

Cambridge Climate Action Plan

Suggestion about the implementation within MIT

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1. Introduction

This report focuses on the implementation of the Climate Protection Plan (CPP) in the City of Cambridge in collaboration with MIT. The CPP envisages a reduction in green house gases of 20% by 2010, by collaborating with institutions, businesses and community. This report highlights the relationship between MIT and Cambridge and how MIT has had to/will adapt to new environmental changes through planning/policy initiatives.

We studied the buildings (old and new) by analyzing how they are being adapted to environmental issues and concerns. The decision to study "green" buildings (i.e. those buildings that are constructed in an environmentally friendly manner by incorporating green features and technology) stems from two factors: a) the bulk of green house emissions came from built environment, and b) as the (MIT – Cambridge) relationship with regard to buildings was less defined (as compared to transportation) we thought it necessitated more attention.

Our investigation was conducted in two stages: The initial phase was fact finding in order to have a better grasp of the problems associated with the different goals of MIT and existing policies (and their implementation) relating to making of "green" buildings. The second phase involved more analysis and discussion, sitting with our immediate group, and the larger 11.336 team. The main effort in this phase was to develop and recommend a framework of "actionability", given the problems we discovered during the first phase.

In our study we found that the challenges posed by environmental problems cannot be compartmentalized and solved in isolation. At MIT; research, education, legal compliance, recycling and other sustainability initiatives are all interrelated.

2. Methodology

At the beginning of the first phase we realized that we had a very limited knowledge of the internal structure of MIT and how environmental policies, specifically those targeting aspects of the CPP, are formed and implemented. As such, we decided that the best approach would be to learn as much as possible about institutional operations at MIT before focusing on specific environmental problems. Unsure of where to begin, we approached Mr. Dan Winograd, Deputy Director of the Senior Counsel's Office. He was able to give us an insightful overview of both the general structure of MIT and, more specifically, how this structure relates to environmental policy within this institution.

In our discussion with Mr. Winograd we learnt that environmental policy does not follow a single, neat path through the MIT hierarchy. In fact, many of the environmental initiatives within MIT are not done through this structure at all, but are implemented by informal networks formed by conscientious members of the institution. Concerned that we would be unable to craft a thorough analysis of MIT as a whole, we decided to tailor our study to one aspect of the plan.

Following our meeting with Mr. Winograd, we selected building usage and transportation as the two areas of greatest concern. Between the two possibilities of transportation or building usage, we discovered that a large percentage of emissions produced in the City of Cambridge originate from buildings, so we decided to focus on this aspect.

We formulated the question: "Are buildings on MIT's campus green, and if not, why?", and began interviewing panoply of actors concerned with building planning and maintenance on MIT's campus. These interviews helped us piece together the basic structure of MIT as it relates to building planning and usage (Figure 1), as well as to begin to understand the answer to our question. Phase two consisted of using the information we gained through our interviews to develop a framework of "actionability." This phase is discussed further in section 3.

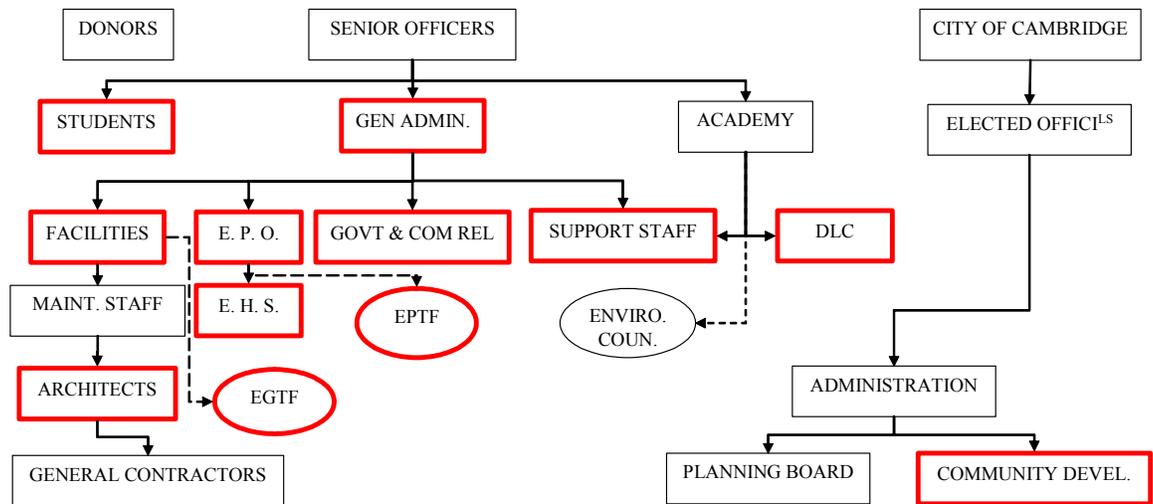


Figure 1 Diagram of MIT hierarchy. Blocks highlighted in red indicate that we spoke to at least one actor from that group. A full list of names and departments of people we spoke to is included in Appendix A.

