Energy Reporting and Carbon Pricing at Duke University

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Objectives

Duke Commitment to Carbon Neutrality and Climate Action

Carbon Emission Reductions on Duke's Campus

Influence Capital Investment Decisions
Impacting sustainability decisions in new construction and energy projects on campus

Influence End User Behavior
Targeting the behavioral aspect of energy usage and communicating energy usage

Recommendations

Background

Why Carbon Policy?
Carbon-emitting entities can reduce emissions and internalize the social cost of carbon.
Carbon policies can:
- Impact decision-making processes
- Reduce emissions through energy-related capital investment
- Provide energy-related research opportunities

Why Duke?
Duke is committed to being carbon-neutral by 2024. Coupled with offsets and energy efficiency, a carbon policy can move the university closer to this goal. Institutions that have or are planning to implement carbon incentivizing policies include:
- Universities: Yale, Princeton, UC Berkeley
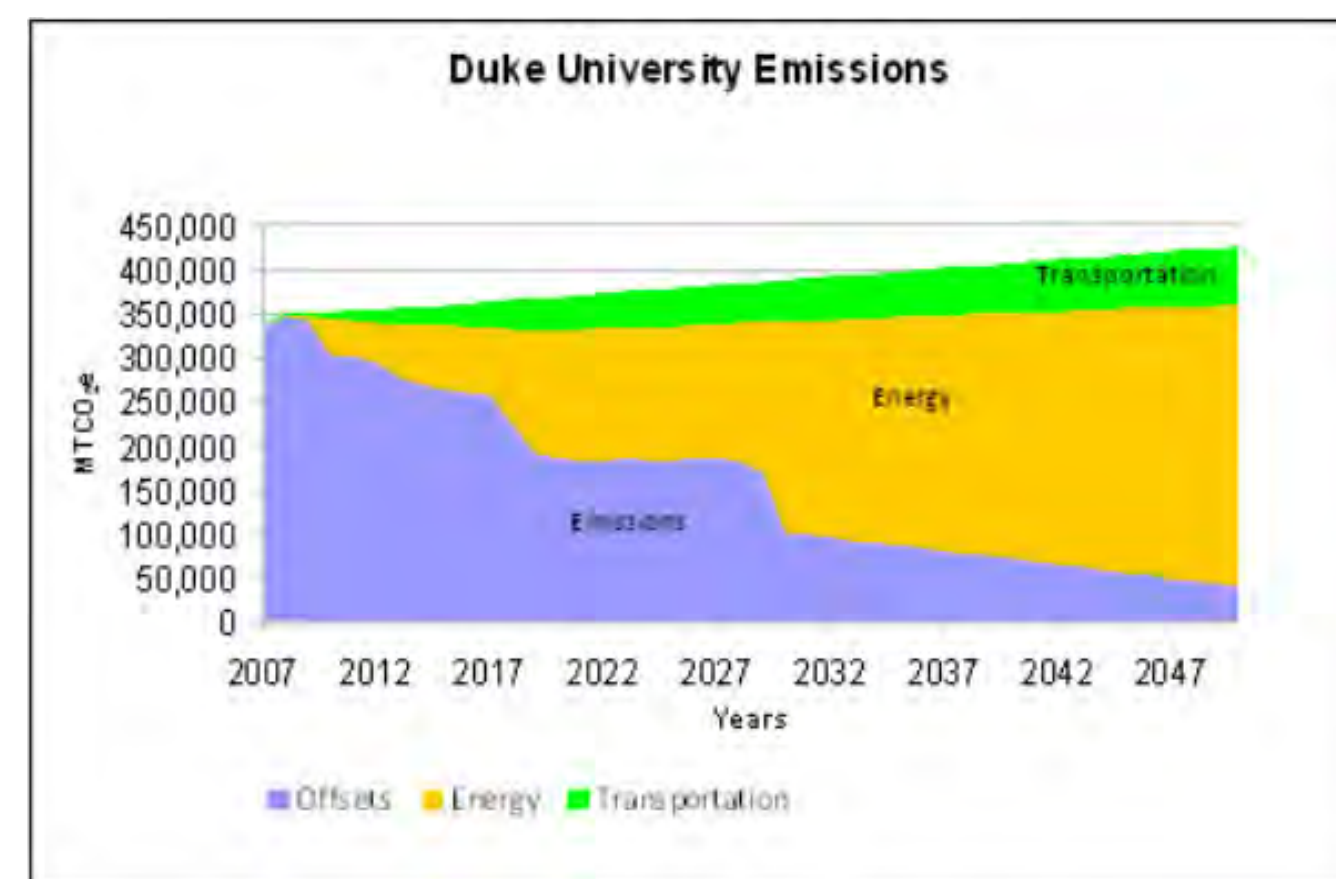- Corporations: Microsoft, British Petroleum (BP)

