

# Cooper Union's Roadmap to 40 X 30



**Melody Baglione**  
Professor of Mechanical Engineering, The Cooper Union for the Advancement of Science and Art  
**John Rundell**  
Principal, Smith Engineering  
**Nicholas Triano**  
ME Class of 2020, The Cooper Union for the Advancement of Science and Art

## Objectives

Cooper Union accepted the NYC Carbon Challenge aiming to reduce its greenhouse gas emissions (GHG) intensity by 40% by 2030. The New York State Energy Research and Development Authority (NYSERDA) awarded Cooper Union with Technical Assistance for Roadmap funding to develop an Energy Master Plan and Carbon Action Plan. The Roadmaps program is providing funds for Cooper Union to work with Smith Engineering to identify and implement energy conservation measures (ECMs) in order to meet the 40 X 30 target.

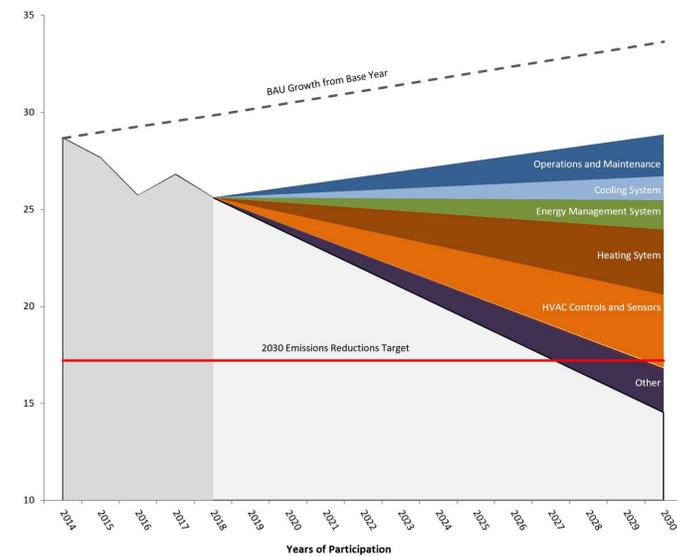
## Methodology

Cooper Union is employing both industry expertise and student resources to meet its carbon reduction goal by:

- 1) Subcontracting Smith Engineering with performing a level 3 ASHRAE energy audit of Cooper Union building facilities
- 2) Engaging Cooper Union students and staff in the carbon reduction process in collaboration with Smith Engineering

## Industry-Side Energy Audit

Smith Engineering is tasked with performing a level 3 ASHRAE energy audit of 41 Cooper Square with the assistance of Cooper Union Students, and its course of action includes several categories of ECMs:



- 1) O&M: Vital repair and replacement of control valves, actuator dampers, building absorber, among other mechanical equipment
- 2) Cooling: Chilled water differential pressure resets and supply temperature optimizations
- 3) Energy Management System: Developing software tools to collect energy usage data and analyze energy saving opportunities
- 4) Heating: Hot water differential pressure resets
- 5) HVAC Controls: Outside air flow rate reductions, air handling unit temperature optimization, static pressure resets, demand-controlled ventilation, improved cogeneration heat recovery
- 6) Other: Future installation of a solar PV array and vacancy sensor thermostat

## Cooper Union

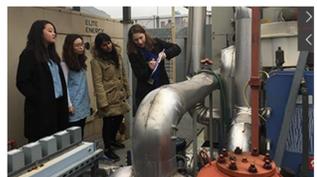


The Cooper Union for the Advancement of Science and Art is a private engineering, art, and architecture school in New York City with about 1,000 enrolled undergraduate students. Its campus consists of three main buildings, including 41 Cooper Square, a 175,000 sq. ft. LEED Platinum-certified academic building with laboratory spaces. The building has two 500-ton chillers, natural gas fired boilers, heat exchangers for radiant ceiling panels, water- and air-side economizers, a 250 kW cogeneration plant, and a building management system to control these mechanical systems.

## Student Involvement in Carbon Reduction

Cooper Union students have unique opportunities to work directly with engineering professionals in achieving 40 X 30 while gaining meaningful engineering knowledge and training for the energy industry. Current student opportunities and deliverables include:

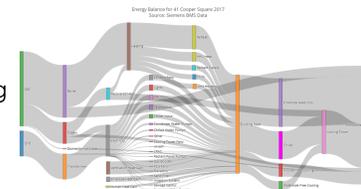
- 1) NYSERDA grant-funded courses co-taught by ME Professor Melody Baglione and Smith Engineering expose students to energy efficient building systems and optimization



- 2) Creating a data historian and reporting tool for Cooper Union's energy use using OSIsoft PI System™ software



- 3) Determining baseline building energy consumption and tracing energy use from source to end use with Sankey diagrams



- 4) Forming undergraduate and Master's research projects centered on energy data analytics and mechanical system optimization, such as energy dashboards



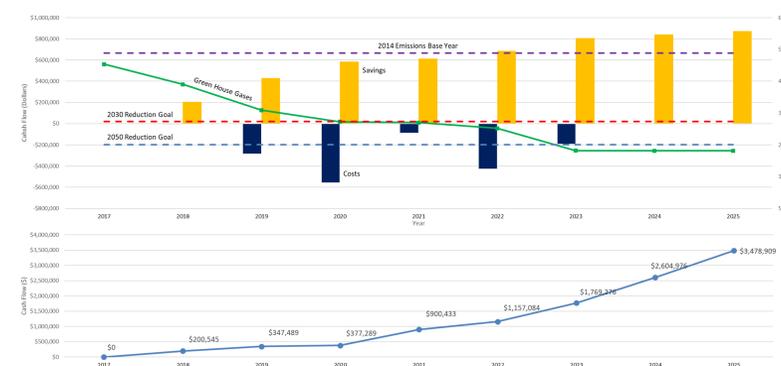
## Outcomes

Cooper Union All Buildings - Electric + NG Savings Results



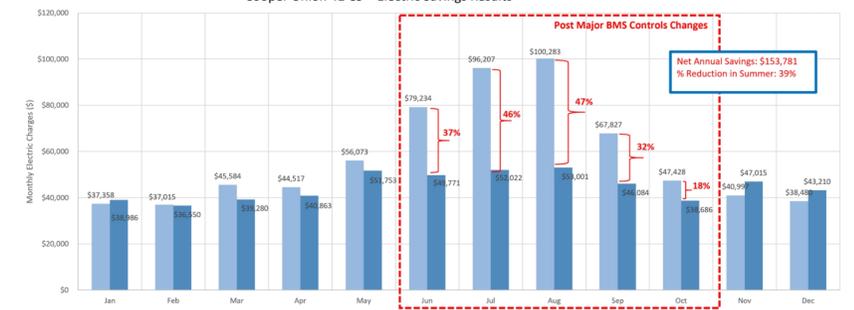
Current ECMs have produced significant financial savings. Peak savings of about 25% have been achieved in summer months compared to baseline electric and natural gas costs and will continue to grow over time.

Project resulted in **5** Master's thesis and **2** Senior Capstone Design projects, **9** student interns and **10** facilities staff trained, **215** tons of CO<sub>2</sub> saved, and **\$192,659** in energy savings



Cooper Union's entire carbon reduction process has remained cashflow positive and will continue to generate growing energy and financial savings for Cooper Union. If all planned ECMs are implemented, Cooper Union is projected to meet its 40 X 30 target by as early as 2021, and its 80% reduction goal by 2023.

Cooper Union 41 CS - Electric Savings Results



Cooper Union has achieved its largest savings in electricity costs. Peak savings of almost 50% have been achieved in summer months compared to baseline electricity costs.