3. Analysis & Preliminary Results

3.1. Decision-Making Process

After discussions with the many actors we attained a general understanding of the building planning process (Figure 2). In addition, the involvement of the various actors in each phase is also shown on this Figure.

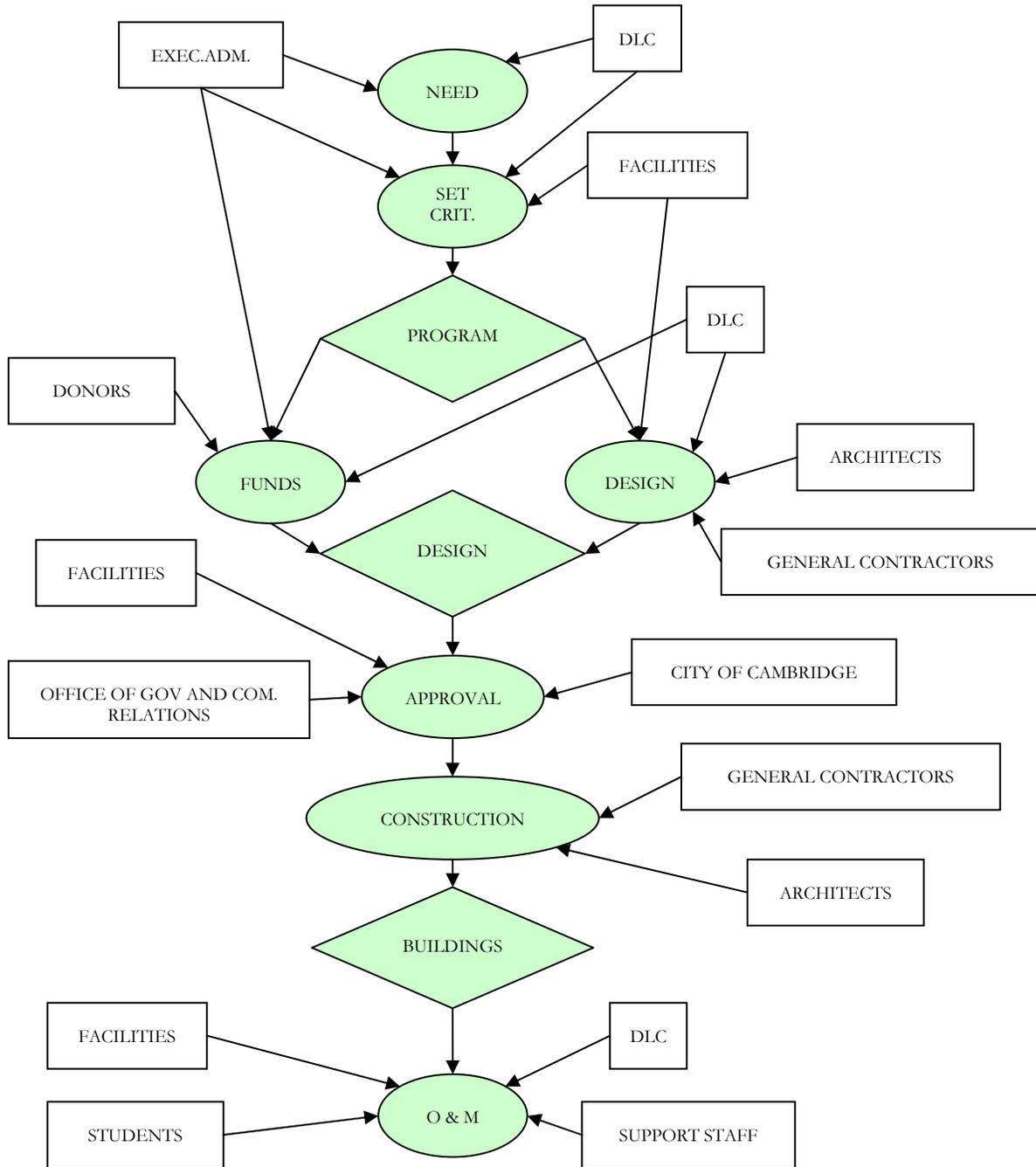
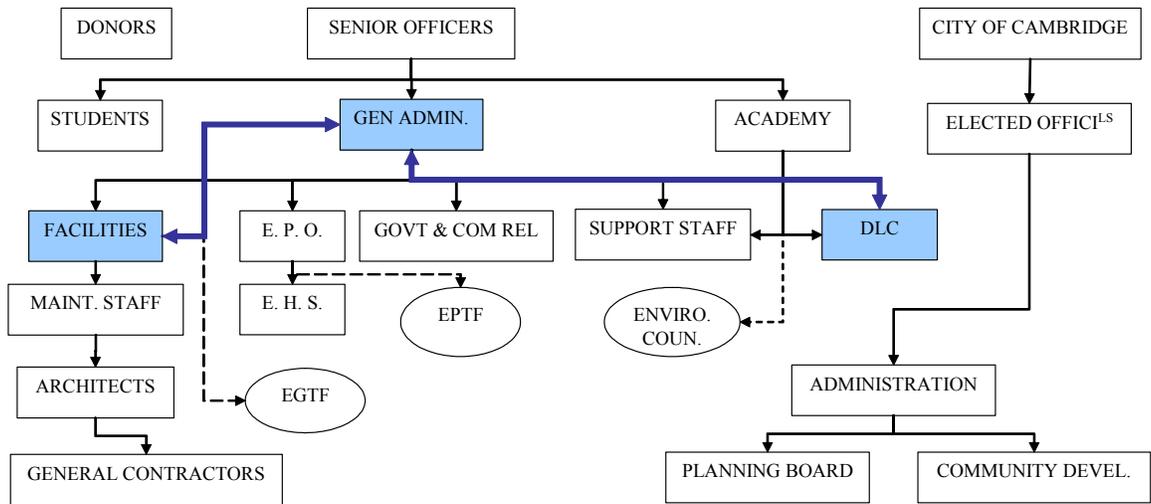


