Energy Generation and Use: Initiatives			
Initiative	**Description**	**Date**	**Progress/Next Steps**
Build Smart: High Performance Buildings	Apply four key principles for new built space: (1) A careful planning process, (2) A "best in class" standard with regard to energy use, (3) Student involvement in every phase of new building processes, and (4) Inclusion of a renewable energy supply sufficient to meet the new building's energy needs.	Fall 2012	Develop plan for major renovation to: (1) reduce consumption to: (1) reduce consumption on the order of 30-40% based on current consumption, (2) improve infrastructure, and (3) be fiscally responsible.
Renewable Energy: Solar Photovoltaic	Hampshire will have to dedicate several acres for solar photovoltaic (PV) installations.	2022	Identifying locations, establishing installation standards.
Renewable Energy: Wind	Long-term PPA with a local or regional wind project. In 2022, Hampshire could begin purchasing the RECs associated with this power.	2022	Initial investigations underway.
Renewable Energy: Biomass & Geothermal	Prime candidates for renewable heating strategies are currently identified as biomass and geothermal heat pumps.	2022	Under investigation.
Offsets	Tactic to be applied only as necessary – current plan requires limited offsets for this category.	2022	View Offsets section of this plan.
Energy Retrofits	20% reductions across campus. Focus on buildings not targeted for major renovation. High level review identified seven key opportunity areas: (1) lighting retrofits, (2) lighting controls, (3) low flow plumbing, (4) building envelope, (5) building seal/ weatherization, (6) pipe insulation, and (7) HVAC control improvements. Additional opportunity areas include: (1) window replacement, (2) roof replacement, and (3) heating and cooling system replacement.	Ongoing	Develop retro-commissioning plan for later-term renovations based on building renovation priority list. Establish annual investment fund.
Energy Conservation – Education, Awareness and Training	Apply integrated conservation programs using education, awareness and evaluating building operation procedures.	Ongoing	Program development.

Build Smart: High Performance Buildings

New Buildings

The Hampshire campus will grow over the next twenty years. Conditioned building space is likely to expand by 10-15% in that time period. Designing and constructing buildings to minimize energy use will thus be a key component of the College's carbon reduction strategy. Hampshire will apply the following principles to any new buildings or additions to be added to the campus:

1. Buildings will only be built after a thoughtful planning process that seeks to:

    a. Optimize the use of existing space before building additional space,

    b. Make the most efficient use of any new space that is built, and

    c. Evaluate the impact of new buildings on the College's overall carbon emissions.

2. Hampshire will strive to build new buildings to a "best in class" standard with regard to energy use. This standard will place particular focus on building envelopes, user and operator controls, and right-sized mechanicals. This process will:

    a. Follow an integrative design process that sets aggressive energy budgets and manages the process to those energy budgets just as projects are managed to a financial budget; and

    b. Be driven by a commissioning agent or sustainability consultant to be hired at the outset of each project to represent the College. The agent or consultant will be charged with and empowered to achieve the performance standards necessary to achieve "best in class" status.

3. New building projects will involve students in a meaningful way in every phase of the project from planning through design, construction and commissioning.

4. New building projects will include a renewable energy supply sufficient to meet all of the building's energy needs. To the extent possible, the renewable energy supply will be integrated into the building itself or mounted on the building.

Greening Existing Buildings

Based on the age and energy use of campus buildings, we believe that we can invest in the College in a way that will (1) improve infrastructure, (2) reduce greenhouse gas emissions, and (3) be fiscally responsible, with most projects paying for the capital investment through energy savings.

At the end of this decade, most major buildings on campus (some 640,000 of 810,000 square feet) will concurrently reach their 50th operational year. Hampshire therefore faces a significant deferred maintenance burden that will require several major building renovations over the next 10-20 years. In some cases it may be in the best interest of the College to replace certain buildings with new facilities.

Comprehensive building renovation projects will provide an opportunity for much deeper energy savings than can typically be achieved through conventional energy retrofits. However, achieving aggressive energy reduction targets will require definition and implementation of an approach to renovation projects that is specifically targeted to achieve very high energy

performance. The approach defined should follow the same outline as the process described above in the *Build Smart* section.

For the purposes of our preliminary planning process, we have assumed that the following buildings will be renovated in the next 20 years, and that in the renovation process Hampshire will aim to reduce energy consumption on the order of 50% relative to current consumption:

- Robert Crown Center
- Harold F. Johnson Library
- Cole Science Center
- Franklin Patterson Hall
- Merrill House
- Greenwich House

We estimate that an incremental energy efficiency investment of $2-3 M (not including the Robert Crown Center project currently in planning) integrated into the renovation of these buildings would produce attractive returns. Additional funds will be required to support the necessary renewable energy installations to get these buildings to net zero energy.

We have estimated the reductions from this aggressive approach to energy efficiency in our buildings at 1,581 $MTCO_2e$ or 21% of 2011 campus greenhouse gas emissions.

Energy Retrofits

The buildings targeted above for comprehensive renovations account for 42% of campus building square footage. The remaining 470,000 gsf of building space will need to be reviewed thoroughly for energy retrofit opportunities. Hampshire has recently completed a deferred maintenance assessment that indicates that over 40% of the College's deferred maintenance burden resides in systems that affect energy use, such as building envelope, HVAC, lighting, and plumbing systems. Given the magnitude of deferred maintenance on the campus, Hampshire will be best served by putting together an integrated energy efficiency and deferred maintenance program that addresses the remainder of the campus.

