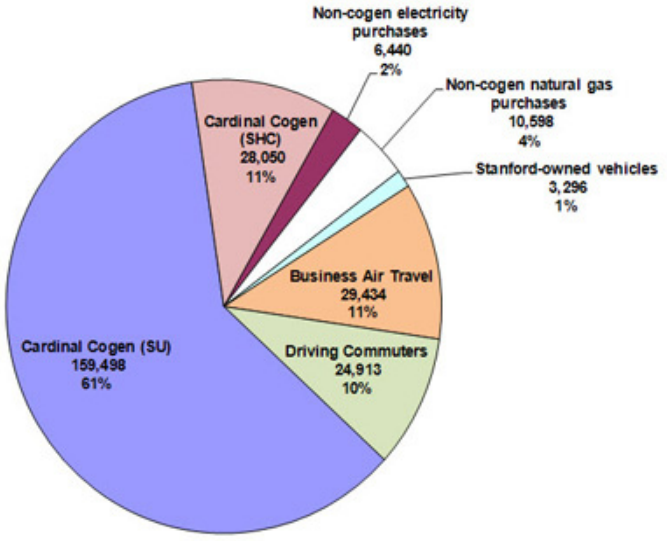
FACT SHEET: ENERGY AND CLIMATE ACTION

STANFORD SUSTAINABILITY OPPORTUNITY

With an ever-increasing demand for research and education, Stanford University faces a formidable task in reducing greenhouse gas emissions (GHG) from campus operations. Since the 1980s, Stanford has used energy metering of all its facilities to understand how and where energy is being used, in order to develop strong energy-efficiency programs. In addition to an aggressive demand-side energy management program, Stanford has used efficient natural-gas-fired cogeneration for virtually all its energy supply since 1987. Nevertheless, Stanford accepts the challenge of our time to go beyond these efforts and raise the bar in energy efficiency and the use of innovative, clean, and renewable energy supplies.

STANFORD'S CARBON EMISSIONS INVENTORY

The university joined the California Climate Action Registry and completed its emissions inventory in 2006 (certified), 2007 (certified) and 2008 (to be certified in November 2009) to account for carbon dioxide CO_2 equivalent emissions from university operations. The latest third party certified inventory (2007) accounted for 180,000 metric tons of CO_2 equivalent from main campus operations. The reports are publicly viewable at https://www.climateregistry.org/CARROT/public/reports.aspx or http://sustainable.stanford.edu/climate_action. The following graphic shows a more complete emissions inventory of 262,000 metric tons of CO_2 equivalent accounting for required reporting to the Registry as well as emissions from university population commute and air travel.



Stanford's full emissions inventory including commute and air travel for calendar year 2008

STANFORD ENERGY AND CLIMATE PLAN (2008 -2009)

Under the leadership of the Department of Sustainability and Energy Management, a planning team comprised of expert faculty and campus operations staff developed Stanford's Energy and Climate Plan from 2008 to 2009, with two consultant peer reviews prior to campus review.

The Energy and Climate Plan sets forth a number of options thoroughly reviewed for their emissions reduction potential, technological feasibility and net present value of the long term investment. Specific principles and methodologies included use of Life Cycle Cost Analysis, maximizing use of existing assets, and adept balance of capital investment. Most notably, the Energy and Climate plan also takes a deeper look at the campus Cogeneration facility, the largest source of Stanford's GHG emissions, and an asset that is nearing the end of its useful life.

The analysis in the Energy and Climate Plan suggests that Stanford can achieve about 20% GHG reduction from the 1990 baseline by 2020, and in the process reduce Stanford's domestic water consumption by 18%, and save about $639 million between the years 2010 and 2050 if: it moves from a natural-gas-fueled cogeneration energy supply strategy to Regeneration (next page); it achieves currently prescribed energy efficiency standards in new construction; it continues and expands its demand-side management programs; and it achieves additional options for GHG reduction through incorporating renewable electricity into its supply portfolio or development of other energy technologies.

Stanford University will not be relying on carbon instruments (Carbon offsets, Renewable Energy Credits, Cap & Trade Allowances) at this time.

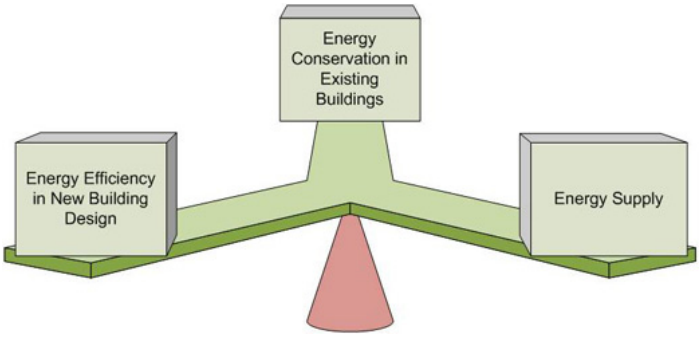
SUSTAINABLE STANFORD

FACT SHEET: ENERGY AND CLIMATE ACTION

CONTINUED

BALANCED PLANNING APPROACH

Given Stanford's plans for significant growth to support its academic mission, its large and diverse existing campus building inventory, and its current reliance on natural gas cogeneration for energy (the main source of its GHG emissions), an adept balance of investment between all three of these areas below have been investigated in the Energy and Climate Plan.