Figure 2 The Actors Involved in the Steps of the Decision and Execution Process for New Buildings



Design and Construction Phase

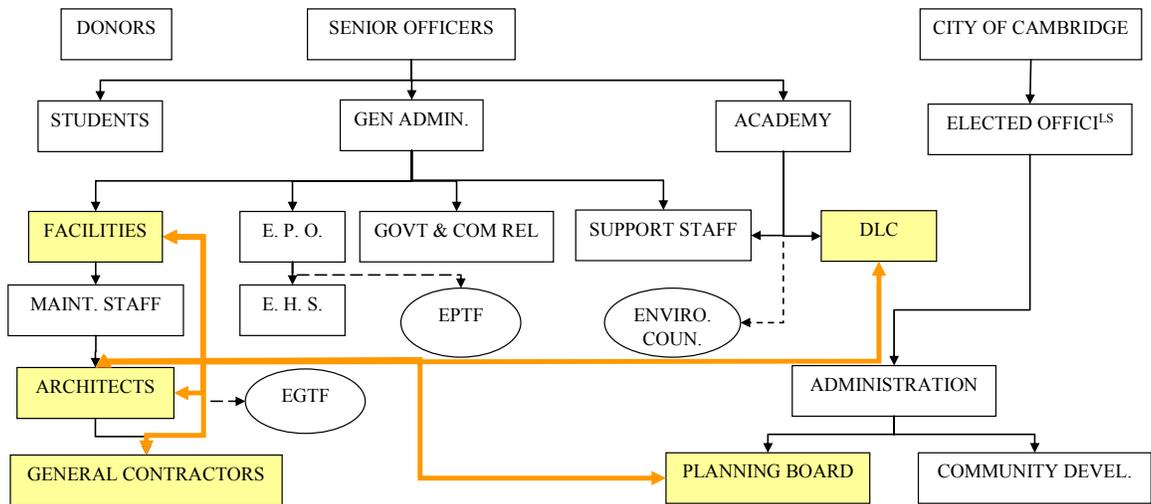


Figure 3 Communication channels in the various phases of planning new buildings

3.2. Problems Identified By Various Actors

During our discussions with the different actors, we asked them for their opinion on why MIT was not making greater strides towards its pledge to have greener buildings. The main problems that were mentioned by the various actors were:

- Lack of political will – no incentive system
 One of the main problems was the absence of a real commitment from the senior administration. Due to this lack of commitment, there is no incentive for people to promote green technology in the construction and renovation of buildings; especially since green technology is widely perceived as being more expensive.

- **Lack of money**

When resources are limited, priorities become streamlined and since there is no formal commitment from the senior office with regards to green buildings, it is very easy for the greening of buildings to get pushed down the agenda.

Decentralization - Lack of coordination

MIT's consensual decision-making process makes it difficult to make and execute institutional changes. .
- **Low priority vs. research**

A few actors suggested that it was a question of priority rather than “lack of money”. For example, many actors were highly critical of the Stata Center, because the greatest priority was given to aesthetics.
- **Asymmetric information**

Some actors also mentioned the problem of a lack of information. For example, the fact that green buildings (at least at silver-LEED certification level) do not necessary have to be more expensive, was not known to most people.
- **No grassroots support for greener buildings**

Finally several actors mentioned that there was no base support for green buildings, making it very difficult to convince the senior officers to make a commitment.

Interestingly, there was no general agreement on the sources of the problems among the different actors. Table 1 summarizes the perceptions of each general category of actors for each problem.

Actors category	Lack of political will	Lack of money	Decentralization –coordination	Low priority vs. research	Asymmetric information
City of Cambridge					
Academia					
General Administration					
Facilities					

Table 1 The reason why MIT’s buildings are not as green as they should be: Identification of problems by the different actors

As you can see from this table, people have very different views on the reasons that buildings on MIT’s campus are not as green as they should be. This lack of consensus among the actors is one of the primary reasons for the lack of progress. As long as there

is no general agreement among the actors on what the problem really is, it is difficult to construct a framework through which the various actors could coordinate all their efforts effectively.