Figure 1: potential reduction in emissions according to Duke's Climate Action Plan

Energy at Duke

All utilities are managed by the Duke Utilities & Engineering Services (DUES) group within the Facilities Management Department. DUES is responsible for utility billing and administrative services, planning, operation, maintenance, and expansion of the University's infrastructure from the point of generation to the point to of delivery. Three major utilities at Duke include:

Electricity: Purchased from Duke Energy, mainly responsible for energy consumption from lighting, electric appliances, and other equipment on campus.

Chilled Water: From Central Chilled Water System, responsible for space cooling on campus.

Steam: Generated from two campus plants, responsible for space heating on campus.
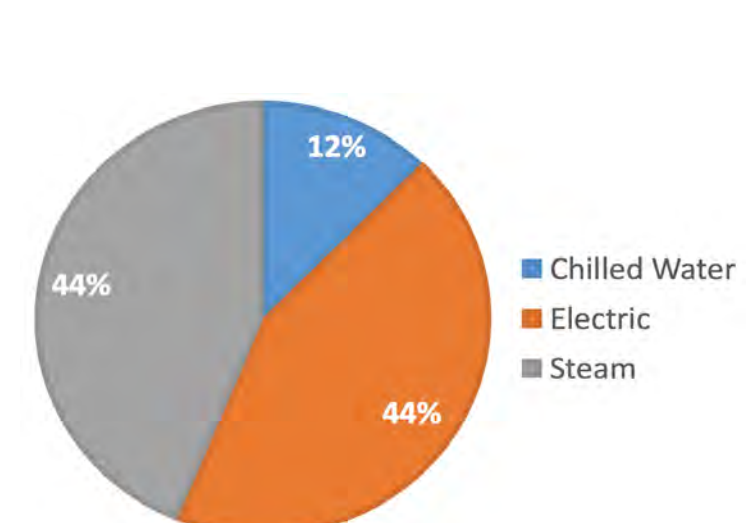
Energy Consumption

Figure 2: Energy consumption segmented by utility types for FY 2015 and 2016. These three utility types accounts for 99.7% of the total consumption in thousand British thermal units (kBtu), while the remaining 0.3% is for hot water usage.
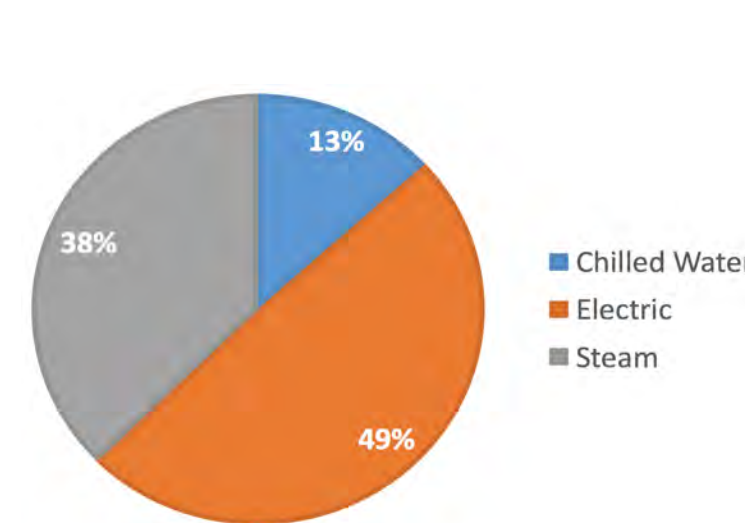
Greenhouse Gas Emissions

