CASE STUDY

Illinois EPA Public Water Infrastructure Program

ILLINOIS SUSTAINABLE TECHNOLOGY CENTER
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ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

SEDAC
SMART ENERGY DESIGN ASSISTANCE CENTER

Herrin WWTP Case Study

In 2018, SEDAC performed an energy assessment for the Herrin IL Wastewater Treatment Plant (WWTP). The assessment identified several energy cost savings measures to reduce energy and utility costs. Most recommended measures focused on variable frequency drives (VFDs) for five 25 HP influent pump motors, four 20 HP effluent pump motors and lift station pump motors. After the assessment, operators made several improvements to the plant based on our recommendations.

To explore the actual savings gained from VFDs, SEDAC worked with the City of Herrin to evaluate energy use data and costs to see if efficiencies were gained at the plant.

Figure 1. City of Herrin WWTP

Energy Assessment Recommendations

The 2018 Herrin WWTP energy assessment evaluated energy cost reduction measures to reduce electrical consumption and utility costs. After thorough evaluation, three energy-saving measures were recommended for implementation based on their effective rates of return. The recommendations focused on installing VFDs for their lift station, influent, and effluent pumps which would reduce 148,000 kWh of electricity and save about $10,000 on their electrical costs.

Measure	kWh Savings	Annual Cost Savings	Project Cost with Incentives	Payback Period (years)
VFDs for lift station pumps	37,600	$2,600	$26,000	10
VFDs for influent pumps	58,000	$4,100	$22,500	5.5
VFDs for effluent pumps	52,400	$3,700	$18,000	5
Total	**148,000**	**$10,400**	**$66,500**	**6.4**

Table 1. City of Herrin WWTP Report Recommendations

Applying VFDs to these pumps allows them to operate at speeds that match the flow demands into and through the treatment plant. For influent pumps, VFDs not only provide a means to match flows, they can also allow the pumps to reverse and clear clogs without having to invest manual labor into returning the pumps to operation. For the influent and effluent pumps, proper staging of the pump motors in combination with the variable flow provided by VFDs can allow the pumps to run at optimal efficiency points on their operating curves. Rather than running a single pump up to full speed, then ramping down when a second pump is started, proper programming may run two pumps at lower average speed and at a higher overall efficiency than single-pump staging.

Evaluating Implementation Results

Based on SEDAC's recommendations, VFDs were installed on the influent and effluent pumps in June of 2020. In 2022, SEDAC worked with Tom Somers, Director of Public Works for City of Herrin IL, and Randy Lattuada, Chief Operating Engineer for the Herrin WWTP to collect their current energy bills and compare them to previous bills to see if energy usage had improved.

Comparing 2017 to 2022 shows that electricity consumption fell 2% while flow through the plant increased by 18% from 721 to 853 MG. The following table documents the results for the plant.

Year	Electricity (kWh/ year)	Plant Flow (MG/ year)	Electric Use Intensity (kWh/ MG/yr)	Actual Annual Cost ($/MG)	Electric Unit Cost ($/kWH)	Total Annual Electrical Cost ($/year)
2017	641,920	721	890	$52	$0.058	$37,191
2021	638,836	821	778	$95	$0.122	$77,913
2022	628,805	853	738	$72	$0.097	$61,240

Table 2: Plant Electrical Consumption, Flow Data and Electric Use Intensity

Electric Use Intensity (EUI), a common benchmarking metric that highlights energy use per million gallons of water treated, decreased from 890 kWh/MG in 2017 to 738 kWh/MG in 2022. This represents a 17% reduction in kWh/MG processing energy intensity. This can be seen in Figure 2 between 2017 and 2022.

This is a significant and important reduction for the plant, especially since electrical costs have risen significantly in the past few years, shown above in Table 2. Had electrical use intensity stayed the same, 2022 electrical costs would have been $73,911, or $12,671 more annually. Even though the cost of electricity affected overall operating costs, VFD applications at the plant reduced energy use intensity at the plant over time and reduced plant operational cost increases.

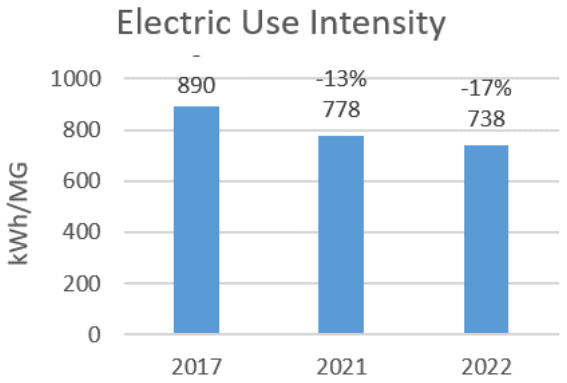

Figure 2. City of Herrin WWTP 2017- 2022 Electrical Use Intensity

Utility Analysis of Lift Stations

SEDAC also evaluated VFDs for certain lift stations that demonstrated significant run times. So far, two lift stations have received VFDs: Sunnyside (two 20 HP motors) and Chittyville Rd. (two 10 HP motors). After analyzing utility data, the Sunnyside lift station demonstrated energy savings of about 20%.

VFDs were installed at the Sunnyside lift station in June of 2020. Table 2 below summarizes the savings achieved from installing VFDs at this lift station, showing 2 years prior to the installation and 1.5 years post-VFD installation.

Date	Total Electric Cost	Annual Pump Energy Usage (kWh)	Electric cost ($/kWh)	Annual Precipitation (inches)	VFD Status
2017	$2,120	21,037	$0.10	45	w/o VFD
2018	$4,746	28,905	$0.16	62	w/o VFD
2020*	$2,369	18,806	$0.13	48	w/VFD
2021	$2,859	21,549	$0.13	48	w/VFD

*VFD was installed in June so ½ of this year is pre-VFD.

Table 3: Sunnyside Lift Station Data

Based on this limited set of data, it does appear that the VFDs are helping the plant save energy. When comparing 2017 to 2020 electric usage data, there is a marked improvement in energy reduction, particularly since 2020 was a wetter year. Electrical consumption was reduced by approximately 11%. However, comparing 2020 to 2021 shows an increase for the same amount of precipitation. This could be due to the intensity of rainfall events and how that precipitation infiltrates the sewer system.

We look forward to keeping in touch with the staff at the Herrin WWTP to study energy reduction as the plant continues to implement energy efficiency projects.

Learn more about the program and apply now for your no-cost energy assessment now!
APPLY @ sedac.org/wastewater.

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Illinois EPA: epa.illinois.gov/topics/energy/eewwtp.html

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