A balanced approach for key components in the Energy and Climate Plan

1) Minimizing energy demand in new buildings: Constructing high performance new buildings to minimize the impacts of growth on campus energy systems and GHG emissions is a key strategy at Stanford. The Sustainable Development Guidelines of 2002 and new building energy efficiency guidelines of 2008 (equivalent to LEED Gold) provide the framework for minimizing energy demand for new construction and major renovations despite campus growth.

2) Reducing energy use in existing buildings: Since the 1980s, Stanford has employed energy metering of all its facilities to understand how and where energy is being used, in order to support strong energy-efficiency programs. While the University has pursued aggressive energy conservation for many years, a continuance and expansion of these programs is another key strategy of the Energy and Climate Plan.

3) Energy supply: Stanford has pursued efficient energy supply through use of natural gas-fired cogeneration for virtually all its energy since 1989. However, fossil fuel use in cogeneration is the largest contributor of GHG emissions for Stanford, and conversion to new options that assure reliability, contain cost, and reduce GHG are an essential third strategy in the Energy and Climate Plan.

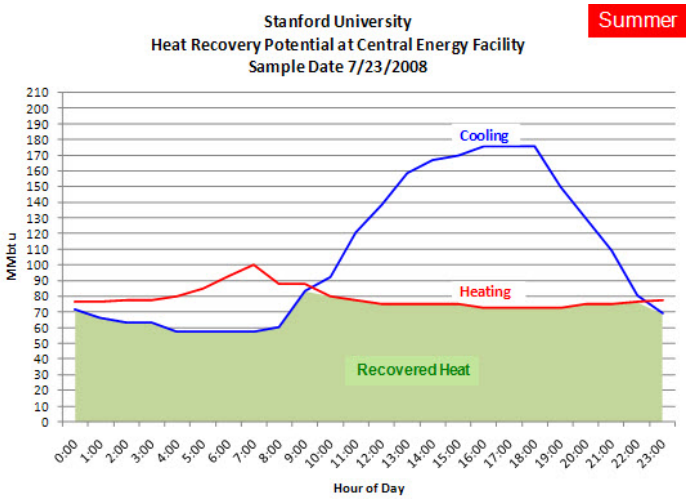
FEATURING REGENERATION

The Regeneration scheme is the most innovative component of the Energy and Climate Plan. During the planning exercise, analysis of real time energy use revealed that Stanford has a significant and simultaneous need for heating and cooling on campus. If the heat is reused, the campus can recover up to 70% of the heat now discharged from the cooling system to meet 50% of campus heating demands.

Based on this finding the Energy and Climate Plan proposes to replace the current natural-gas powered cogeneration plant with an electricity-powered 'regeneration' plant based on heat recovery, along with conversion of the campus steam distribution system to a hot water system. The conversion from a steam to hot water distribution system requires significant up front capital investment and is projected to take from five to ten years to implement, but promises very significant long term cost, GHG, and water savings for Stanford University.

HOW WILL REGENERATION WORK?

An energy supply system that uses fossil fuel to produce electricity and then recovers waste heat from the combustion process for heating is known as combined heat and power, or cogeneration. An energy supply system that allows flexibility in the method of electricity generation, such as renewable resources, and which recovers waste heat produced freely by the environment (rather than fossil fuel combustion) is thought of as Regeneration.



Heat Recovery potential and real-time thermal overlap (summer)