3.3. *Synthesis*

A concerted analysis of the problems mentioned by the various actors showed that not all problems have the same actionability. Similarly, some of them have a large change potential, while others do not. Creating the framework presented in the Table 2 helped us understand better where the focus of the action should be.

	Large Problem	Small Problem
High Potential	<ul style="list-style-type: none">• Lack of Political Will• No Incentive structure• Lack of Knowledge	<ul style="list-style-type: none">• Lack of coordination• No base support for greener buildings
Low Potential	<ul style="list-style-type: none">• Lack of Money• Consensual decision making	

Table 2 Framework for the problems' analysis

Based on the results presented above, we have established a list of the issues that impede the progress of green buildings at MIT. This list is based on the problems identified through the discussions with the actors, but reflects a broader understanding.

- The fact that MIT has a consensual decision-making process is the root of the problem. If MIT was fully decentralized, each department would plan, pay for and operate its own buildings, hence assuring that life cycle cost would be considered. However, because MIT is a complex centralized institution, decision-making involves a plethora of people with conflicting views and interests; often resulting in a lengthy process of negotiation and culminating in either a preservation of the status quo or infinite postponement.
- The people drafting the policies and the people executing them are not the same. The lack of coordination between the two stages of executing policy generates problems because it is difficult for the decision makers to make informed decisions if they are not fully aware of all the consequences of their decision.
- Lack of Money is certainly not the real problem, at least at the Silver LEED certification level that is currently pursued. The latest planned project, the East Campus Extension of the Sloan School of Management, has been entirely planned and designed to fulfill LEED specifications. Interestingly enough, the building is not expected to be more expensive than other similar buildings. The East Campus Extension of the Sloan School of Management example illustrates the crucial problem of asymmetric information and misconceptions regarding green buildings.

Based on those considerations, we have established a list of recommendations that are aimed at tackling those fundamental issues. These recommendations are presented in the subsequent section.

4. Recommendations

4.1. *Concept*

As a consequence of our discussions with the various actors, we thought that suggesting well-defined actions would not be a successful strategy at MIT. In general people are not receptive to executive mandates. Rather, we thought of coming up with a framework within which the different actors could choose a custom collection of actions that would best suit their needs.

After studying the interactions between the different actors in MIT, we have identified four axes of actions to remedy several corresponding environmental problems. These four axes of actions include making polluters pay, formulating incentives and rewards for the behavior that we are trying to encourage (mainly being more environmentally friendly), creating commitment and marketing green. Each axis will be discussed in more detail below. Note here that we do not attempt to tackle the consensual decision making process directly because we believe it has low actionability (due to the already present cross over groups), but we believe that it will be indirectly solved through the actions presented below.

Table 3 shows that there are many overlaps in recommended actions. Even though each axis represents a different goal to address a specific problem, the method to attain that goal often overlaps with several other axes' action goal. Hence, we have decided not to focus on simply one area that we believe is important because we put equal weight on each of these goals, and because it makes more sense to achieve two or three goals while using one primary action. Moreover, the same action may be essential in achieving a goal, but also helps achieve another goal, albeit to a lesser degree. Due to all these overlaps in actions and goals, although to differing degrees, it makes more sense to pursue several policies simultaneously instead of focusing on just one issue and matching actions.

Additionally, we decided to create varying strategies in order to engage the broadest range of people. For example, if competition through the rewards/incentive scheme does not appeal to one person, then perhaps the economic incentives or the market green approach might work. Since individuals in MIT are not homogenous it does not make sense to homogenize environmental policy.

	Make polluter pay	Utilize competition	Create commitment	Market green
Metering	Red	Orange		
Incentive/rewards	Red	Yellow	Yellow	
Benchmarking	Orange	Red		
MIT/Harvard competition		Orange	Yellow	
Awards		Orange	Yellow	
Mass Movement	Yellow	Yellow	Red	Orange
Commitment from the top	Orange	Yellow	Red	Yellow
Increase Awareness	Yellow	Yellow	Red	Red
Green Benefit MIT			Orange	Orange
MIT's the greenest		Yellow	Yellow	Orange

Table 3 Role of each action in accomplishing the four goals

4.2. ***Make Polluters Pay: (Accountability?)***

Sustainable design process and implementation not only promotes “green architecture” but also seeks to remedy some of the harmful “consumptive” patterns of users. These sometimes harmful practices lead to energy inefficiency and wastage, which should be identified and remedied. Therefore, to build in a sustainable fashion, one needs to establish sustainable goals as part of developing the project's concept. And, one of the ways in achieving these goals would be to build into the system certain rewards and penalties.

4.2.1. **Why**

After interviewing various people, the wide-held view with regards to green buildings was “Yes, we would like green buildings, but nobody is really willing to invest the time and the resources in the design of these buildings.” Fundamentally, member of the MIT community had no real incentive to conduct themselves in a more environmentally conscientious manner.

