2006-2016 CLIMATE GOAL REPORT

HOW HARVARD UNIVERSITY MET ITS GREENHOUSE GAS EMISSIONS REDUCTION TARGET

Acting on climate is part of Harvard's broader commitment to transform our campus into a low-carbon community that enhances the well-being of people and the planet. A University-wide Sustainability Plan provides the framework for this work, and is focused on translating research into action by creating practical solutions that contribute to local, regional and global progress.

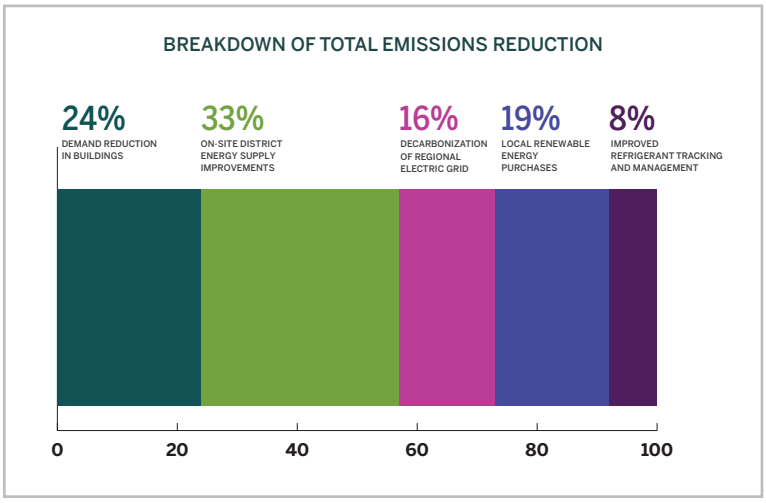
In 2008, Harvard built upon its longstanding research and teaching on climate change by setting an ambitious goal to reduce University-wide greenhouse gas emissions 30% by 2016, from a 2006 baseline. The target was science-based, stemming from what climate scientists said was necessary to avoid two degrees Celsius of warming, instead of what was achievable through on-campus reductions alone.

What Made The Goal Unique:

- **Based on established climate science**
- **Imposed a short-term target in order to spur immediate action**
- **Reflected absolute emissions, inclusive of campus growth**
- **Included all properties within operational control throughout North America**

ACHIEVING HARVARD'S HISTORIC CLIMATE GOAL

Students, staff, and faculty at every level of the University embraced the challenge of meeting our aggressive 30% reduction goal. Changes to energy supply and demand, including the decarbonization of the regional electric grid, resulted in a 24% absolute reduction in emissions. This progress was achieved despite the addition of over three million square feet of space. Purchased electricity from local renewable energy sources fulfilled the remaining 6% reduction needed to meet the goal. Excluding campus growth, emissions were reduced by 40%.



1. ENERGY EFFICIENCY FIRST
2. IMPROVING DISTRICT ENERGY
3. DECARBONIZATION OF THE REGIONAL ELECTRIC GRID
4. ADVANCING THE TRANSITION TO RENEWABLE ENERGY
5. EXPLORING OFF-SITE EMISSIONS REDUCTION
6. CREATING SYSTEMS CHANGE

UNDERSTANDING THE CHALLENGE

Harvard tracks and publicly reports on University-wide Scope 1 and 2 greenhouse gas emissions using the Climate Registry's operational control methodology. The University's emissions inventory was third-party verified in 2016 and received Climate Registered™ status. Management and tracking of short-lived pollutants in our inventory has improved since 2006, resulting in more accurate data on the actual losses of refrigerant gases and their associated emissions impact. Due to historical overestimations, this change appears as a decrease in the inventory.

97% of the University's emissions are from building electricity use, heating, and cooling. Vehicle fleet and refrigerant losses account for the remaining **3%**.

Laboratories consume **46%** of energy on campus but represent only **22%** of the square footage, illustrating the unique challenge that research-focused organizations face as they seek to reduce their emissions footprint.

Greenhouse gas emissions inventory:

- **Scope 1 (direct) and Scope 2 (indirect) emissions**
- **All 7 greenhouse gases recognized by the Kyoto Protocol**
- **600+ buildings across North America**
- **25 million square feet of space**
- **3 on-site district energy systems (steam, chilled water, electricity)**

1. ENERGY EFFICIENCY FIRST

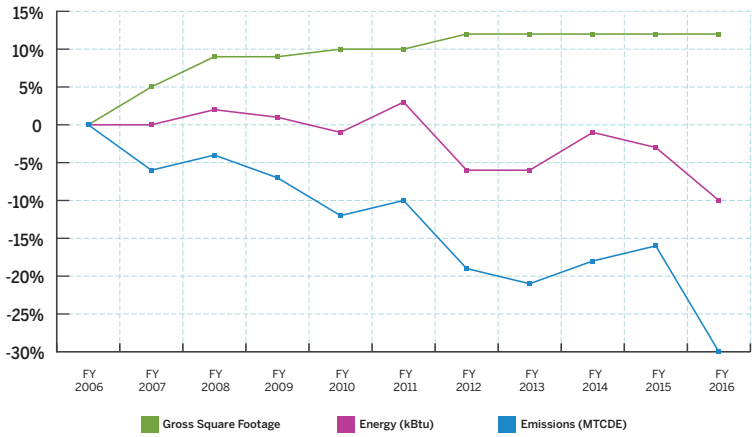
As a first step in meeting its climate goal, Harvard undertook a University-wide initiative to increase the energy efficiency of its buildings. Over 80% of the campus was energy audited, including all energy-intensive spaces, and energy reduction requirements were incorporated into the five-year capital planning process.

