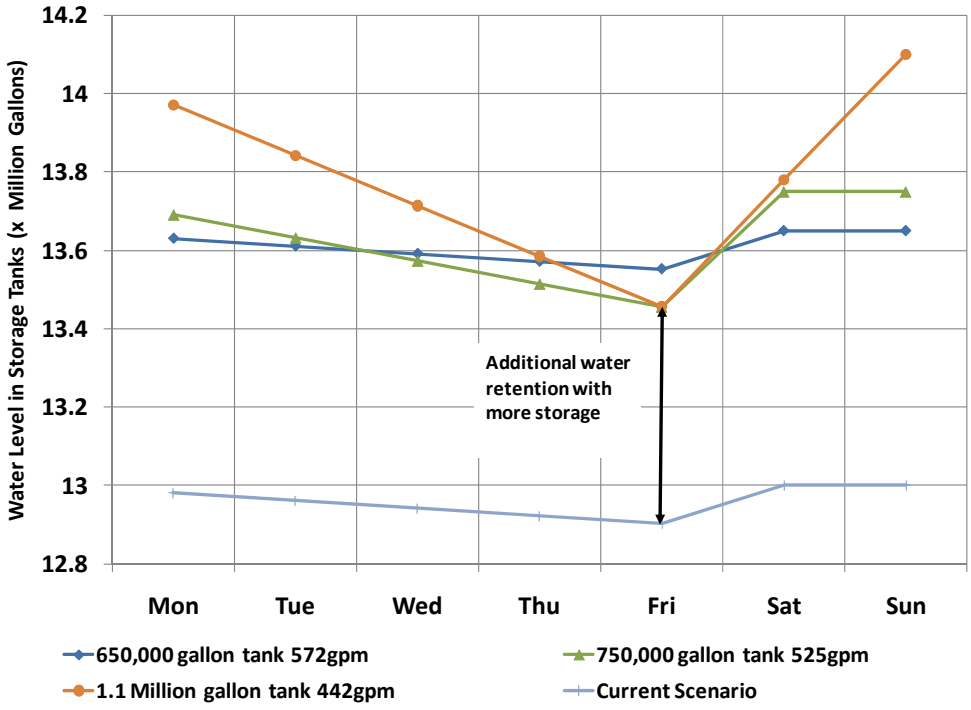
and seasonal water demands to ensure that potential energy savings do not get in the way of day-to-day operation of the water system.

In most water supply and distribution facilities, many control strategies can be implemented on distribution pumps by adding extra storage. Variable frequency drives can be used to ramp down pump speed during average day, weekday and off-season conditions all of which may have different pumping requirements, to save energy. With adequate storage capacity, pumping energy can be shifted to off-peak periods or weekends as well.

Typical energy-efficiency recommendations may include the following:

- Pump upgrades
- Addition of VFD controls
- Optimization of existing controls
- Hydroelectric turbine
- Optimization of existing storage capacity
- Additional storage capacity

By applying some, or all, of the measures above, water facility managers may be able to effectively optimize their operations. The graph below illustrates how simply increasing water tank storage capacities can save a significant amount of electricity.



If the water utility's minimum acceptable storage capacity is 13.5 million gallons, the energy audit of this system may recommend capacity upgrades as well as optimized use of existing pumping and control systems to achieve a savings of as much as 20% of the total energy consumption.