To battle this attitude of complacency, a dual system of rewards and penalties was suggested to promote an efficient management of energy in buildings. This suggestion came from the faculty, some of whom were working on areas closely related to green buildings and technology, but who were not an integral part of making MIT a greener campus.

Introducing rewards and penalties will compel members of the MIT community to take responsibility for their actions.

4.2.2. Metering

a) *How*

Electricity consumption forms the bulk of the energy costs at MIT. MIT has only large service meters for a cluster of buildings which does not allow individual buildings to keep track of how much energy they are consuming. Raising awareness of how much energy each building is utilizing is essential in decreasing energy consumption because without individual gauges benchmarking is not possible. Sub-metering would create accountability among the various users by recording metered data, and holding the particular building responsible for superfluous energy consumption. This accountability could lead to penalties relating to fines as well as bad publicity for the building in terms of pin up boards ranking buildings with the most wasteful energy usage.

MIT faces the challenge of monitoring individual buildings. While many possible actions to address energy supply and cost issues exist, one option is to sub-meter individual buildings on campus.

b) *Who*

The installation costs of the sub-metering would be paid by facilities/utilities because this is under their jurisdiction and would help them locate areas of energy inefficiency. In the long run, the disproportionate costs (over a set limit) would no longer be borne by the facilities/utilities but by the users of specific buildings. Hence, the cost of installation would be offset by an efficient use of energy by the users (who would aim to not exceed the set limit).

4.2.3. Incentives/Rewards for people doing well

a) *How*

There are social - environmental, economic and personal incentives for people to become “green”. Benefits are manifold, though the priorities vary on which would be the best option at any given time. These incentives are linked to:

- Environmental and Social Benefits: Least energy usage, and a healthy environment is a definite consideration for students, faculty and administration at MIT.
- Economic Benefits: Reducing in infrastructure demands for the city (Cambridge) and MIT’s utility bills.
- Monetary Rewards: If utility bills are low and there exists efficiency in energy usage, then the particular building could be considered for subsidized purchasing of services/facilities from within MIT and the City of Cambridge.
- Personal/Psychological Benefits: The personal satisfaction of working towards a greener environment, (e.g. using the revolving door for ones own satisfaction)
- Publicity: The various departments at MIT get good publicity with their names ranking high in energy efficiency. Show case good practices and stories. This in turn would be a compliment for the City of Cambridge as well, as MIT resides within the area.

- Awards: the institution and by the city could award periodically Departments that stand out in saving energy by both.

b) Who

Even though this axis of action requires campus wide participation, senior office commitment is necessary. Collaboration between the Departments, Labs and Centers (DLC's), students senior officers, is key to sustaining this action of axis.

4.3. Utilize Competition

4.3.1. Why

Competitiveness is an essential component of the MIT culture. Competition is what has driven MIT to be one of the best educational institutes in the world. From the students to the faculty to the administration, each member of MIT is infused with the competitive spirit, thriving on challenges and always rising to meet challenges.

Based on our discussions with a cross-section of MIT's population, we believe that this culture of competition can be harnessed into a productive tool to create a greener campus. This belief is based not only on our assessment of the academic climate of the institute, but also on concrete examples, such as the success of the recycling program. Until a few years ago, the percent of waste recycled at MIT was barely in the double digits. However, over the last few years, marked by the City of Cambridge challenging both MIT and Harvard to raise their recycling rates to 40%, MIT has drastically increased its recycling rate.

We also believe that the harnessing of this competitive culture is one of the key points of entry for the City of Cambridge to engage MIT and Harvard. By inciting a climate of friendly competition between the universities, the City of Cambridge can help nudge these institutions toward the goals of the Climate Protection Plan.

It is noted here that when focusing on competition, care must be taken to avoid creating an atmosphere of conflict. If the atmosphere of competition develops confrontational overtones, it may have adverse consequences and sour relations between the Cambridge, MIT and Harvard, which is not desirable.

4.3.2. Benchmarking

a) How

Benchmarking is essential because it creates a framework within which competition can be fostered. Without a system of benchmarks, it is impossible to record the progress that has been made toward a set goal. Therefore it is recommended that a system of benchmarking environmental impacts, specifically the effects due to buildings and building use, should be created. This system should be based on a two tiered system, with the first tier focusing on inter-institutional (MIT, Harvard, the City of Cambridge) bench marks and the second tier focusing on inner-institutional (departments and housing units) bench marks. It is noted here that until metering is more universal on the MIT campus, inner-institutional bench marks will be difficult to establish as well as monitor.

The bench marking system should be designed to incorporate the emission study currently being conducted at MIT, as well as be extended to include the other aspects of the plan. The system should consist of a visual chart displaying the bench mark levels within each category of the plan. This chart should be updated on a bi-yearly basis to display the levels achieved by each participant along side the benchmark to allow easy comparisons.