Figure 3: Carbon Emissions (MTCO2e) segmented by utility types for FY 2015 and 2016. This chart accounts for emission associated with site energy consumption other than source energy consumption (e.g. It takes 0.76kWh electric power to produce 1 ton-hour of chilled water).
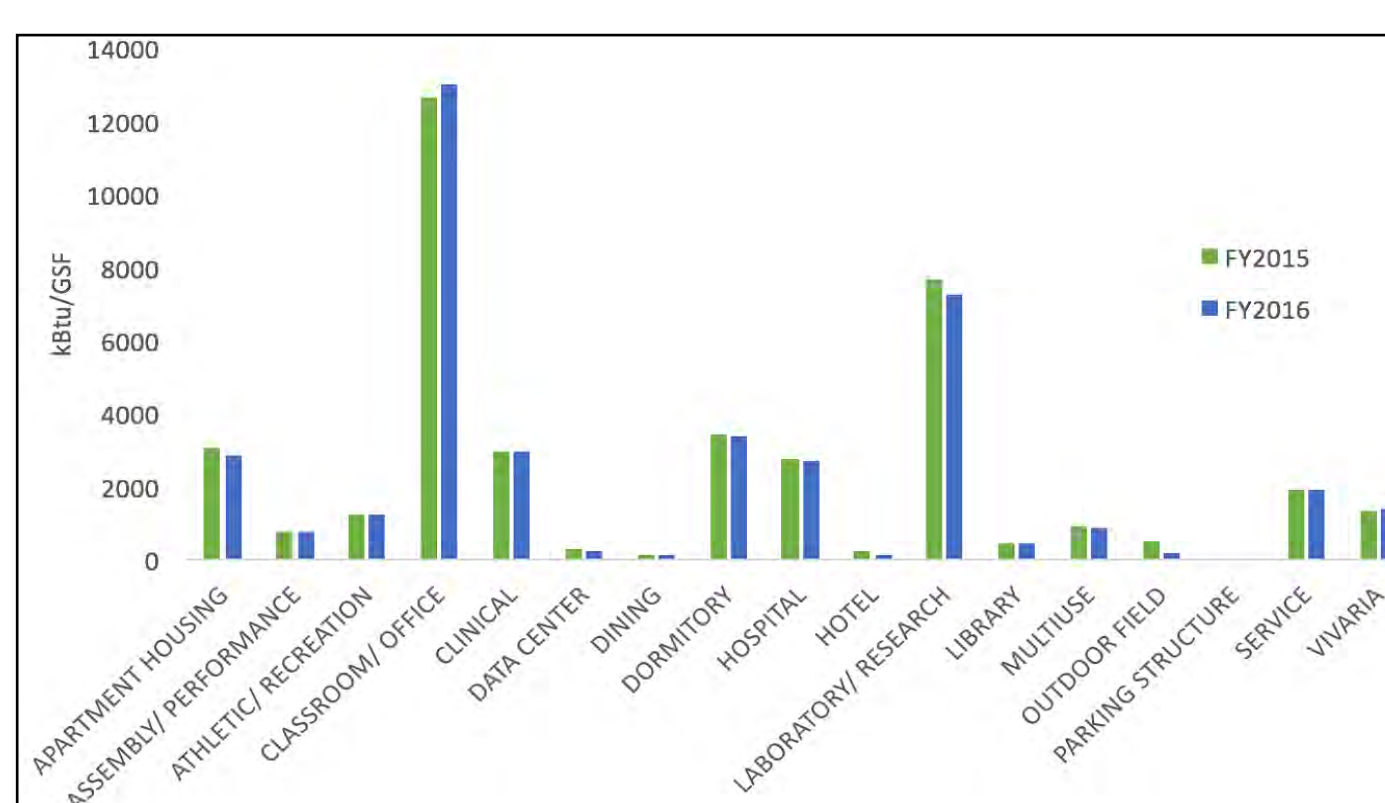