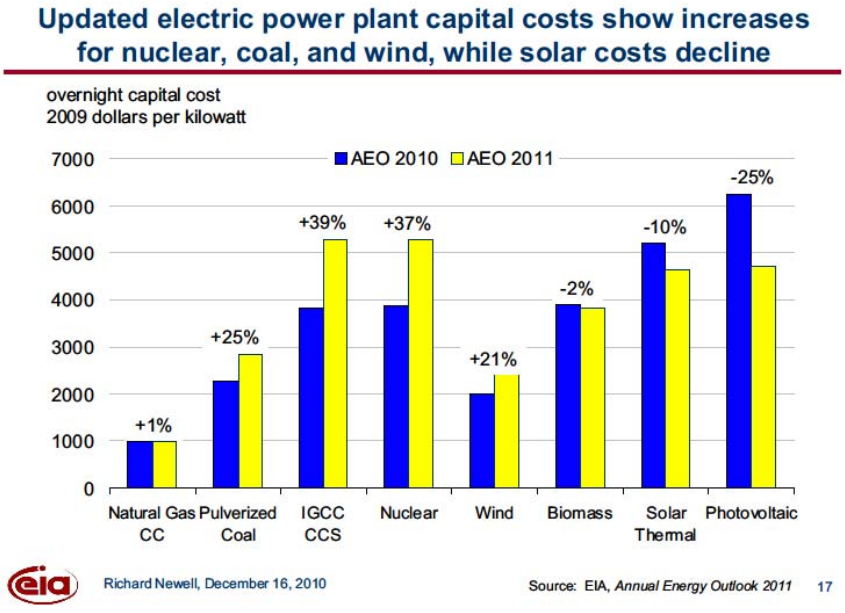
To find out what energy reductions and savings can be realized at your facility, please contact Lincus' engineering staff for a complete evaluation of your water distribution system. We look forward to personally working with your engineering team to optimize your water distribution plant operations.

ENERGY INVESTMENTS

MANAGEMENT STRATEGIES FOR ENERGY EFFICIENCY AND RENEWABLE ENERGY

As the cost of producing electricity through conventional means continues to escalate, consumers are seeking alternative methods to offset the rising costs. Energy Efficiency (EE) and Renewable Energy (RE) represent "demand-side" and "supply-side" energy management strategies that are, respectively, helping consumers mitigate these increases.

Both EE and RE strategies are widely incentivized and subsidized by the government and utility providers. EE measures are often feasible without the need for an incentive, while RE measures are usually heavily subsidized to make them economically feasible. The continuing escalation of energy cost have made the implementation of EE measures very attractive and offer increasingly shorter payback periods.



Electricity production using Natural Gas has stayed relatively on track with 2010 projections. Solar thermal has decreased by 10% and photovoltaic production has decreased by 25%. These costs are important to consider as many power plants in the U.S. rapidly approach the end of their useful life and new generating stations will need to be built in to replace the capacity lost as they are decommissioned. Base power is provided by coal and nuclear plants; natural gas plants are used for peaking power; and renewable energy (including solar, wind, geothermal, hydro, etc.) make up only a small portion of total generation. When EE measures are placed in the equation, the benefits are clearly evident. When required generation capacity is reduced, in most instances, the measures can be controlled and the payback periods are much shorter than the than that of new generating capacity.

Table 1. Estimated Levelized Cost of New Generation Resources, 2016.

Plant Type	Capacity Factor (%)	U.S. Average Levelized Costs (2009 $/megawatthour) for Plants Entering Service in 2016				
		Levelized Capital Cost	Fixed O&M	Variable O&M (including fuel)	Transmission Investment	Total System Levelized Cost
Conventional Coal	85	65.3	3.9	24.3	1.2	94.8
Advanced Coal	85	74.6	7.9	25.7	1.2	109.4
Advanced Coal with CCS	85	92.7	9.2	33.1	1.2	136.2
Natural Gas-fired						
Conventional Combined Cycle	87	17.5	1.9	45.6	1.2	66.1
Advanced Combined Cycle	87	17.9	1.9	42.1	1.2	63.1
Advanced CC with CCS	87	34.6	3.9	49.6	1.2	89.3
Conventional Combustion Turbine	30	45.8	3.7	71.5	3.5	124.5
Advanced Combustion Turbine	30	31.6	5.5	62.9	3.5	103.5
Advanced Nuclear	90	90.1	11.1	11.7	1.0	113.9
Wind	34	83.9	9.6	0.0	3.5	97.0
Wind – Offshore	34	209.3	28.1	0.0	5.9	243.2
Solar PV[1]	25	194.6	12.1	0.0	4.0	210.7
Solar Thermal	18	259.4	46.6	0.0	5.8	311.8
Geothermal	92	79.3	11.9	9.5	1.0	101.7
Biomass	83	55.3	13.7	42.3	1.3	112.5
Hydro	52	74.5	3.8	6.3	1.9	86.4

[1] Costs are expressed in terms of net AC power available to the grid for the installed capacity.