It is noted here that benchmarking is an inherently difficult action to accomplish as one must consider both where the actors currently stand, as well as what can realistically be accomplished. Therefore the specifics of this recommendation are left for a later date when a more thorough analysis can be conducted.

b) Who

Bench marking can only be successful if it has both the financial and political backing of the senior officials of each institution involved. In this way, each institution (MIT, Harvard and the City of Cambridge) must make a commitment to assess their current situation and to develop a system of benchmarks. However the senior officials should not be expected to act alone. They should utilize the resources of the two universities, enlisting both graduate and undergraduate students in the process of assessing the current conditions. This could be done either through formal channels, e.g. creating a bi-yearly class, or through informal channels, e.g. enlisting an environmental group.

4.3.3. Harvard/MIT competition

a) How

The recycling example has demonstrated that a friendly climate of competition between the universities can foster an environment where the goals of the plan can be achieved. Therefore it is recommended that the City of Cambridge continue to use this competitive culture to further the aims of the plan.

Furthermore, it is suggested that the City of Cambridge, in conjunction with the two universities; develop an electricity usage reduction target to be achieved by the year 2014. The city should then monitor the universities throughout the process, using the successes of one to encourage the other. In determining the reduction target, the fact that both institutes are still growing and a simple percentage reduction may not be feasible. Thus, it has been suggested that a reduction target based on square footage might be more appropriate. Additionally, the differences in space usage at the institutions (lab space vs. classroom space) should be taken into consideration.

Once the target is established, it is recommended that, with the approval of the two universities, the progress of the universities toward this target be displayed in a prominent place within the city, e.g. on a billboard, as well as through the yearly Town Gown reports. This will not only prevent the commitment of the universities from waning as other priorities come up, but will also demonstrate to the city that the two universities are taking serious steps to address climate control. This also offers a convenient way for the city to publicize the plan to a large segment of the city.

b) Who

Similar benchmarking, the success of this recommendation depends on the commitment of the senior officials. Members of the City Council should bring together officials from both universities and develop an appropriate reduction target. It will then be the responsibility of the university officials, with the help of the city, to publicize the target to the respective campuses. Again, the success of this recommendation does not fall completely on the shoulders of the senior officials. Once the target has been set, it is up to the entire community to address those things that they can change to help achieve those goals. Thus demonstrating the cyclic nature of this process, as this recommendation both fosters commitment and depends on it. Throughout the process, both the city officials and the administration should use the competitive spirit to promote the target and encourage their respective community members to contribute where they can.

4.3.4. Awards

a) How

Similar to benchmarking, this recommendation is two tiered. The first tier focuses on inter-institutional awards while the second addresses intra-institutional awards. With regards to the first tier, the City of Cambridge can continue the process of nudging the larger organizations (such as the two universities) in the right direction by establishing a city-wide award system. It is recommended that, coupled with the first two sections (paragraphs 4.3.2 and 4.3.3), an annual city-wide award be established. This award should be given to the university that has demonstrated the most progress toward achieving the goals of the plan. We believe that due to the size and prominence of the universities, a single award that brings them into direct competition will have more success than an award based on reaching a targeted level.

As both MIT and Harvard are beginning to face more and more competition from other colleges and universities, they have become more concerned with their image because the way in which people perceive the Institution is important when attracting students. By providing the two centers for learning with an incentive to become more environmentally friendly (e.g. an award to show prospective students and faculty), the city can further the aims of its plan. This point is addressed further in section 4.6.

With reference to the second tier, MIT can institute an internal award system to encourage environmentally friendly practices within its sphere of influence. Once metering and benchmarking have been achieved, it is recommended that the Institute create a system of inter-building energy competitions. It is recommended that the award system should be two tiered as well; with one overall best performing award and a second level of awards for all participants who have achieved the desired level of conservation.

b) Who

This axis of action requires the commitment of the senior officials to institute the inter-institutional awards. As the City of Cambridge is the logical mediator between the two universities, it is recommended that they take the lead in setting up the meetings and

creating the awards and appointing an independent selection committee. In this way, the city will be seen as both a concerned participant as well as a neutral mediator.

On the intra-institutional plane, there are several actors who should participate. The senior officials are in the best position to establish an institute-wide award system, and it is therefore recommended that they do so. However other actors, such as student groups or individual departments, can also create internal awards and should be encouraged to do so.

4.4. *Create Commitment*

4.4.1. *Why*

Cultivating commitment within the MIT community, across each and every department and organizational group is imperative in promoting green buildings and technology as well as providing the institutional setting for continual renovation of older buildings to bring them closer to fulfilling the LEED certification criteria.

4.4.2. *Mass Movement*

a) *How*

MIT should strive for both formal and informal commitment. Formal commitment is when there are formal procedural guidelines that must be observed while informal commitment is observed in the form of individuals within department taking the initiative to raise green issues whenever they feel appropriate. These individuals form connections with other such environmentally concerned individuals and attempt to work together and push for greener action. Additionally, environmentally conscious individuals expand their informal networks of action by recruiting individuals who have an interest in such matters but have not consciously done anything about making MIT's buildings greener.

b) *Who*

The most challenging part of this cyclical process is the initial catalyst that triggers the cycle. We have identified two potential triggers. The first is a "champion" in the form of any member of MIT or a group of members from MIT who are deeply committed to the mission of greening MIT's buildings, both new and old. A potential problem that might arise from a student assuming this role is that her/his participation in MIT is temporary and relatively short in the long-run. This is a problem because policy change and social norm shifts (e.g. persuading people within the institution to make green buildings a priority) may span a longer period of time than the designated student, faculty, administrator "champion," resulting in discontinuity and hence setbacks via time lags.