Figure 4: Energy consumption segmented by building primary uses for FY2015 & 2016. This chart shows that classrooms and research related buildings have the highest carbon emission intensity (total carbon emission per gross square feet).
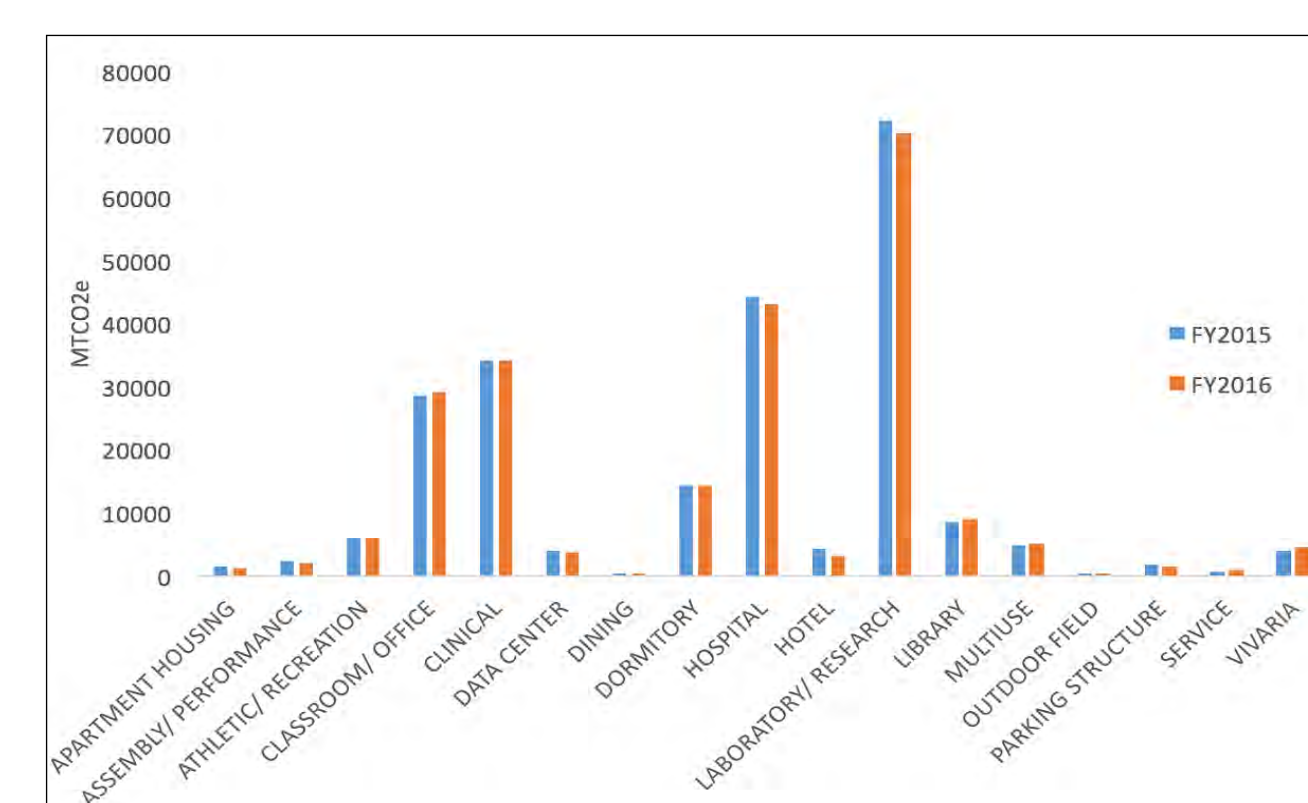

Figure 5: Carbon emission levels (MTCO2e) segmented by building's primary uses for FY2015 & 2016. Labs and research-related buildings account for the most GHG emissions.