Source: Energy Information Administration, Annual Energy Outlook 2011, December 2010, DOE/EIA-0383(2010)

Lincus strongly encourages implementation of both Energy Efficiency (EE) and Renewable Energy (RE) management strategies. And as we continue to evaluate the economic cases for EE and RE, it is clear that when making a choice for implementation, EE measures are the more feasible of the two. A study performed by the American

Council for and Energy Efficient Economy found an average cost per kilowatt hour (kWh) saved $0.025. This cost is less than half of any RE measure's cost to produce a new kWh, demonstrating how EE measures often make economic sense even without government and utility incentives.

Moving forward, Lincus will continue to develop effective and cost-savings strategies for EE and RE implementation as we examine both "tried and true" methods alongside the cutting edge technologies that continually emerge into the marketplace.

MANAGEMENT TOOLS

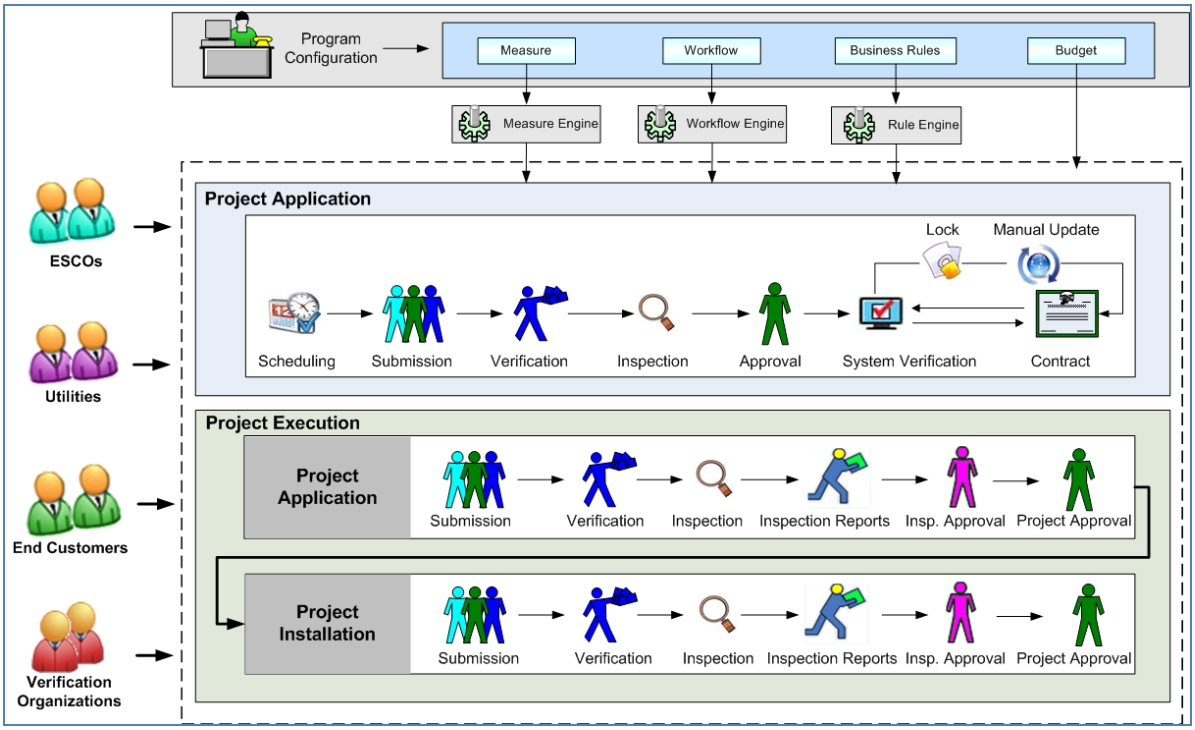
INCREASING YOUR DSM PROGRAM'S kWh YIELD

Based on our EM&V experience of how multiple investor-owned and public utilities are managing their DSM programs, we came to the conclusion that there is a tremendous need for a comprehensive DSM program management tool to help improve program results.