The problem of transience may be solved by creating a formal post for the advancement of green buildings within the institution with provisions in the appointment letter to ensure continuity even after the designated person has left. One of the environmental advocate's tasks would be to inform the institutional body at large to raise awareness concerning the importance of MIT's commitment to green buildings. In the process of

raising awareness through informing the institutional body, grassroots support will be developed.

4.4.3. **Bottom-up – top-down approach**

a) How

The chain of commitment is cyclical because in order for the senior administration to pass policy, grassroots support is initially required. Once the formal policy is passed, more grassroots support is generated which should pressure the senior administration to expand their formal policy and so forth.

b) Who

A combination of formal and informal commitment is ideal. In fact, the two go hand in hand. A formal commitment, such as an executive order from the senior office would ensure compliance with certain regulations. However, before the senior administration will take a firm stand, there must be grassroots support (these include lower administration, faculty and students) and pressure for such issues to rise to the top of the senior administration agenda.

4.4.4. **Increase Awareness (“educating”)**

a) How

Increasing awareness is a key component in creating mass movement which should then create pressure on the senior administration to pass formal policy to cement a more conscientious behavioral and social norm shift. Educating the masses to catalyze the mass movement can be done in a variety of ways. First, more courses addressing not only green buildings but other aspects promoting the Cambridge CPP could be required. For example, when the first-years come to campus, half a day could be spent discussing these issues. Alternatively, the administration could alter course requirements to include a course requirement that dealt with these issues. These course requirements and mandatory sessions would stimulate awareness on campus and hopefully create concern from the students that would encourage increased participation in environmentally-conscious activities. Increasing awareness need not only take place in formal settings, such as classrooms and orientation programs, but could also manifest itself in the form of informal lectures over lunch sponsored by one or more academic departments..

Moreover, the campus should aim to sponsor at least one environmentally themed event each month to keep visibility of the cause on the forefront. More casual, fun affairs could be held in the infinity corridor where a plethora of student organizations are visible. This area is an ideal location especially for the undergraduates since the location has such high traffic and movement of students.

b) Who

Almost any group of body in the institution could help in increasing awareness on campus. However, the two main groups would be the faculty and the students. Faculty and students alike could present in an informal setting, such as in lectures or in task force meetings.

The axis of action to organize at least one environmentally themed event once a month would be coordinated by the person hired by the campus to oversee all environmental affairs on campus, who we will call, hypothetically, “Director of Environmental Affairs” (DEA). The DEA would actively involve each and every possible group on campus so that a sense of ownership and responsibility is engendered. The more groups that are involved the greater participation there will be, which aids in creating the mass movement effect that MIT should aim for.

4.5. *Market green*

4.5.1. Why

Our analysis has shown that there is currently no broad recognition of the positive effects of green buildings and a green campus in general. People often accept that green buildings are “good” for the natural environment, but do not relate improvements in this direction with improvements in their working environment. Although several members of the faculty have insisted that research had long shown people working in green buildings were happier and hence greater productivity, people do not seriously consider this in their decision-making related to new buildings.

Similarly, other positive effects of green buildings or a green campus in terms of the image of MIT, the increased attractiveness for prospective students, faculty members and sponsors etc, were never mentioned as a factor to be considered in the decision-making process.

After a long discussion within our group, we have agreed that people will only lastingly change their behavior if they can see some direct benefit for them. The benefit is valued by assessing the consequences of each decision with one’s internal system of values. This means that in order to implement a durable change towards more “green” on the campus of MIT, we need to change the way people perceive and value the environment. In fact, a reframing of the way the environment is perceived is necessary.

Currently, people do not see any direct benefit for them to consider environmental issues in their decisions. Rather, they might do it only if external benefits are provided (principle of the reward / incentive system presented in the paragraph 4.2.3), thus “biasing” their decision.

The idea behind the “market green” axis of action is to complement the other strategies by a long-term change in the systems of value of the people on campus, so that acting in a green way becomes a natural decision rather than a forced one. In fact, acting in an environmentally friendly way should be seen as an advantage, rather than a hassle.

Although this axis action might appear to be the least defined and most difficult one, we think it is the only way to induce a long-term change on MIT’s campus.

We envisage the following actions:

- Improve the education about the environment and its positive influence on day-to-day life

- Increase awareness about the positive role that a green campus could play in MIT's policy and image
- Suggest an audacious plan for MIT to be the leader in the environmental field as it is in others.

While those actions will not have an immediate effect on people's behavior, we think that making clear and visible the positive consequences and aspects of the environment will help internalize such values as sustainability and environmental friendliness.

