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# Harvard University
## Cambridge, Massachusetts
## Solar Photovoltaic Installation

**SCHOOL**
Founded in 1636, Harvard University is a private research institution made up of 10 principal academic units - nine faculties and the Radcliffe Institute for Advanced Study. Approximately 2,100 faculty teach a student body made up of 6,700 undergraduates and more than 12,000 graduate and professional students.

**ABSTRACT**
Harvard Real Estate Services decided to take advantage of a confluence of opportunities – funding partnerships, a large flat roof, and state of the art solar technology – to create a 500 kW solar installation, the largest institutional solar project in New England. The location was a Harvard property with a roof the area of three football fields at 311 Arsenal Street in Watertown, MA. Completed in December 2009, this project consists of 1616 panels and is expected to produce 635,272 kWh of electricity each year. (*Use Google Earth to get an aerial view of the solar panels by searching for 311 Arsenal St, Watertown MA).*

A division of Harvard University Campus Services, Harvard Real Estate Services (HRES) has made greenhouse gas reduction a primary focus of its capital and operating plans since the early 2000s. Recent advances in technology have made it both economically and technically feasible to incorporate solar photovoltaic and wind into our energy mix.

HRES has implemented both wind and solar projects on their properties as a symbol of their commitment to green energy and sustainability:
http://sustainability.hres.harvard.edu/icb/icb.do?keyword=k59241&pageid=icb.page252416

Overall, Harvard has approximately 600kW of on-campus renewable energy projects which can be viewed on a map at: http://green.harvard.edu/renewable-energy.

**GOALS AND OUTCOMES**
**Goals**
The goal of the project was to take a leading role in transitioning our energy supply to renewable sources. We anticipate the project will produce up to 635,000 kWh of clean energy per year for the life of the panels, a minimum of 25 years.

**Accomplishments and Outcomes**
Since coming on line, the system has performed as expected, meeting our very aggressive projections of energy production. Production to date is 458,259kWh. The benefit of the system can also be seen when comparing the peak electric load of the building between prior summers and this one. On our hottest days so far, when temperatures soared to over 90 F, the building remained below the peak demand experienced in previous summers. By managing peak electric load, we help reduce the need for our New England power grid to engage the old, dirty power plants that are used only during peak demand.

**Challenges and Responses**
Funding was the largest obstacle to a solar installation of this size. Thanks to availability of federal funding and a state grant, the project was attractive to third party financers, which enabled collaboration between Harvard, the Commonwealth of Massachusetts, and a private market energy company. Harvard was willing to host, rather than own, the project in order to make it happen in fiscally challenging times. Under a Power Purchase Agreement, Harvard agreed to buy energy and environmental attributes without the burden of initial costs or ongoing maintenance responsibilities.
Another challenge was that the existing roof had an expected remaining life of just nine years, and we needed to be sure it would be viable for at least 20 years, to more closely align with the life of the solar panels. Rather than undertake an expensive replacement, we re-seamed the existing roof and had the warranty extended.

Luckily, the project easily met with approval from all interested parties, including the Massachusetts Historical Commission.

**Campus Climate Action: Your School's Carbon Footprint**
This project directly addresses global climate change by reducing emissions. Anticipated greenhouse gas reduction is 238 metric tons carbon dioxide (MTCDE) per year for the life of the project. That's equivalent to powering 31 houses or taking 52 cars off the road every year.

## ENGAGEMENT AND SUPPORT

**Leaders and Supporters**
Harvard Real Estate Services' sustainability group worked with multiple Harvard, state and private entities to bring this project to fruition. These included Harvard's Office for Sustainability, Harvard's Engineering & Utilities group, Harvard's University & Commercial Real Estate, Massachusetts Technology Collaborative (now the Clean Energy Center), as well as finance partners, contractors, engineers, and solar designers.

**Funding and Resources**
The initial cost was partially funded by a $1.08 million grant awarded by the Massachusetts Technology Collaborative to Harvard University. This money was consigned to Crimson Solar (the system's operator) when the project went online. Unlike Harvard, which is a non-profit, Crimson Solar is eligible to receive federal incentives that made the project financially viable. Crimson Solar raised the remainder of the money required for the project.

**Education and Community Outreach**
We educated the building occupants through a lobby display during the construction period. Several articles appeared in on-campus and local press outlets, and on public web sites. Interested parties within the Harvard community were given tours, including a class from the School of Engineering and Applied Sciences.

## CONTACT INFORMATION

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## MORE ABOUT YOUR SCHOOL

### Campus Sustainability History

Harvard University is dedicated to confronting the challenges of climate change and global sustainability both through academic research and by translating that research into action on campus.

Harvard's efforts are driven by three flagship sustainability commitments: Sustainability Principles that provide broad vision to guide University efforts; Green Building Standards that require LEED silver plus additional energy requirements; and a Greenhouse Gas Reduction Goal to reduce emissions 30 percent below a 2006 baseline by 2016 including growth. These commitments are administered through the Harvard Office for Sustainability.

As of the end of Fiscal Year 2009 emissions have decreased 7 percent including growth, 14 percent without growth (from base buildings). As of September 2010, Harvard had 79 green building projects registered with the United States Green Building Council, 37 of which are certified LEED (Leadership in Energy and Environmental Design) projects, a 55 percent recycling rate, renewable energy projects on campus, composting in residential and commercial dining halls, organic landscaping in Harvard Yard, and a drive-alone rate of only 15 percent, to name just a few examples.

Harvard's Office for Sustainability is advancing these efforts by bringing together thousands of students, faculty and staff across the University to translate knowledge into action. By successfully integrating sustainability principles into all Harvard practices, the University delivers tangible, positive contributions to the global environment and human well-being.

Please visit the Harvard Office for Sustainability website for more information at
http://www.green.harvard.edu