

# Energy improvements move ahead while enhancements emerge

August 15 2013, by Kate Chesley

---



Project manager Joseph Kearney. Credit: Kate Chesley

Installation of 20 miles of underground pipes, steam-to-hot-water conversion of 150 buildings and construction of a new energy facility continue on campus, while more enhancements emerge under the university's comprehensive [Stanford Energy System Innovations](#).

Installation of [campus underground pipes](#) as part of the massive Stanford

Energy System Innovations (SESI) is ahead of schedule, with 12 of the 20 miles of the new hot-water system now in place.

The pipe installation, which is causing some disruption to campus pedestrian and vehicle traffic, is probably the most visible aspect of the comprehensive, campus-wide, \$438 million [energy](#) system overhaul that will [reduce Stanford's carbon emissions by 50 percent](#), cut water use by 18 percent and save an estimated \$300 million over the next 35 years.

When implemented in 2015, SESI will result in one of the most energy-efficient systems in the world, according to Joseph Stagner, executive director of sustainability and energy management. The system is already garnering accolades: Stagner and his team recently accepted an [innovation award](#) from the Association of Physical Plant Administrators.

## **Campus disruptions**

"We're moving incredibly fast," said Stagner, who has overseen similar, but smaller, conversions in the past. "I was nervous before installing such a huge underground system. I thought we would be cutting into utilities, causing [power blackouts](#) and water leaks. That hasn't happened. The crews have been very fast without disrupting the campus as much as feared."

The lack of incidents is due to careful planning and close coordination of vendor and campus teams, according to Joseph Kearney of the Department of Project Management, who is responsible for the pipe installation as well as for the steam-to-hot-water conversion of about 150 buildings.

"We're in a rhythm," Kearney said of the 11 crews currently working to install underground pipes. Kearney and his team focus on logistics and campus outreach to help diminish what he acknowledges is campus

"construction fatigue." Underground utility work will be completed by October 2014.

Kearney said building conversion is picking up pace, with seven buildings completed and 17 more underway. That work, although focused primarily on mechanical rooms, can nevertheless cause disruptions for building occupants when water or electricity is shut down. Each building is unique, Kearney said, presenting different challenges for work crews. Kearney said additional crews will soon be joining the effort as the work ramps up in the fall.

The new energy system envisioned under SESI will be cleaner, more efficient and cheaper. The integrated system is designed to be flexible, allowing Stanford to take advantage of a variety of energy options – including buying energy from the grid – and to adopt future green technologies not yet invented.

Unlike cogeneration, the new electric facility takes advantage of Stanford's temperate climate. Because of that climate and because research facilities make continuous use of refrigeration, university buildings are being cooled and heated at the same time. The new system achieves efficiency by taking advantage of this overlap, capturing waste heat from the chilling system to produce hot water for the heating system.

"In the old days, energy was a lot cheaper," said Stagner. "So, the approach was to overcome the environment and to change it to meet human needs. Stanford's cogen was very efficient, but it still used fossil fuel to overcome the environment. This new system proves that you can use what is available in the environment to be more efficient and clean at the same time."

The facility will be operated by an automated control system invented at

Stanford that will operate the plant while simultaneously securing the most cost-efficient electricity available at any one time.

"Sometimes people will ask me, 'Are you sure this is going to work, Joe?' Yes, I'm sure," Stagner said. "We have had extensive peer reviews. The technology is not space age – it is all readily known."

The pipe installation and building conversions are just two parts of the multi-faceted SESI, which was approved by the Board of Trustees in 2011. Combined with the construction of a new [energy facility](#), they are the aspects most obvious to the campus community. The new 125,000-gross-square-foot energy facility taking shape on Searsville Road will replace the Cardinal Cogeneration plant and is about 30 percent complete.

## **Comprehensive plan**

SESI will eventually replace the natural-gas-fired cogeneration system the university has used since 1987 for virtually all of its energy needs. Cardinal Cogeneration, which is located on Campus Drive and is nearing the end of its useful life, produces electricity and then recovers and reuses waste heat from the combustion process. Although considered efficient, the system discarded useful heat generated by cooling processes.

## **Other enhancements**

Since earning board approval in 2011, Stagner and his team have made progress on three additional aspects to SESI. Studies on all three will culminate in the next several months.

The first is a high-voltage transmission link that will join Stanford with

the SLAC National Accelerator Laboratory and the city of Palo Alto. Such a link would strengthen the area's electrical grid and protect each partner from energy disruptions. Stagner hopes to submit a proposal with Palo Alto to the U.S. Department of Energy to create the connection.

A second enhancement calls for installing photovoltaic technology on campus buildings. Stagner's team has worked with a vendor to study the feasibility and identify appropriate buildings. The university, he said, is now analyzing whether to move ahead with solar panel installation.

A third possible enhancement is ground-source heat exchange, which would leverage the constant 60-to 65-degree temperature of the ground beneath the university to provide heat in the winter and to deposit unwanted heat in the summer. Stagner said his department has done exploratory borings on the west side of campus to test the feasibility of ground-source heat exchange and has met with regulatory agencies to see how receptive they would be to a proposal.

Since 2011, Stagner said, two other possible enhancements to SESI have also emerged, including an electrical vehicle charging infrastructure and increased campus electrical storage.

"We knew electrical vehicles were coming," Stagner said. "We predicted that Stanford – with 20,000 parking spaces – would need to be prepared. We've put a proposal in front of campus decision-makers and asked them to consider what they would like Stanford to do."

Stagner and his team are also investigating converting about 100 building diesel emergency generators to battery power. The objective is to increase electrical storage on campus, better protect against energy disruptions and level off energy use and production.

"The goal with Stanford's electrical footprint on the grid is to make it as

level as possible," Stagner said. "You want to shave the demand peaks. We have thermal storage tanks at the new facility, which means we can run our electrical equipment during nights when demand is lower and cheaper. We also have advanced electrical-use software."

But Stagner said he and his team began to wonder if a distributed battery system could further reduce the dips and rises of energy demand and use, especially if Stanford begins to rely on photovoltaic energy. Just one cloud passing over campus, for instance, can create a significant dip in the 10 megawatts of power that solar panels may contribute. Could the battery-powered generators kick in at those diminished times?

"We're studying this to see if there might be a better long-term solution for providing both back-up power to individual buildings and also making our campus micro-grid more efficient and economical," Stagner said.

## **Next steps**

All of SESI's enhancements are coming to fruition in the next several months, Stagner said.

"We expect by the end of the year to have these five [energy system](#) enhancements on the table for executive decision-making," he said.

"That will wrap up our comprehensive look at our 21st-century system. If developments occur down the line, we'll take a new look. But for now, this is all the innovation and best practices we can think of."

The next step in SESI implementation will then be the strategic purchase of power on the energy market, beginning in 2015 when Cardinal Cogeneration is decommissioned and the new facility comes on line. Among the options his team will be investigating is locking in long-term renewable power at attractive prices, much as the city of Palo Alto has

done. Stagner hopes to convene a campus advisory group to plot out potential strategies.

In the meantime, Stagner remains circumspect about the challenges ahead.

"Society has had a nice 150 years of the industrial revolution, but we came in like a bulldozer," he said. "We prospered, but we messed up our sandbox in the process. Now is the time to adjust course. Yes, we can slowly transform our society and still have a great life in the process. So, it's fun to be an engineer these days, and Stanford is prepared. We're ready for just about anything."

Provided by Stanford University

Citation: Energy improvements move ahead while enhancements emerge (2013, August 15)  
retrieved 20 March 2024 from <https://phys.org/news/2013-08-energy-emerge.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------