4.5.2. **Green Benefits MIT**

a) How

We believe that if MIT had a very green campus, it would improve its position in attracting and retaining:

- Prospective Students
- New Faculty and Researchers
- Sponsors and Donors

However, as long as no hard figures are available to show this, it might be very difficult to convince the senior officers and administration of the integral role of the environment to MIT's success. Thus, initial efforts should go into collecting existing and new data supporting (or refuting) the assumption of a positive effect of green buildings and campus.

The data collected would then be used in a systematic economic assessment of the pros and cons of green buildings by considering not only the lifecycle costs (beneficial only for the O&M people), but also positive/negative externalities of working in a green building. If the study were to confirm the economic sense of green buildings for the users, not only for the Operation and Maintenance staff, we think much more of the decision-makers could be convinced of supporting green buildings.

b) Who

We think that the lead should come from the research side. There are already several professors who mentioned the important contribution of green buildings to life and work quality. This topic could be researched as a master's thesis in departments such as Urban Studies or Graduate Programs such as TPP (Technology and Policy Planning). The subsequent economic analysis could be part of an interdisciplinary research between the department of Urban Studies and Sloan or the Department of Economics.

With a systematic research about this available, it would then be the role of the responsible Faculty to make sure that the information does not only get publicized, but also reaches the potential users in the DLCs and in the administration. It would certainly be a powerful argument for supporters of green buildings to convince the current and future users, who play an integral role in the planning process.

4.5.3. MIT’s the Greenest

a) How

MIT has a tradition of excellence. However, it had not been true to its reputation in the environmental domain so far. There is a large disconnect between what is taught and what is practiced. We believe that here again, there is a potential for large improvement. Building on the “Utilize Competition” axis of action, MIT could try and become an example of self-sufficient campus in the Country and in the World.

There is a lot of research being conducted currently on the Campus about topics as diverse as fuel cells, green buildings, water conservation, biological waste treatment, solar energy etc. All those efforts could be bundled into a commitment to make, in the long term, MIT the most self-sufficient campus in the World. We believe that setting very ambitious goals is an effective way of mobilizing latent energy.

b) Who

Once again, most of the effort would come from the academic side. However, such a huge commitment cannot be taken without the active support of some highly placed person. We believe that only a pledge of the senior officers of the Institute, following a consensual discussion-making process involving the related academic bodies, can lead to success. This action is therefore subsequent to the “Create Commitment” axis of action – a sense of commitment needs to be created first. Following this, an interdepartmental effort would be needed, probably through the creation of a coordination body (matching the efforts of the academic community and the needs of the administrative side). Eventually all actors in MIT, users as well as planners and decision makers, need to be involved in a coordinated movement to make this ambitious goal happen.

5. Implementation

Because all the actions presented above are interrelated and not independent, a structured implementation plan is needed. Of great importance is also the concept of not starting too big. Rather, we recommend starting with baby steps, then building on each of those steps to get further and further.

Table 4 summarizes the suggested implementation concept for each of the actions that have been presented in the chapter 4. For each action, this table presents the way this action could be implemented, the actors responsible for the implementation as well as the source for the recommendation – the person or group of persons who recommended this action during our discussion process.

Category	Action	Implementation	Actor	Source
Make Polluters Pay	Metering	Install sub-meters	Dept. of Facilities	Academia, Facilities
	Incentives/Rewards	Make DLC pay for energy usage	General Administration	Academia, Facilities, General Administration

Category	Action	Implementation	Actor	Source
Utilize Competition	Bench Marking	Create standard levels of success	Senior Officials and City of Cambridge	Academia, City of Cambridge
	MIT/Harvard Competition	Use friendly competition between the two universities	Senior Officials and City of Cambridge	City of Cambridge, General Administration
	Awards	Create awards for environmentally friendly behavior.	Senior Officials and City of Cambridge Student Groups and Departments	-
Create Commitment	Mass Movement	Engage the entire Institute	Everybody	General Administration
	Commitment from the Top	Create pressure from the base (grass root)	Senior Officers (indirectly from the base),	Everybody
	Increase Awareness	Increase visibility of actions, improve education about the Environment	Everybody	General Administration
Market Green	Green benefits MIT	Show MIT's green image as an important factor of success	Academia	-
	MIT's the greenest	Make MIT the most self-sufficient campus in the World	Everybody	Academia

Table 4 Implementation concept for the actions

Finally, and as a complement to the implementation table, Figure 4 presents the implementation spiral – the suggested sequence of actions that will allow the build-up process presented earlier. The series of action on the left are basic steps that form the foundation on which the other actions can be built – going further and further. Starting with the inner spiral, going through each round will allow building up the awareness and commitment level within the MIT community, until really ambitious actions can be implemented – eventually leading to MIT being the greenest building out there. The spiral also demonstrates that many of the actions must be maintained over the long term in order to keep interest and commitment in the more specific actions recommended.

provide a broad enough framework to engage all members of the MIT community, but in the end the human aspect will be a critical factor of success for our suggested strategy.