Facilities teams and building managers took advantage of a $12 million Green Revolving Fund, Life Cycle Costing Policy, and Green Building Standards to install cutting-edge energy efficiency technologies and optimize existing systems through ongoing commissioning. The most common types of improvements were HVAC (heating and cooling) and lighting upgrades. As a result, overall energy use is down 10% across the University, even as the campus grew (energy use varies year-to-year depending on weather conditions).

1,600
ENERGY CONSERVATION MEASURES IMPLEMENTED

10% Reduction
NET ENERGY USE (23% REDUCTION EXCLUDING GROWTH)

CHANGE IN ABSOLUTE EMISSIONS, ENERGY, AND SQUARE FOOTAGE
2006-2016



2. IMPROVING DISTRICT ENERGY

For nearly a century, Harvard has leveraged the benefits of on-site district energy to improve the resiliency of our campus. Projects undertaken to improve the efficiency and performance of the on-site Blackstone Steam Plant and two chilled water facilities account for the largest portion of on-site emissions reduction.

Fuel switching to natural gas **+** Expanded combined heat and power system **+** Additional utility efficiency upgrades **=** 20,500 MTCDE reduction equivalent to taking over 4,300 cars off the road

3. DECARBONIZATION OF THE REGIONAL ELECTRIC GRID

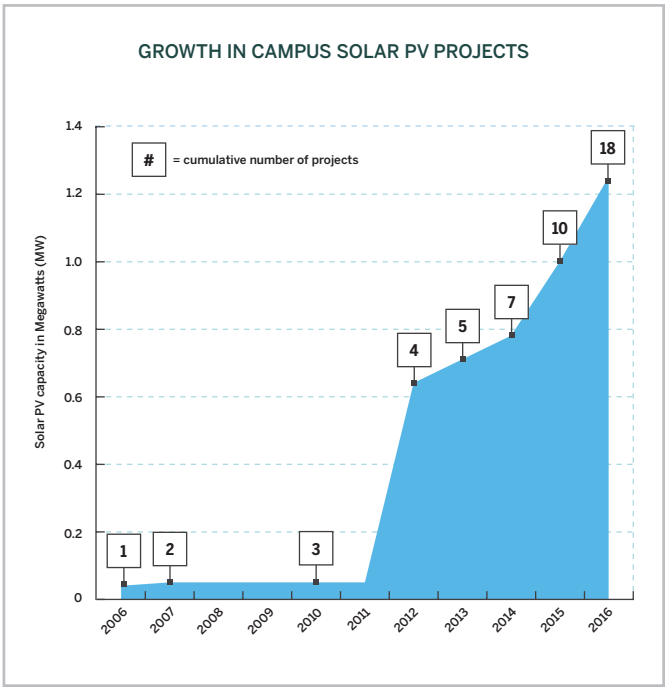
The electricity that Harvard purchases from the regional electric grid has become cleaner in the last decade, driven primarily by the replacement of dirtier fuel oils and coal with less carbon-intensive natural gas—from 2000 to 2015, the percentage of the grid's total electric energy production from natural gas increased from 15% to 49% while coal decreased from 18% to 4%, and oil from 22% to 2%. (*source: ISO-NE*)

	NATURAL GAS	COAL	OIL
2000	15%	18%	22%
2015	49%	4%	2%

4. ADVANCING THE TRANSITION TO RENEWABLE ENERGY

Harvard was an early adopter of renewable energy, piloting emerging technologies, assessing wind energy potential along the Charles River, and investing in solar and wind projects to accelerate the transition to clean energy. On-site solar PV, solar thermal, biomass, and geothermal installations play an important role diversifying Harvard's energy supply and serving as a testing ground to inform future action.

In 2009, Harvard entered into a long-term power purchasing agreement for 12 MW of carbon-free energy from the Stetson II wind farm in Maine, making us the largest purchaser of wind power by a college or university in New England at that time. Harvard has retired the Renewable Energy Certificates (RECs) from the project to meet requirements of the Massachusetts Renewable Portfolio Standard (2009–2016) and to meet part of our voluntary emissions reduction goal (2016). Excess RECs are sold.



5. EXPLORING OFF-SITE EMISSIONS REDUCTION

In 2015, a faculty-led advisory group determined that the markets for off-site emissions reduction are complex and evolving. Following their guidance, Harvard is funding a three-year, multi-disciplinary graduate level course, as well as research projects to design and analyze practical tools for using off-site means as a component of achieving carbon neutrality.

Using criteria provided by the faculty advisors, Harvard identified a mix of off-site options to pursue that included regional, national, and global renewable energy and carbon offset projects. To complement the emissions reductions from energy supply and demand, the University purchased wind from Maine and existing hydro power from Massachusetts in 2016 to meet our short-term climate goal (the other options identified were not needed as the on-site emissions reductions were larger than projected).

6. CREATING SYSTEMS CHANGE

Harvard's campus-wide climate action plan aligned our decentralized organization around a common set of principles and policies that provided individual units with the autonomy to act and innovate within the unique constraints of their School or department. Creating and implementing the plan was managed by the Office for Sustainability, and overseen by an Executive Committee of senior faculty and administrators appointed by President Faust.

The experience provided a blueprint for the development of a University-wide Sustainability Plan in 2014 which positioned climate action under a broader sustainable development vision.