The goals of such a beneficial tool will be to:

- Improve EE program productivity -- kWh yield at the lowest $/kWh cost to the utility.
- Provide on-demand reports on goals and budget.
- Help introduce new programs more rapidly or aid in realizing programs that are not as productive as others for faster results.
- Provide a single-source data capture allowing for a review of the past year's results compared against the present year's performance.
- Provide reports and record keeping by uploading files and application forms for EM&V and program evaluation.

With these factors in mind, Lincus is now offering a program-management software platform called **EE Program Manager** that combines many of the separate and independent worksheets into in one central location. The purpose of this energy-efficiency program management platform is to actively promote, track, and evaluate energy-efficiency installations made by your utility, allowing you to configure and release new energy-efficiency programs in a shorter time frame for different customer segments, while keeping track of program results and comparing various programs or measures within a single business tool. In addition, this type of software can provide detailed business critical reports for program administrators, customer service representatives, and inspection and EM&V consultants to review overall program performance.



Some of the key features of this automated-approach to DSM program management tool include:

- A secure, web-based solution to track, streamline, and report business and residential energy-efficiency projects.
- Ease of managing assignments and tracking the status of changes (including installation measurement and rebate acceptance).
- Notification of pending tasks, prioritization, remaining budget, and program success.
- Validation of a program's check list (eliminating manual intervention) to increase net-to-gross ratio.
- Quick access to EE program information through summarized or detailed or reports.
- Use of a centralized data warehouse (to aid when regulatory information is requested by the PUC).
- Accommodates changes to the existing program without delays.
- The flexibility to be adjusted as your business changes and grows.

Lincus' DSM software tool provides a long list of capabilities that benefit all sides of a program. With this tool a team can be more effective, efficient, and better able to respond to the needs of customers. These qualities ensure the long term success of programs already established or that are still in development.

ENERGY SAVINGS IN OIL PRODUCTION PUMPS

Q: We are an oil production facility in California with more than 100 oil production wells. The artificial lift system is the sucker rod pumps. We would like to find out how we can calculate energy savings resulting from converting existing oil wells to "SMART" wells. It is our understanding that the "SMART" well conversion can reduce water-to-oil ratio from an oil production well by using selectively perforated casing inside the well. The wells are currently operating 24/7 except for some maintenance down time. Can you provide guidance in calculating the potential energy savings from "SMART" well conversion?

A: Reduction in energy consumption, in this application, is highly dependent on the oil-to-water ratio before and after the conversion to a SMART well from the current state. There are some highly complex geological modeling tools available in the market to predict oil-to-water ratio after the "SMART" well conversion. Based on our experience with more than 500 oil production wells, the reduction in water content can be anywhere between 5-50%.

Energy savings will be achieved in:

1) The energy required to lift the product fluid (Artificial Lift)

2) The energy required for surface pumping

3) The energy required for reinjection

Annual kWh savings is the difference between the pre-installation kWh and the post-installation kWh. Energy savings are calculated based on the oil- and water-flow rates for the well for baseline and installed conditions.

In order to fully document the benefits and savings from SMART wells, it is important that the measurement period for the oil- and water-flow rates be a reasonably representative period for the current operation so that the savings may be reliably calculated. Additionally, well depth, surface discharge pressure, and the re-injection pump discharge pressure will be required. Energy savings are calculated as the difference between the annual baseline and post-installation energy consumption. The annual operating hours should allow for the maintenance outages as well. Because the kW demand is expected to remain constant and this type of pump operates 24/7 (except for occasional downtime for maintenance) , we recommend that you calculate the peak kW demand savings by dividing the annual kWh savings with the annual operating hours.

We want to hear from you!

If you have a suggestion for any type of energy-efficiency related article topic, please send it to us at: energyconnection@lincusenergy.com.

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