Process

Capital Investments → End Users → Literature Review → Informational Interviews → Policy Evaluation → Recommendations and Next Steps

Informational Interviews: We visited Yale in the fall to interview people associated with it's carbon pricing program. We have also conducted interviews at Duke to map the university's internal decision-making structure and to understand the motivations of stakeholders

Literature Review: To better understand the global state of carbon policies, we have reviewed existing and planned carbon policies for countries, states, universities, and corporations. Along with interviews, this process informs our evaluation of different policies.

Policy Evaluation

Our policy evaluation includes two primary questions:

1. Should our proposed policy collect revenue, or should collected money be distributed back to taxpayers in a revenue-neutral model?

2. What policy design is the most effective: a cap-and-trade, a tax, or a hybrid?

For both decision processes, we are evaluating based on 6 main criteria:

Evaluation Criteria	Purpose
Implementation Feasibility	What are the political and institutional roadblocks that favor one option over another?
Emissions Reduction	What sort of policy has the largest likelihood of quickly driving down on-campus emissions?
Research and Institutional Value	What policy design option best positions Duke to continue serving as a climate and sustainability leader among higher education institutions?
Student Engagement	How can Duke students be a part of the proposed policy, through administration of the program and associated research projects?
Long-Term Feasibility	A carbon policy is one part of Duke's larger push towards climate neutrality, so what policy design has the best chance of long-term success?
Behavioral Incentives	What design scheme is most likely to influence behavioral changes on campus? Changes may include different processes for approving energy-efficiency retrofits or new building construction.

Obstacles

Lack of uniformity among energy billing processes for different departments
Significant variation exists between who pays for energy and how it is monitored amongst buildings and departments. This complicates the proposal for a one-size-fits-all solution to a carbon policy.

Financial and administrative difficulties to implementing a pricing scheme
A pricing scheme results in a financial and administrative strain on all stakeholders. Due to varying agendas, balancing the needs of all stakeholders involved, such as facilities, administration, and individual departments presents a challenge.

Difficulty in ensuring fairness of a pricing scheme
Departments often share the space in buildings and the nature of their needs varies, ranging from lab space to offices to classrooms. Building profile also varies considerably, ranging from new, energy-efficient buildings to century-old buildings. As a result, equitably billing departments within a carbon policy presents a formidable challenge.

Lessons Learned

Need to clarify energy billing process
The current energy billing process is quite complicated, involving various software platforms and dozens of employees. Different departments also have different processes in place for paying their bills.

Importance of stakeholder buy-in
Building stakeholder buy-in is vital for the longevity of a carbon charge program. All departments must have a place at the table because all will be impacted by a carbon policy.

Need to influence decision-making for capital investments
The current capital investment decision-making process, such as construction of new buildings and energy-efficiency retrofits, does not account for a social cost of carbon.

Need to supply end-users with usage information
Currently, departments are not aware of specific energy consumption data because it is nested alongside various other services into one "Facilities" fee. Educating stakeholders about their actual energy consumption is a crucial first step to motivating change and obtaining buy-in.

Moving Forward

Streamline energy billing process
The energy billing process at Duke should be simplified to allow for a carbon charge to be levied as part of a carbon policy. One main component of it is to introduce carbon charge as a line item in the energy bills departments receive.

Conduct pilot study
A pilot study will help departments with the transition to a carbon charge program. Benefits include:
- Allowing administrators to identify areas of excellence and improvements necessary
- Opportunity for departments and end-users to give feedback before actual implementation