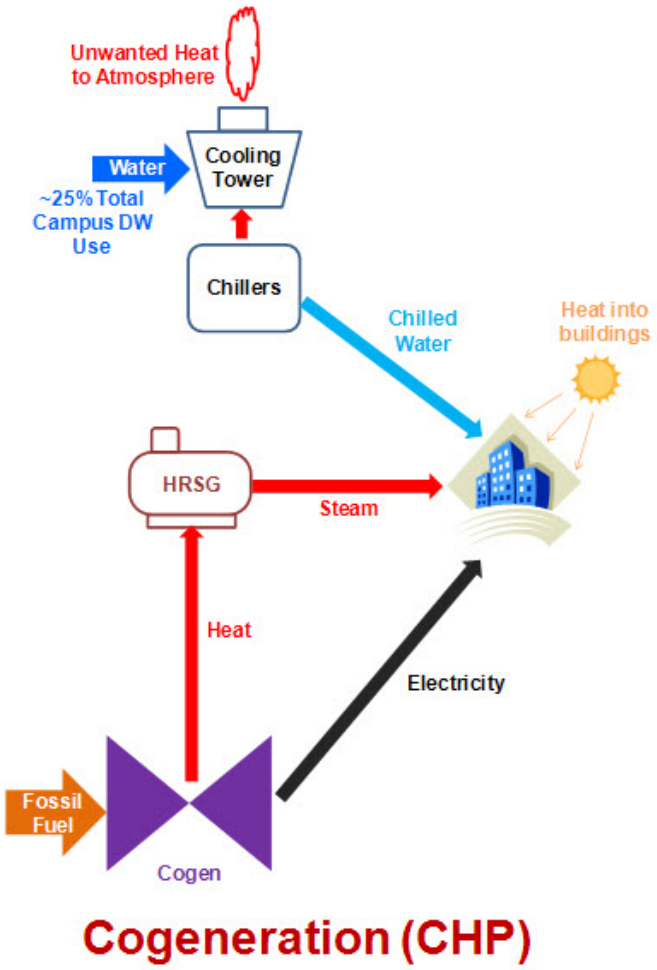
Regeneration will work by capturing the heat given off from building air conditioning systems and using it to meet simultaneous building heating and hot water needs that are now met by burning fossil fuel. Unlike residences and simpler commercial buildings, simultaneous heating and cooling of indoor air occur in more complex buildings such as university laboratories and museums to properly manage their air temperature and humidity. While 'heat wheels' and other systems are sometimes used for heat recovery in individual buildings, the Regeneration project at Stanford would replace its existing fossil fuel fired cogeneration plant with a central energy plant that applies these techniques on a campus-wide scale. This is possible by taking advantage of the existing district

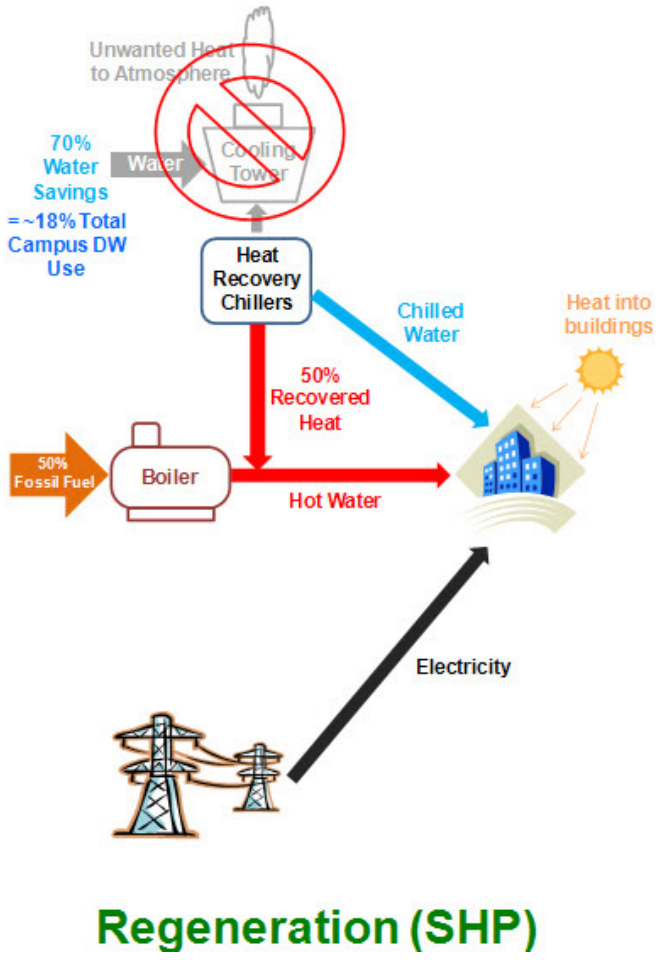
FACT SHEET: ENERGY AND CLIMATE ACTION

CONTINUED

heating and cooling system that supports the university's 125 largest buildings and would result in central plant energy efficiency with corresponding GHG reductions. By reusing heat rejected from the buildings instead of using evaporative cooling to eject it to the atmosphere, an 18% savings in total campus water use would also be achieved.

Below is a schematic diagram that explains how Regeneration would work compared to Cogeneration, dramatically reducing the need for fossil fuel to generate electricity, eliminating unwanted heat release into the atmosphere and reducing campus water use. In an ongoing pursuit of sustainability, the Regeneration scheme will move Stanford into a new energy era with significantly lower costs, GHG emissions, and water use. Just as Stanford's move to Cogeneration 25 years ago represented a major shift in campus energy supply technology for the better, so too does Regeneration represent a significant shift of the campus energy supply to a more efficient and sustainable technology.





VISIT SUSTAINABLE STANFORD WEBSITE FOR MORE INFORMATION: http://sustainable.stanford.edu/climate_action

SUSTAINABLE STANFORD

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