The integrated energy efficiency and deferred maintenance program will:

1. Define buildings targeted for major renovations over the next 10 years and remove them from the energy retrofit/deferred maintenance program;

2. Prepare preliminary budgets for the program based on deferred maintenance database and estimated energy efficiency opportunity;

3. Develop a high-level, multi-year plan for implementation;

4. Set energy targets as a key performance metric for the program manager;

5. Conduct retrocommissioning of key buildings;

6. Implement a balanced mix of energy efficiency and deferred maintenance projects such that relatively quick paybacks on energy efficiency measures combine with longer payback measures that address critical deferred maintenance issues; and

7. Monitor building energy performance to ensure achievement and maintenance of energy reductions.

We have estimated that the energy efficiency and deferred maintenance program outlined above can reduce energy use in the buildings addressed by 20% or more, yielding emissions reductions of 674 $MTCO_2e$.

Renewable Energy

The following sections explore options for Hampshire's transition to a renewable energy portfolio. The principles outlined in the table above will guide our renewable plan, no matter which sources are selected for implementation.

Principles Guiding All Renewable Energy Initiatives
RECs will be sold in the early years of purchase agreements as necessary to make the projects economically viable.
Projects must enhance the community and preference will be given first to energy generated on-site and then to energy generated nearby.
Projects can be accomplished through partnerships.
Fuel source must be sustainable.

Over the last 20 years, Hampshire has converted significant portions of the campus from electric heat to natural gas heat. At current gas prices, these conversions are saving the College hundreds of thousands of dollars annually in utility costs. If Hampshire were to continue with the natural gas conversions, there would be still more savings to be had. However, given the significant environmental concerns with regard to natural gas sourcing, and provided the College's aggressive carbon neutrality goals, Hampshire must look beyond natural gas to renewable heat sources.

Solar Photovoltaic

Solar Photovoltaic (PV) presents a significant opportunity to Hampshire due to one of the College's great assets: its land. To achieve the goal of climate neutrality for scope 1 and scope 2 emissions by 2022, Hampshire will have to dedicate several acres to solar PV installations. Hampshire has a significant amount of open space that could be utilized for this purpose. However, exploratory work still needs to be done to identify the right parcels of land for PV installations, to set standards for the installation, and to get community buy-in on use of the selected plots for this purpose. Further investigation will focus on technologies and approaches that allow for ongoing use of the land.

Several other obstacles will need to be worked through to get a significant PV installation on campus, including state net metering limits and considerable financial constraints.

Wind

It is likely that the College will not build sufficient solar PV capacity to meet its entire electric load, and Hampshire will have to supplement its electricity supply with an additional renewable source. Although the College is unlikely to build a significant wind installation on its campus, Hampshire intends to investigate opportunities to participate in regional wind developments. Projects should be local (within New England or New York) and the College should be able to play a keyenabling role. Ideally, Hampshire would enter into a long-term PPA with a wind power provider. Hampshire may not purchase the RECs associated with this power in the short term, but will begin doing so by 2022. Initial investigations indicate that procurement of wind power will be a viable option for the College, although under current market conditions there will likely be a premium for wind. Nonetheless, under the right market conditions, a long-term wind PPA can serve as a good financial hedge against future energy cost increases, and play an integral role in reaching Hampshire's climate neutrality goals.

Biomass and Geothermal

Our plans for climate neutrality require significant focus on campus heating systems. Currently, the campus is heated by a mix of distributed natural gas boiler systems and electric resistance heat. For the purposes of the Plan, we have divided the campus into four districts:

- Central (Cole Science Center, Johnson Library, Crown Center)
- Southwest (Merrill, Dakin and Franklin Patterson Halls)
- Southeast (Prescott, Arts District, Lemelson)
- Northwest (Enfield, Emily Dickinson Hall, Greenwich)

Heating strategies will be developed for each district. The primary renewable candidates are ground source (geothermal) heat pumps and biomass. The current plan is based on conversion of most or all of these districts to primarily geothermal heat sources. However, installing a wood chip or other biomass boiler to provide heat to one or more of the districts remains an option for consideration as we move forward with implementation of this plan.

Although the geothermal conversions *per se* are not a renewable energy source (they still require electric energy from an outside source), coupling geothermal heat pumps with a renewable electric supply will be a very important and impactful tactic for achieving climate neutrality.

Biomass projects will require significant attention to fuel sourcing to ensure that the fuel is harvested from local/regional sources and is done so in a sustainable fashion. Also, biomass boilers will represent a significant operational complication.

Focus Area: Operational Emissions

While the emissions footprints of the operational components of Scopes 1 and 3 of the campus footprint, or fleet and liquid fuel, solid waste and water waste, is tiny compared to the building energy related footprints, any comprehensive carbon neutrality plan must address these areas. Hampshire's strategy will always be to first reduce consumption, then implement alternative practices, and finally rely on carbon offsets only after other options are exhausted. In many cases the solutions in these areas could also result in other positive returns to the campus environment such as increased staff efficiency or community engagement opportunities.