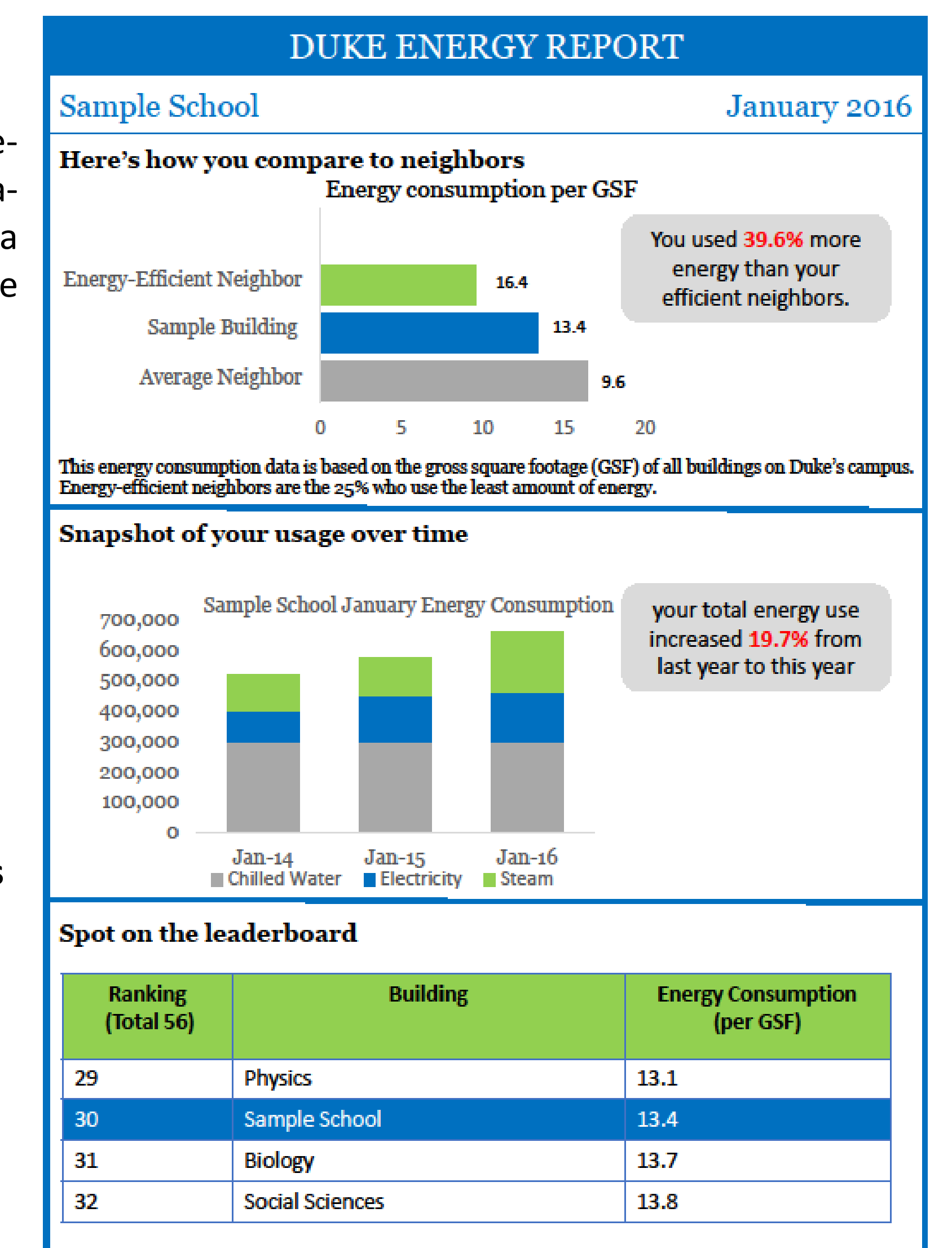**Form management committee to ensure continuity of project**
There is a need for a specialized management committee to serve the administration and communications aspects of a carbon pricing program. This committee will also help retain program expertise.

Implement shadow pricing
Given that current capital investment projects do not take into account a social cost of carbon, a shadow pricing scheme should be implemented so that potential carbon emissions are taken into account when making decisions.

Distribute departmental energy reports to heads of departments
To give end-users a better idea of their energy consumption pattern, there is a need to design a departmental energy report which will be distributed to the heads of various departments to influence usage. A sample of the energy report is attached: