Draft 22 March 2022

**University of Maine Survey on Campus Carbon Emission Issues**

The University of Maine Faculty Senate Environment Committee is considering several motions to pursue in regard to meeting the long-standing UMaine campus goal of achieving net-zero carbon emissions by 2040. A short whitepaper has been prepared and reviewed by numerous physical, social, and climate scientists, engineers, economists, and additional UMaine faculty members. The white paper provides background information on campus progress achieving net-zero carbon emissions to date and how the long-term goal might be achieved.

To familiarize yourself with the terminology and many of the issues raised in the survey questions that follow, we highly recommend that you first read the whitepaper in entirety or at a minimum the Executive Summary.*

Responses to this survey will help inform the Faculty Senate on the opinions of campus community members and help construct the motions to be included at the end of the white paper. That is, some of the following proposed actions are under consideration for incorporation into motions to be considered by the University of Maine Faculty Senate. These potential survey items are derived from the whitepaper or suggested by committee members.

Feedback comments already received to date begin on page 6.
Note: With the addition of new questions, the ordering of the following questions may be rearranged.

**(1) Supporting Campus Actions Responsive to Climate Science Findings**
It's important for the University of Maine to do its part in helping the state and nation to keep the world within 1.5 to 2°C of global warming above pre-industrial levels.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

**(2) Building a Campus-wide Societal Problem-Solving Reputation**
The University of Maine should strive to become a destination campus for students from across the state, nation and the globe who want to make a difference in solving societal problems. **

__ Strongly Agree
__ Agree
__ No Opinion

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* If you are interested in suggesting edits to the white paper itself, please do so separately by sending suggested changes with your citations to Faculty Senate Environment Committee Co-Chair Harlan Onsrud, harlan.onsrud@maine.edu
** Item is viewed as a **mid-level level priority (level 2)** in the event that the survey needs to be shortened.
*** Item is viewed as acceptable but a **low priority (level 3)** in the event that the survey needs to be shortened.

__ Disagree
__ Strongly Disagree

**(3) Building a Campus-wide Sustainability Reputation**
The University of Maine should strive to become a magnet for students, researchers, educators, and industry partners who are interested in working collaboratively and from diverse disciplinary and inclusive perspectives to comprehensively address the technological, social, economic, and environmental challenges of climate change and sustainability.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

**(4) Staying the Course in Achieving the UMaine Zero Carbon Emission Commitment**
The University of Maine should abide by its 2007 widely publicized and annually confirmed long-term commitment to achieve net-zero greenhouse gas (GHG) emissions by 2040.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

**(5) Ensuring Annual Progress**
The University should decrease greenhouse gas emissions each and every year at a rate consistent with the required annual minimum or greater to achieve the 2040 commitment or should expend the funds for carbon sequestering or carbon offsets to achieve yearly targets.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

(**6) No Expansion of Campus Greenhouse Gas Net Emissions: Building Design and Cost Obligations**
New campus construction and renovation projects should not cause expansion of the campus carbon footprint during either construction or long-term operation of the new or rebuilt facilities.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

**(7) No Expansion of Campus Greenhouse Gas Net Emissions: State and Federal Matching Fund Opportunities**

The University of Maine administration and the UMS Board of Trustees should not seek or approve the use of any state or federal funds for any new construction or reconstruction that would expand the University of Maine carbon footprint.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

**(8) Hypothetical Deployment of Clean Energy Infrastructure for All versus a few New Clean Energy Buildings** <Several reviewers identified problematic wording – see dd, gg, hh, and ii for potential replacements. New items hh and ii are currently recommended as replacements for this item>
Hypothetically, if the campus administration and UMS Board of Trustees were to acquire major State of Maine bond funding for Orono campus capital improvements, the funding should be used primarily to upgrade as many current buildings as possible to supply them with zero carbon emission energy rather than to construct several new clean energy buildings spread across the campus colleges.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

**(9) Decreasing versus Not Enlarging the Campus Carbon Footprint**
Decreasing the carbon footprint of the campus should be made a design and funding requirement of each and every campus building and infrastructure project.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

**(10) Banning Addition of Any Fossil Fuel Connections**
~~Similar to the Columbia University pledge~~, The University of Maine should not install fossil fuel connections to any new campus construction or renovation projects.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

**(11) Regular Tracking of Campus Progress**
The Faculty Senate should create a *Climate Change Audit Committee* under the auspices of the standing *Environment Committee* to closely track and aid the campus in achieving zero greenhouse gas emissions by 2040. It should regularly communicate and coordinate with the

University of Maine *President's Sustainability Council* and the *UMaine Climate Action Plan Working Group*.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

**(12) Divestment of Fossil Fuels**
Following the lead of State of Maine Legislative Bill LD99 (2021) that now bans new public investments in fossil fuels and full divestment within 5 years, the University of Maine System should formally commit to stopping any new investments in fossil fuel companies and fully divest funds in fossil fuel companies within 5 years.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

**Respondent Relation to the University of Maine**

(For student version of the survey)
**(13) My primary relation to the University of Maine is best described as:**

__ undergraduate student
__ graduate student
__ other, please describe: < short text field >

**(14) I am most closely affiliated with the following college.**

__ College of Education and Human Development
__ College of Engineering
__ College of Liberal Arts and Sciences
__ College of Natural Sciences, Forestry, and Agriculture
__ Maine Business School
__ All, none, or Other, please specify: < short text field >

**(15) I am pursuing my academic program(s) primarily through:**

__ On-campus attendance
__ UMaine Online

(For faculty/staff version of the survey)
**(16) My primary relation to the University of Maine is best described as:**

__ full-time faculty member
__ part-time faculty member
__ staff in a primarily research setting

__ staff in a departmental or similar setting
__ research unit head (e.g., organized research unit)
__ unit head (e.g., department or school) or associate/assistant dean
__ upper-level administrator (i.e., dean or above)

**(17) I am most closely affiliated with the following college.**

__ College of Education and Human Development
__ College of Engineering
__ College of Liberal Arts and Sciences
__ College of Natural Sciences, Forestry, and Agriculture
__ Maine Business School
__ All, None, or Other, please specify: < short text field >

(For both versions of the survey)

**General Comments**

**(18) Please provide any additional comments you wish to make.**
<medium text field >

**SUBMIT**

We thank you for your time spent taking this survey. Your response has been recorded. Summary results will be made available on the FS Environment Committee website.

## APPENDIX

### Suggestions by Reviewers to Date for Consideration by the Committee Prior to Survey Deployment

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### A. Comments and Suggested Edits by Environment Committee Members and Corresponding Faculty Members

The comments below were submitted by committee members and corresponding faculty members. This appendix is under active development with further input being solicited from additional parties for improvement of the survey.

#### Suggested Edits to the White Paper

Reviewer Comment: The white paper needs a short paragraph introduction stating its purpose.

Subcommittee Response: This edit has been made. It was added to the version of the whitepaper dated 16 Jan 2022. A further expansion in the form of an executive summary will be added.

Reviewer Comment: A section needs to be added summarizing the findings to date of global warming scientists. The need for urgent action should be documented.

Subcommittee Response: This information has been added in a new Section II in the whitepaper.

Reviewer Comment: The pros and cons of potential biofuel use in the campus steam plant needs to be added.

Subcommittee Response: This information is now added in a new section VI and new Appendices 2 and 3 in the whitepaper.

**Suggested Edits to Survey Items**

Comment: The differences in what information is being sought from survey respondents from question to question is not clear.

Subcommittee Response: A heading for each survey item has been added and the previous headings for groups of questions have been dropped.

Comment: Remove the background information in survey items 1 and 2 and instead include that material in the whitepaper.

Subcommittee Response: The background information has been removed and a new section II has been added in the whitepaper incorporating the information. Previous items 1 and 2 have been combined into survey item 1 as illustrated above.

Comment: Shorten and simplify item 7.

Subcommittee Response: Done. Now number 6.

Comment: Shorten and simplify item 8.

Subcommittee Response: Done. Now number 7.

Comment: Item 9 is awkwardly worded. Rewrite.

Subcommittee Response: Done. Now number 8.

Comment: Shorten item 10 and reword it as a "requirement" rather than as a priority.

Subcommittee Response: Done. Now number 9.

Comment: Shorten and simplify item 13 and instruct UMS to adhere to the new law.

Subcommittee Response: Now number 12. Whether the University is included within the bounds of the legislation has not yet been confirmed. Wording is left as is for now until clarification is achieved.

**Suggested Eliminations of Survey Items**

Comment: Although item 3 (now item 2 above) is included in the whitepaper discussion in section V, this survey item does not relate directly to the campus climate commitment so it should be dropped.

Subcommittee Response: With the addition of the headings for each survey item, we believe the intent of this question is clearer. However, the item has been marked ** indicating it is considered only at a mid-level (level 2) priority for inclusion by the subcommittee.

**Suggested Additions of Further Survey Items**

**(aa) Adding University of Maine Machias to the Zero Carbon Commitment**

The University of Maine Machias campus should be added to the University of Maine commitment to achieve net-zero greenhouse gas (GHG) emissions by 2040.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree

__ Strongly Disagree

Subcommittee Response: This item will NOT be added to the survey since this is an action for the UMaine administration to consider in including UMM within the bounds of the 2040 commitment and UMM continues to operate its own faculty assembly that may choose to act or not in a manner similar to that of the UMaine Faculty Senate.

**(bb) *Annual Public Address on Climate Commitment Progress***
The President of the University of Maine should present annually an oral address open to the campus community and public at large on the *State of the University's Climate Commitment toward Achieving Net-Zero Carbon Emissions by 2040*. ***

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

Subcommittee Response: This suggestion to be added but marked *** as a low-level (level 3) priority for inclusion. Although an annual public address by the president would be welcome, the greatest need is for an independent group of faculty, researchers, academics, scientists and others to continually and regularly scrutinize the details of any campus plans for achieving zero carbon emissions and to promote the acquisition of funding to achieve unmet needs.

**(cc) Adding Carbon Emission Offset Costs to University Travel Expenses**
Until such time as U.S. society resolves the issue of travel carbon emissions generally, the carbon emissions for each university-funded travel trip should be computed and the cost of offsetting/sequestering the carbon emissions should be applied to the university travel costs for the trip and actually spent for this purpose.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

Subcommittee Response: This suggestion to be added but marked ** as a mid-level (level 2) priority for inclusion.

**(dd) Preference for Non-Combustion Near-Zero Carbon Emission Energy Sources**
UMaine should avoid to the greatest extent possible converting to burning renewable biofuels on campus and instead go straight to full electrification of buildings and facilities powered by clean solar, wind, hydro, and other non-combustion near-zero carbon emission energy sources.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

Subcommittee Response: Item was **NOT** included. This item is similar to items gg and hh below.

**Further Item Suggestions**
(Sample wording for these items has yet to be prepared.)

(ee) A non-specific survey item suggestion was made to add questions in support of diversity, equity and inclusion.

Subcommittee Response: A new item was **NOT** included due to the difficulty in formulating wording directly germane to the zero-carbon emission challenges. However, the concepts of diversity and inclusion are now included explicitly in item 3 and equity is among the societal challenges to be embraced by the item.

(ff) A non-specific survey item suggestion was made to add an item about support for discouraging reliance on carbon offsets to meet carbon neutrality goals.

Specific Item: **Discouragement of Carbon Offsets**

As a general proposition, the University of Maine should prioritize the elimination of carbon emissions rather than making carbon offset payments in order to achieve carbon neutrality goals.

Subcommittee Response: Item was **NOT** added. Item somewhat conflicts with item cc. It also conflicts with the idea that carbon offsets should indeed be used as an internal incentive on a temporary basis to motivate the university to no longer emit carbon into the atmosphere.

(gg) An item should be prepared on priority spending on long-term solutions (i.e., electrification powered by wind and solar) over stop gap solutions (i.e., dependence on the burning of biofuels that emit pollutants and greenhouse gases on campus).

Specific Item: **Preference for Non-Combustion Near-Zero Carbon Emission Energy Sources**

The University of Maine should prioritize its clean energy infrastructure core spending on long-term solutions (e.g,, heating and electricity powered by wind, solar, hydro, and other non-combustion near-zero energy sources that might be supplemented through potential use of biofuels for power generation to top off geothermal heating during periods of high demand) rather than prioritize core spending on a combustion-based wood biomass solution that would continue to emit pollutants and greenhouse gases on campus as well as increase noise and truck traffic.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

Subcommittee Response: This wording is preferred over item dd. This item will tentatively replace Question 8 on the survey. Also see related new item (hh) below

**B. Comments and Suggested Edits Received in Response to a Distribution Sent to Faculty Senate Elected Members**

Response 1

In regard to: "**(3) Building a Campus-wide Sustainability Reputation**.
Should we expand this question to ask if the University of Maine should market itself as an energy efficient, green university? Thus, actively drawing faculty and students to UMaine (and Maine) to live and work?

Subcommittee Response: The subcommittee believes the concepts of marketing and green university are already strongly implied within item 3. We have already adapted the item to include diversity and inclusion. Adding more specific details would make the item less clear.

Response 2

Wood is dirty (more particulates), and it can sometimes be "net-zero", rather than near true zero as solar, wind and hydro are. As mentioned, wood is NOT net-zero unless you also take legal ownership or control of the carbon absorption capacity, and claim a certain section of forest as designated for heating of UMaine's campus. Ownership is best. Contracts are second-best. Relying on 3rd party certification is a distant third. Using uncertified land is a complete failure. The campus must be careful about considering wood, and if we use it, it must only be temporary.

Subcommittee Response: These issues are raised in new Appendices 2 and 3.

Response 3

As noted in the paper, the burning of wood waste on campus to create steam isn't a solution exportable to the rest of the nation. It relies on antiquated steam pipe heating infrastructure.

The best way to support the forest industry in Maine through the improved energy infrastructure of the campus (if that is or should be an objective), would be to build or support a functional power plant that could utilize, demonstrate, and test the burning of biofuels. A huge market will exist for biofuels in a clean energy future since they will be needed to supplement solar, wind, and other near-zero GHG electric power sources during peak demand times and when the sun isn't shining nor the wind blowing. This functional biofuel demonstration power plant would be designed to supplement the campus's near-zero GHG electric power sources when needed. It could be designed to accommodate waste wood, wood pellets, renewable natural gas (i.e., landfill gas), and other emerging biofuels produced in Maine (e.g., waste from existing cellulose crops, new cellulose crops, etc.). This model would be exportable to the rest of the nation and could result in very high returns for Maine industry under predicted global warming futures.

Subcommittee Response: These issues are raised in new Appendix 3.

The campus steam plant would be minimally maintained and refurbished as needed until such time as all buildings on campus were electrified to enable them to use clean and renewable energy sources. A new powerplant could be built away from the center of campus avoiding many of the pollution and traffic issues that would otherwise arise from burning wood waste in the current steam plant location.

Has the administration seriously considered and priced out this option? The campus might not even need to finance such a powerplant since private industry might be very interested in doing so if the campus created a long-term demand for local biofuel power. Does the administration know what it would cost to fully electrify one-by-one each major building on campus? If it has $130 million to spend now on heating infrastructure, how far would that money go instead in

fully electrifying core buildings on the campus? Would not that money be better spent in the long-run on electrification conversions?

Subcommittee Response: These issues are now raised in the context of supporting biofuels for electric power generation as a long-term complement to non-combustion energy sources during high demand rather than in the context of an either/or expenditure of funds. See survey items (gg) and (hh), and Appendices 2 and 3 of the whitepaper.

These issues should be raised in the whitepaper and a survey item should address the campus community preference.

Subcommittee Response: Issues raised are partially addressed by new survey item gg. The issue of building conversions is now addressed by the following.

**(hh) Building Conversions to Enable Primary Use of Wind, Solar, and Other Non-combustion Near-zero Carbon Emission Energy Sources**
Regardless of whether the university pursues primarily a biofuels heating solution with currently available funding, its highest future priority in pursuing bond money or other substantial state or federal government funding should be to pursue funding for electrification conversion for existing university buildings to allow their use of wind, solar, hydro, and other non-combustion near-zero energy sources to supply both their heat and electricity (Example: Funding of a first phase demonstration project enabling powering of all heat and electricity needs for a group of buildings that then could lead to widespread electrification of the campus).

Response 4

I hesitate to send the following as they are not significant comments, I know.

(2)&(3) Someone from English probably already OK'd it but should 'that' be replaced by 'who'?
Subcommittee Response: Replaced.
(8) Seems odd phrasing? ". . . rather than to construct several new clean energy buildings with at least one going to each college." [There are more than several campuses? Addressing only this campus or all UMS campuses?]
Subcommittee Response: Survey item 8 has been replaced.
(11) Good choice of the word 'aid.' [. . . Committee to closely track and aid the campus. . . ]
Subcommittee Response: Agree
(bb) I would add this.
Subcommittee Response: See the response to survey item (bb). This is currently a low-level (level 3) priority for inclusion on the survey.
(cc). The last two lines of this aren't clear to me but perhaps are clear to others.
Subcommittee Response: The item was slightly reworded. This is currently a mid-level (level 2) priority for inclusion on the survey and thus might be dropped if the survey is viewed as too long.

In the Further Item Suggestions. I would approve of point 2 [i.e. (ff) discouraging reliance on carbon offsets.]
Subcommittee Response: See the response to item (ff). Currently this item will NOT be included on the survey.

Response 5

My primary feedback is that this looks reasonable to me, but I do have a few "wonders".

1. I wonder if in the question that references Columbia's pledge (i.e., Item (10)), a link could be provided to that pledge for the user to see before rating the question.

Subcommittee Response: The reference to Columbia University has been dropped.

2. I know that in an ideal world people would read the white paper but I suspect they won't, particularly if this issue is not on the front burner for them. I'd be much more inclined to look at an executive summary of one page with a link to the longer paper for those that want to engage further.

Subcommittee Response: In the context of a widely distributed survey, an attachment whether in the form of one page or many will NOT be included or it will be identified as spam. A url link may be included and thus the link will go to the full white paper with an executive summary at the front. The invitation will recommend that the entire paper be downloaded and at least the executive summary be read.

Response 6

Item #8 is ambiguous. Would these funds be for this university alone or the system? Colleges here at UMaine or throughout the system?

Subcommittee Response: Survey item 8 has been replaced as discussed under (gg) and (hh) above.

#12 does this include the University of Maine Foundation? I ask because the Foundation is not a part of this university or the system. It operates as an independent organization with its own board, etc. (https://umainefoundation.org/about-the-foundation/).

Subcommittee Response: Divestment of University of Maine Foundation funds is not included in this specific motion. The Foundation may want to pursue a similar stance if it has not already done so.

#14 (students) - Division of Life Long Learning?

Subcommittee Response: This response would overlap with and complicate choices by students. Most DLL students are pursuing graduate credentials and know the college with which that credential is most closely affiliated. The option of “All, none, or Other” covers any that don’t. We have also added the ability to specify the “other” affiliation.

#16 (faculty) - What is the purpose of identifying adjunct faculty? Why aren't they just faculty members? Why not just "Faculty member"? If it is important to record this information faculty should be listed as: "Full-time Faculty" and "Part-time Faculty" rather than "faculty member" contrasted with "adjunct faculty member" which creates the impression that they are not really members of the faculty.

Subcommittee Response: Change made.

#18 - a larger area for comments looks more inviting.

Subcommittee Response: We will choose a large text window option for this response.

Response 7

Thank you so much for leading on this and for allowing me a chance to comment on the survey.

1.) I would not do the survey. Questions 1-5: we can assume people are supportive and you'll see that in the results. I don't think you'll learn anything. If you want to show support, why not

just ask Senate to endorse a statement? Same results, but easier. Questions 6-12: support will vary, but I want you, the experts, coming up with a plan, not respondents. Why ask these?

Subcommittee Response: Through discussions with others on campus there appears to be a broad range of response as to whether and to what extent the campus should react to climate change and whether sustainability should be a high or low priority as compared to other objectives for the campus. Questions 1 - 5 may help determine levels of consensus or disagreement. Regarding questions 6 -12, there is no intent that the Faculty Senate with volunteer support would come up with a plan for revising the energy infrastructure on campus. That requires financial investment in detailed studies and plans by the administration. Rather the goal is to scrutinize progress, current plans, and future plans by the administration through volunteer help. We are asking questions to aid the process of exploring approaches and priorities that the administration may not have considered in order to arrive at best solutions for the campus. The more perspectives gathered, the better will be the likelihood that acceptable technical, social, and societal objectives will be achieved.

2.) We need a plan, but we also need to know why past plans since 2007 haven't worked. Farmington is ahead of us! Why? We were told in 2017-18 that the admin was working on a contract, then there was conflict of interest and it had to go back to bid, then covid hit and we never heard about it again. What happened?

Subcommittee Response: Feel free to pursue this with the administration. The subcommittee is focused on where the process is today and to spur greater action for the future

We got this all the time with Gen Ed. People said, "we always try, it never works, why is this any different?" We had to answer that by knowing why past efforts failed and saying how we'd address those factors. What also helped was showing what other places did. We'd say, "we just want what Cal. State Chico has".

Subcommittee Response: The faculty subcommittee and reviewers of the documents have made extensive citations to the literature and to experiences elsewhere.

3.) It would help to know what you mean in the email above when you say that the administration might be moving in the right direction but we don't know the end game. What is the current state of administration planning (you may not know yet)?

Subcommittee Response: Reviewers need to read or at least skim the entire whitepaper if they are interested enough to become more informed about the potential directions that might be pursued or are likely to be pursued by the administration. Appendix 2 probably now best expresses the administration’s current directions.

4.) The white paper is great but senators and others need a one-pager version too (e.g.: here's where we are, what University X did, here's what we want to do, here's the barriers, here's our plan to address them).

Subcommittee Response: An executive summary is being added. See Response 5 above.

Great start - really important and should gather momentum!

Dear Reviewer,
Thanks! We have included your comments in the growing compilation for consideration by the subcommittee.
A major reason for creating both the whitepaper and deploying a survey is the hope that at least a few more people will become informed about the details of the issues being raised by reading

the whitepaper, raise the visibility of the issues, suggest and scrutinize potential solutions through exposure of the issues to a broad range of academics and solicitation of feedback, and encourage a response and rational plan by the administration.

Response 8

Question 2: consider removing the quotes around “make a difference”

Subcommittee Response: Done.

Question 13: It might be worthwhile to include a few additional categories here, such as early college students, distance learning students from DLL, or potentially students from UMS, but not UMaine taking online courses... perhaps not all of those groups need to be included, but including one or so extra categories might reduce the number of folks who respond 'other'

Subcommittee Response: The subcommittee chose to keep the primary categories of undergraduate and graduate students with the affiliation of each student specified in Question 14. In Question 15 we prefer keeping the online versus on-campus designation as a primary distinguishing difference among students. Students now have the ability to describe their “Other” situation under question 14

Question 16: Similarly, I wonder if it would be good to include a few more categories or to include an 'other' response here. For example, I'm not sure that staff working for facilities, in the student union or library, etc... would have a category to choose for this question.

Subcommittee Response: The Question 16 categories have been revised to be more inclusive. We want only one question to have an “Other” category for each respondent and that is Question 14 for students and Question 17 for faculty/staff.

Response 9

Thank you for giving me this opportunity to respond to your survey. I understand that you want only specific suggestions to the survey itself. I cannot help but preface my suggestion with two points:

Point 1: Renewable energy--solar and wind--seems like a win-win technology. However, its development in Maine seems to me to be based on a sort of gold rush mentality. When there are subsidies, developers rush to install these technologies wherever they can without any central planning or collective thoughtfulness. Thus, we have wind turbines haphazardly placed on mountain tops around Maine and now solar panels in every fallow field with no plan for decommissioning and no thought to biodiversity. We as Mainers cannot discover whether these facilities actually produce the power promised by the developers. We need to be careful that Maine doesn't become an energy plantation for the rest of New England.

Subcommittee Response: Comments are noted. It should also be noted that a large number of environmental scientist and policy specialist disagree not with your expressed need for good planning and transparency for Maine citizens but with any underlying implied objections to building a clean energy industry in Maine. Development of an industry to mine the energy of the sun where combustion takes place 90 million miles away from Earth using solar and wind farms in Maine, using that near-zero carbon energy to support the energy needs of Maine homes and industries, taking a percentage of the savings to directly reduce electric energy costs for Maine consumers who voluntarily choose to use clean energy, and selling the remaining RECs elsewhere in the nation too less nimble industries as they catch up is a strategy that ultimately increases the amount of non-combustion near-zero carbon energy produced for the nation and that directly benefits Maine consumers. This describes a program advocated and put in place

by the current Maine Governor Janet Mills with strong support of the environmental policy and scientist communities. The reasoning is that it is far better for Maine to invest in creating jobs in the clean energy industry in Maine than many of the alternative industries that the State might want to attract to support its future economy. A miniscule proportion of land would be used to support such solar and wind mining efforts than has been traditionally used for any other major societal infrastructure need such as for farming, forestry, roads, highways, housing, public parks, or industrial sites. If one believes that an Earth emergency is imminent within the next few decades due to global warming as many scientists believe, investment in clean energy advancements would be a very good environmental investment as well as a good economic and financial investment for Maine.

Point 2: I completely agree that the University should refrain from expanding its carbon footprint (through development) and that it should use any available funding to **reduce** that carbon footprint. However, I do not believe that the rest of us can continue to live as we always have lived. So what I find contradictory in your survey is the statement that we must achieve our goal of net-zero carbon emissions by 2040 but we should also be a magnet for researchers and students from around the world. You do not address travel in this survey or Scope 3 emissions. The University should be encouraging more students to live on campus. It should encourage less commuting. Perhaps more conferences should be virtual, now that we have the technology.

Subcommittee Response: Offsetting the carbon footprints of university travel has been added as a survey item.

Subcommittee Response: An additional question in regard to reducing energy consumption is as follows:

**(jj) Funding for Energy Consumption Reduction*****

The University of Maine should make as a high priority for funding the reduction of energy demand and losses within existing buildings and facilities and to support energy reduction initiatives generally.

Note: The above item is viewed as acceptable but at a **low priority (level 3)** in the event that the survey needs to be shortened. The primary focus of the survey should be on big-picture expensive long-term challenges that are most difficult to achieve.

I suggest a question on how to address Scope 3 emissions with more than carbon offsets, which are ultimately just smoke and mirrors.

Subcommittee Response: The most critical issues to focus on at this time are scope 1 and 2 challenges. A scope 3 question has been added for university funded travel that may incentivize the avoidance of some business travel using some of the methods suggested. U.S. society is moving toward electric vehicles and, if electrification of campus facilities occurs, then charging stations for vehicles may be far more likely to be built into new campus construction. One goal with carbon offsets is to ensure that those applied when carbon emissions can't be avoided remove carbon at a 1:1 ratio and are enforced through accounting/auditing processes.

Thank you very much for focusing on this issue. I tremble to think of the trees that may be cut for the new athletic complex we'll be developing with the Alfond money.

Response 10

My comments:

Q2 is somewhat vague, though maybe that's on purpose? I don't think anyone will disagree that we want our students to 'make a difference' but if the goal is to either a) gauge whether people think making a particular difference in climate is important; or b) present evidence that a LOT of people think making that particular difference is important, more specific wording would help.

Subcommittee Response: Phrasing has been changed. Item is specifically focused on problem solving in general since many might view this goal as being supported while not wanting the university generally to focus on environmental issue problem solving. See Response 7 above. The item is viewed by the subcommittee as a **mid-level level priority (level 2)** in the event that the survey needs to be shortened.

Or...reading Q3, is Q2 meant to be general and Q3 meant to be specific? If so, disregard the above.

Subcommittee Response: Yes, Q3 is meant to be specific.

Q6) I confess I didn't read the white paper super closely so when I came to this question, I half scoffed, half scratched my head at the concept. I expect that this will be a common reaction (and lack of reading). This might benefit from a direct reference to the White Paper in terms of what it means to be a Carbon Neutral project.

Subcommittee Response: The term “campus carbon footprint” has been removed from the titles of Questions 6 and 7 with substitute language in an attempt to help define the phrase as used in both items. Hopefully this clarifies the meaning of the items although the term “greenhouse gas net emissions” may also be confusing.

How does Q7 differ from Q6? Is the goal to proactively cut the knees out of "but the money is free!" sorts of arguments against carbon neutral building? Gift horses and mouths and all that.

Subcommittee Response: Yes, the Board of Trustees and the campus administration both have the ability to refuse to seek or approve the use of funds for building projects that would expand the campus carbon footprint.

Q9 similar to Q2 above. If you're interested in truly learning what people think, the question is great. If you're interested in a solid Agree/Strong agree consensus to bring to decision makers, changing "requirement" to "goal" may be more successful.

Subcommittee Response: Requirement is the preferred term as it forces respondents to commit one way or another.

Q10 Any chance of framing this in a different term than the Columbia pledge? These sorts of things are easier to do when you're rich and easier to poo-poo if you're only seeing the rich people do it. It would be nice to reference other Endowmently-challenged universities.

Subommittee Response: The reference to Columbia University has been dropped.

I hope you find these comments entertaining, if not actually useful.

Response 11

All looks good to me. No additional suggestions.

Response 12

It's clear that a lot of time, thought, and care have gone into the creation of both documents. I don't have many notes/comments for you, but here are a couple:

— Question 8 strikes me as both too vague and too specific. Why $500 million? Is there a specific discussion of that number in the works? I think the question would be clearer if it just read "Hypothetically, if the campus administration and UMS Board of Trustees were to acquire State of Maine bond funding for campus capital improvements, the funding should be used primarily to upgrade…."

Subcommittee Response: Replaced. See the notes following the first appearance of the question above.

— Is there any value in specifically addressing a question toward carbon footprint in relation to the plans for the new athletic facilities?

Subcommittee Response: Since many new buildings on campus are in the planning stages, it makes little sense to single out one grouping of buildings at the current time. A rational policy should be developed and applied to all upcoming construction across all uses.

Response 13

The use of any type of fuel for heating and/or electricity generation requires both context and long-term analysis. While renewable energy such as wind and solar are appealing, the efficiency is quite low. Nuclear, with current low pressure reactor technology, is safe and essentially emission free. However, the disposal of nuclear waste after 30 years or so of use is problematic. Hydrothermal energy is safe, efficient and environmentally friendly although the initial costs and maintenance are high. Landfill gas produces expensive energy and the presence of Sulphur is an ongoing problem.

The University of Maine has proposed several versions of systems that use biomass as a fuel. The use and benefits of renewable biomass related fuels must be seen in the context of Life cycle analysis (LCA). Multiple careful studies show results that indicate that the carbon intensity of wood pellets and chips are significantly lower than that of fossil heating oil and natural gas. (Unnasch. S. and L. Buchan (2021). Life Cycle Analysis of Renewable Fuel Standard Implementation for Thermal Pathways for Wood Pellets and Chips, Life Cycle Associates Report LCA.6161. 209.2021, Prepared for Technology Transition Corporation, p. 49). This indicates that wood pellets and chips are a promising alternative for heating oil and natural gas. However, such use may not be appropriate in the context of some of the wood combustion options that may be under consideration at the University of Maine.

My major concern is with Appendix 2 of the whitepaper. The US Environmental Protection Agency (EPA) Revised Renewable Fuel Standard (RFS2) does NOT currently include a pathway for the combustion of woody biomass for use as a heating fuel. (IBID, p. vii)

While such use is under consideration by the USDA (and advocated in the referenced article – see p. viii), it is not yet known if such a pathway will be approved by the EPA and, if so, when. Nor is it known what potentially stringent conditions might be imposed in the burning of biomass for heating in order to qualify under RFS2. EU standards have long accepted woody biomass, particularly, dry wood pellets for use in heating and power generation.

For other purposes (such as in the use of forest residue to produce liquid biofuels), woody biomass is included under RFS2 but only when sustainable forest practices are employed.

Thus, such verifiable forest practices may be expected at a minimum as one of the qualifying conditions if and when biomass is approved as a renewable source for heating. This would encompass about 5 million acres of forestland in the United States and nearly all of the woodlands in Maine.

The university is taking a major gamble if it is seriously considering investing $130 million on a steam plant upgrade that currently would not be accepted by the U.S. federal government as employing renewable energy. There are currently no major federal support programs for burning of woody biomass for heating such as exist for electrification using clean solar and wind energy projects. Perhaps federal programs might eventually exist for wood chip and pellet burning for electricity generating power plants (e.g., an approach used in the U.K. dependent upon residual "waste" biomass grown, harvested, and pelletized in the southeast U.S.). However, for heating operations this seems unlikely in the U.S. in the near future although carbon credit markets related to greenhouse gas production are used in the northeast and stringent monitoring is done at all biomass burning facilities that generate appreciable amounts of heat and/or electricity.

> Germane Reference: The Regional Greenhouse Gas Initiative (RGGI) is the first mandatory cap-and-trade program in the United States to limit carbon dioxide from the power sector. Eleven states currently participate in RGGI: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey (withdrew in 2012, rejoined in 2020), New York, Rhode Island, Vermont, and Virginia. In 2019, Pennsylvania Gov. Tom Wolf directed the state's Department of Environmental Protection to develop regulations for the state to join RGGI, and the state is expected to join in 2022.
>
> Subcommittee Response: Most of the issues and references above have been included in new Appendices 2 and 3 of the whitepaper.

Response 14

As many expected, the US corn-ethanol biofuel program has likely created more emissions and environmental impacts than would have occurred by simply using the gasoline it replaced.

Recent news:
https://arstechnica.com/tech-policy/2022/02/us-biofuel-mandate-likely-increased-carbon-emissions-inflated-crop-prices-20-30/

https://www.pnas.org/content/119/9/e2101084119

The University needs to be very careful and perhaps skeptical about the idea that it could use wood-based biofuels without causing a similar issue. The key metric that needs to be addressed is, of course, lifecycle greenhouse gas emissions. But when buying waste wood, the market becomes distorted, which changes the entire system, often for the worse as happened with corn ethanol.

I understand the limitations of our old heating infrastructure. However, it seems to me that a better approach would be to renovate and build buildings with ground-source geothermal heating, or other renewable electric heating systems. This might be slower, and more expensive. But the era for natural-capitalism-style win-win solutions is largely behind us. The cost to future generations is already high enough.

Subcommittee Response: These issues are now largely addressed in Appendix 3 of the whitepaper.

Response 15

Question 8 on the survey should be replaced with the following:
**Prioritization of Existing Buildings over New Buildings**
Although both should move forward, the University of Maine should prioritize investments in converting heating units in existing campus buildings to enable their use of solar, wind, and other near-zero carbon emission energy sources over investment in new buildings.

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree
Subcommittee Response: This specific issue on conversion of existing buildings to allow maximization of their use of near zero carbon emission energy sources is covered by new item (ii) above. That item is about promoting and prioritizing future funding for heating conversions for existing buildings.

Question 8 on the survey should be followed up with:
**Arguably Renewable but Substantially Increasing Greenhous Gas Emissions on Campus**
With the current bond funding of $130 million available for campus heating plant improvements, it would be better to expend the funds to convert heating units in existing campus buildings to enable use of solar, wind, and other near-zero carbon emission energy sources to meet at least 25% of the campus heating load rather than to convert the steam plant to burn wood waste that would greatly increase annual greenhouse gas and particulate emissions on campus (although the fuel is arguably renewable over about a fifty year period).

__ Strongly Agree
__ Agree
__ No Opinion
__ Disagree
__ Strongly Disagree

Subcommittee Response: This specific issue in preferring near zero carbon emission energy sources over combustion-based biofuels is now covered by new item (gg) above. That item now frames the issue in terms of long-term versus stopgap solutions. The committee believes biofuels do have a potential role in long-term solutions for generating electrical power under high energy demand loads.

**C. Comments and Suggested Edits Received in Response to a Distribution Sent to Department Chairs, Deans, and Research Unit Heads**

Response A

Thank you for including me in the review of your survey. I applaud and support your work. This may not be possible, but if there is a way to reduce the technicality of the survey for those who are not as familiar with the terminology, you might get a better response (specifically, students). For example, many people may not know what carbon emissions are, or carbon footprint. If you could put lay terms in parentheses that may be helpful.

> Subcommittee Response: We have attempted to clarify several survey items as indicated above. We are also providing an executive summary for the whitepaper in the hopes that many more people become informed and educated on the energy issues confronted by the campus, state and nation. The whitepaper is meant for the lay reader and again our hope is that a substantial number of members of the community will read it.

Response B

I thought it would be better to be quick than comprehensive:

Here are some thoughts.

I note that the white paper specifically states:
"What ***technological*** approaches are being explored for achieving the campus net-zero carbon commitment"

That is fine, but from my perspective, only 1/2 of the issue, the other is behavioral. Unless I am missing something, I see nothing on: reducing travel (home-work commute, business travel, student group travel, sports travel), turning buildings off (down) during vacations - used to do this at U. of Tennessee 20 years ago!, turning off lights in buildings, etc. etc. And, perhaps, "scope 4" actions - improvements at home from the UMaine community.

> Subcommittee Response: Your comments are noted. In the current initiative we are focused on major upcoming campus expenditures in energy infrastructure. We should of course implement smart buildings to reduce energy loads when not in use and as well support behavioral changes in individuals that advance the welfare of the campus community. However, getting down to this level of specificity at this point in time is not a current priority for this particular study. We have added however survey item (jj) that at least partially addresses some of the issues you raise.

Next:
"Why holding to 1.5°C to 2°C is Important: Within 1.5 to 2 degrees of warming, scientists predict that numerous abrupt ecological and climate system disruptions will occur or be put in motion"

=> My view is this is not constructive. Most technical/policy people I know think this is an unrealistic goal except as a political motivator to some segment of the population. The emissions for 1.5 - 2 C are already committed. I am done pretending to work for a goal that is not real - it is time to be honest with people. More constructive is to have realistic goals that can be measured and enforced. Also, long range planning for adaptation is probably also appropriate.

Subcommittee Response: As we note in the whitepaper under the section II on *Scientific Evidence for Urgent Action*, there is disagreement in the scientific community as to what extent findings should be reported to the broader community and the definiteness of those findings. We also clearly acknowledge that "For many scientists the goals of both 1.5 and 2 degrees are beginning to look widely out of reach …" We believe we are being honest with readers throughout the whitepaper and have asked reviewers to scrutinize our statements and to explicitly provide better wordings and additional or alternative references as appropriate.

As to the survey: Questions of intent without costs are not useful. It is too easy to check the box: extremely important to keep our commitments. A better, more constructive approach would be a survey that posits choices (called conjoint analysis): 'The university has $2 Million to spend: How much for climate mitigation efforts, how much for campus beautification, how much for parking improvements (or whatever). The point is I don't think it is particularly useful to ask people how much they care about something without bearing any of the costs (dollars, time, behavioral change). This is a well-known and documented problem in survey design (hypothetical bias).

Subcommittee Response: The university currently has $130 million to spend but it must be spent in meeting a narrowly proscribed objective. Conjoint analysis is difficult when bond money has been explicitly approved for energy infrastructure improvement and therefore asking for comparisons outside of these constraints would be inappropriate. Further, we don't have a study where several features or attributes are being evaluated against each other except in the context of very technical analysis and balances being assessed by experts. However, with your concerns in mind we have replaced item 8 with two alternative items as noted above. Item (gg) is now a comparison between two choices and these two choices are really only "predominantly non-combustion" versus "predominantly combustion" approaches to providing net-zero carbon energy for the campus if the campus intends to meet its 2040 commitment.

Maybe a question:
"Would you support spending 1% of the pool of money allocated for faculty raises on proven (verifiable) GHG mitigation efforts? This will not affect your individual compensation." I am thinking of something similar to the question on the Maine tax form: "would you support $4 going to the clean election fund, this will not impact your refund?"

Subcommittee Response: Your suggestion is noted. Our group of faculty and scientist volunteers does not have the resources to cost out the reasonable range of approaches that the campus might use to meet its Zero Carbon Commitment by 2040. This is a role for the administration. At this point we are more interested in determining what percentage of the campus community has as its highest or a high priority the pursuit of funding of zero carbon emission energy over all other competing campus needs (e.g., item (hh) as noted above). If respondents are not interested enough to read the background materials in order to provide an opinion or there is very little interest in pursuing campus resources for clean energy, then this may very well affect any motions the Faculty Senate submits to the administration.

Also, the white paper should probably note that hydro power is not zero carbon. Here is some data from Hydro Quebec. Hydro is very low (5%?) varying significantly from site to site and over the life span of projects, temperature, and vegetation displaced.

Subcommittee Response: We state in the footnotes at the beginning of the whitepaper that no alternative is a zero-carbon alternative. All approaches emit some carbon in their use of resources to create the ability for humans to use the energy resource. We

distinguish between near-zero carbon non-combustion approaches (i.e. solar, wind, hydro, etc.) and combustion approaches which may or may not be arguably renewable.

Response C

Thank you for sharing the survey and white paper with me. I'm impressed by the considerable work that has already been completed in this area and appreciate the opportunity to be brought up to speed on the initiative.

I have no new additions to the survey feedback that has already been provided; I would underscore the importance of adding these (previously suggested) items:
(aa) The University of Maine Machias campus should be added to the University of Maine commitment to achieve net-zero greenhouse gas (GHG) emissions by 2040.

Subcommittee Response: See our response under (aa)

(cc) Until such time as U.S. society resolves the issue of travel carbon emissions generally, the carbon emissions for each university-funded travel trip should be computed and the cost of offsetting/sequestering the carbon emissions should be applied to the university costs for the trip and actually spent for this purpose.

Subcommittee Response: See our response under (cc)

Response D

Thanks for sharing this. My main concern is with the vagueness of some of the terms and the euphemistic nature of some of the others. For instance, what would it mean if the university were to do its part to lower the temperature (question 1)? What does a "Reputation to solve problems" mean? How do we define a carbon footprint? Without clear operational definitions, people are going to interpret these according to their own frames, and so while they might give the same anwer, those answers won't mean the same thing.
In addition, it would help to be very clear about some of the ideas mentioned in the survey. For instance, what is the 2007 long-term commitment referenced in question 3? The survey should provide a brief description of this (so brief that people will read it). What are fossil fuel connections - gas lines? What about electricity? Electricity is produced by fossil fuel, so are these buildings going to be solar- or wind-powered? And how reliable is that?

Subcommittee Response: Respondents are highly encouraged to read the whitepaper or at least the new executive summary prior to responding to the survey. Most of the questions asked are answered at a level understandable to most university level readers in the whitepaper. A major goal of the survey is to incentivize further faculty, administrators, staff, and students to become better informed about the energy infrastructure issues that the campus is facing, the urgency of those issues, and to convey to readers what it will take to meet the campus Zero Carbon Commitment by 2040. We believe the whitepaper feedback and survey processes to be means for informing the community on a set of important issues, planting ideas, receiving constructive feedback, and helping to improve any decisions that move forward. The process may be as important or more important than the survey findings.

Because of the lack of clear definitions or descriptions, I imagine people might interpret these survey questions as a measure of how much they care about the environment. So they'll give you socially desirable answers rather than the truth (e.g., yes, we all want a reduction in the loss of fossil fuel, but do we still want that if that means our buildings are going to be kept at 62F in the winter and AC will be banned in the summer? Just some extreme examples).

Subcommittee Response: Points noted. See as well the subcommittee responses to reviewer Response B above.

Anyway, hope that helps.

Response E

I reviewed the concept paper and the survey. This being my first time reviewing this paper, I don't have much to add or comment on. It seems very appropriate to state wanting to take these actions. I don't have any comments on the survey. I will admit that I don't have a sense of the feasibility of achieving the goals set forward.

Subcommittee Response: Comments noted

Response F

Thank you for inviting comments on the survey. Here are my suggestions:

#2 is overly general. There are many ways students might envision making a difference; the question isn't specific to climate change. I think you could omit this one.

Subcommittee Response: See the rewritten item 2 above and note that the item has been moved to a **mid-level level priority (level 2)** in the event that the survey needs to be shortened. This item is also addressed in responses to other reviewers with similar comments.

#7 could be more nuanced. Suppose new construction would increase the carbon footprint but is planned to be offset by demolition or renovation of more energy-intensive buildings. According to the question as posed, someone who agreed with this plan would have to indicate "strongly disagree." That doesn't seem right.

Subcommittee Response: This issue is addressed in the whitepaper with this specific example used. The Zero Carbon Commitment by 2040 is a net-zero carbon commitment where closing down another building as a means for achieving the net-zero carbon commitment would be acceptable. See as well our subcommittee response to Response D which is just a few lines above. We have also included the term "greenhouse gas net emissions" in the titles of both questions 6 and 7. Whether this provides greater or lesser clarity to lay readers may be disputed.

#8 is puzzling. What are you trying to find out? If $90M would reduce carbon emissions equally in upgrades or new construction, does it matter what preference is expressed? If $90M would go further in upgrades vs. new construction, shouldn't the university pick whatever approach yields the largest reduction in the carbon footprint, regardless of expressed preferences? Also, in my limited experience with this, bond funding is generally issued with specific projects in mind. An unrestricted bond for reducing emissions doesn't seem likely. I would suggest omitting this question.

Subcommittee Response: Question 8 has been replaced by Questions (gg) and (hh) as noted above. We believe these may address your expressed concerns.

#16 categories seem odd. Maybe consider:
__ full-time faculty member
__ part-time faculty member
__ staff in a primarily research setting
__ staff in a departmental or similar setting

__ research unit head (e.g., organized research unit)
__ unit head (e.g., department or school) or associate/assistant dean
__ upper-level administrator (i.e., dean or above)

Subcommittee Response: Changes made

I will be interested to see the results. Thanks again.

Note: Several additional administrator respondents indicated that their comments will be forthcoming.

**D. Comments and Suggested Edits from a Discussion with UMaine Campus Energy Team**

UMaine Energy Team Responses to Faculty Senate Carbon Commitment Subcommittee Email Dated: 2/28/2022

Question 1. Under the current steam plant heating infrastructure, how many tons of greenhouse gas and particulate matter are released into the campus atmosphere on average at the burner tip each year? If burning "waste" woody biomass instead, how many tons of greenhouse gases and particulate matter are predicted to be released into the campus atmosphere at the burner tip each year? (i.e. ignore the net zero carbon computations for new forest growth over future decades).

Energy Team Response:

a. 2019 steam plant fossil GHG “stack” emissions were 33,000 MT CO2e
b. 70,000 MT CO2e of non-fossil GHG stack emissions would be produced from the use of renewable residual woody biomass at a UMaine steam plant

Subcommittee Follow Up:
Thus, there will be over twice as much CO2e emitted over each year at the steam plant and the release of these greenhouse gases will be emitted on campus rather than spread over Maine’s forestlands where some of the carbon would have otherwise have returned to the soil.

c. UMaine is not planning to clear-cut our valuable state working forest, we intend to use only residual biomass, produced as a by-product of existing forest harvesting and management operations, to offset the majority of our scope 1 fossil GHG emissions.

Subcommittee Follow Up:
Acknowledged. However, you don’t respond to the particulate issue. With particulate controls deployed, how many tons would be released each year? One should know and consider the adverse ramifications of a proposed solution with open eyes. To state that financial analysis will determine the amount of particulate matter to be removed is insufficient. What standard will be met? Will this be a modern standard suitable for application within a few hundred feet of campus dormitories and academic buildings?

Question 2. The EPA does not currently classify the burning of woody biomass for heating as a renewable energy source. What are the short term and long-term risks from your perspective if the U.S. government never recognizes it as a renewable energy option for heating?

Energy Team Response:

a. The EPA does classify certain types of woody biomass as renewable (see highlighted sections in attachments: epa_usda_doe_response_to_congress_re_forest_biomass_11-1-18_1 and EPA_biomass_policy_statement_2018_04_23), for example:

> "[Congress seeks to:] establish clear and simple policies for the use of forest biomass as an energy solution, including policies that— reflect the carbon-neutrality of forest bioenergy and recognize biomass as a renewable energy source, provided the use of forest biomass for energy production does not cause conversion of forests to non-forest use"

Subcommittee Follow Up:

This is a misleading response. You reference a 2018 report from EPA. It is quite clear from this document that regulatory uncertainty exists, the uncertainty makes planning future investments riskier than if greater clarity was provided, this "statement of agency policy does not represent a final agency action", and "(a)ny changes to the current treatment of biogenic CO2 emissions at a specific entity or in a specific regulatory program or other context will be accomplished through the appropriate mechanisms" such as through legislation or appropriate agency rule making. None of that has happened to date. Current EPA regulations do NOT include the burning of biomass for heat alone at a stationary site as renewable energy and the reference cited does not make clear whether this situation would change with the policy being advocated. That would be determined through the political process. The Climate Change political environment has become far more pressing since 2018 with reports emanating from the IPCC indicating that that warming is happening much faster than previously predicted. Do you have evidence that the Biden administration would continue to support the EPA intended direction from 2018 and/or that it would explicitly support as renewable the heat combustion solution as being advocated on the UMaine campus? The report does point out that acceptable accounting approaches for assessing renewability in the burning of biomass will be critical in informing the political process.

b. Although these federal positions on the carbon neutrality of forest biomass were coined during the previous administration, to date, there has not been any significant effort by the current administration to reverse the existing federal stance on this issue. Additionally, as a forward-thinking and modern institution of higher education, it behooves the university to do the right thing based upon facts and data, irrespective of federal stances on specific issues.

Subcommittee Follow Up:

The federal stance you cite is a stated preferred direction by the EPA Director at the time and not law or regulation. Yet, the US Environmental Protection Agency (EPA) Revised Renewable Fuel Standard (RFS2) does not currently include a pathway for the combustion of woody biomass for use as a heating fuel. You are assuming that the current law or regulations will be changed in regard to the burning of biomass as a heating fuel at stationary sites. That is not at all clear and won't be until such time as federal rulemaking, Executive Orders, or Congressional action provide that clarity. This is not likely to occur for several years and may very well be decided in favor of greater protection for the environment as opposed to lesser protection for the environment. If so, this is a significant risk for the university. Ignoring the risks of current and likely future

federal laws and regulations defining renewability seems inappropriate. As a forward-thinking and modern institution of higher education, it might behoove the university to do the right thing by following the lead of the vast majority of state and federal incentive programs as well as the lead of industry in converting as quickly as possible to reliance on non-combustion near-zero carbon emission energy sources. This may involve an interim step of heavy dependence on biofuels for a period of years (i.e., similar to the use of ethanol prior to conversion to the use of non-combustion electric engines for transportation) but the long-term goal should remain to embrace non-combustion near-zero carbon emission energy sources to the greatest extent possible as soon as possible.

Yes, the value of the TRECS that could be generated from the burning of biomass for heating would be of high value in some existing markets. This does not negate the risk that other future national level opportunities might be limited by pursuing a combustion-based biofuels approach.

Some universities are major purchasers or RECs in attempts to attain their zero carbon emission goals (e.g., the University of Pennsylvania in Philadelphia). Selling UMaine RECs to another entity however means that we could not claim then that we are using renewable energy since we have separated off and sold the renewable attribute. Further, trading higher valued TRECs for lower-valued carbon offsets does not speak well for the university. This smells and feels like spurious accounting.

c. UMaine is not planning to clear-cut our valuable state working forest, we intend to use only residual biomass, produced as a by-product of existing forest harvesting and management operations, to offset the majority of our scope 1 fossil GHG emissions.

Subcommittee Follow Up:
Acknowledged. However, the devil is in the details as evidenced from other "renewable" wood combustion energy operations that have become controversial to the point of becoming negatively newsworthy. See the references in the whitepaper. There appears to be no campus plan in place to specify legally enforceable contractual details to bind residual biomass suppliers to ensure appropriate accounting for renewability. The administration provides little evidence to date of campus interest in exploring or detailing such provisions.

d. The existing residual biomass we intend to use is already being burned or left to decompose. Surely, common sense dictates that using it to eliminate fossil fuel emissions is a beneficial use.

Subcommittee Follow Up:
Not all the biomass delivered to campus would have been burned on site in the forest. If residual biomass decomposes on the forest floor some goes into the atmosphere and some is retained in the soil. Emissions into the atmosphere take years as compared to going up in smoke very quickly after cutting on campus. It should not be taken on faith that sequestering of carbon from the atmosphere through new Maine forest growth will occur at a 1:1 ratio. We would like to see the computations, the assumptions made in support of the computations, and how those assumptions may be enforced over time. Common sense dictates that such challenges should be addressed up front prior to moving forward.

e. Furthermore, the State of Maine encourages renewable biomass for heating (please see attached doc: Renewable Biomass for UMaine Heating for a discussion around Maine TREC incentives)

Subcommittee Follow Up:
If UMaine desires to pursue a biomass combustion solution as the primary fuel for elimination of the use of fossil fuels on campus, whether for an initial period of years or potentially multiple decades, it should do so in a stellar fashion if the desire is to build a sustainability reputation. It should use the highest standards established such as using residual waste from only lands certified by the Forest Stewardship Council (FSC) (i.e., lands certified by the Sustainable Forestry Initiative (SFI) allow clear cuts of up to 120 acres), rigorous renewability accounting procedures and audits that among other items account for all offsite and onsite transportation and processing costs of the biomass fuel, require and enforce stiff penalties for source material lands not kept in sustainable forestry after residual from them has been used by the university as biofuel, require stiff penalties for cutting of full tree swaths of forest to meet the university's combustion demand rather than using residual waste product from forestry cut for other societal purposes, ensure the highest standards for pollution controls in the combustion process, and similar implementation and contractual obligations. The campus's sustainability reputation could and should be a highly valuable asset in the future for attracting students and research and development funds. If it deploys a biomass combustion installation it should be a very best practices solution that can be pointed to as a positive exemplar. The campus should not open itself to critique for questionable sustainability claims in regard to its practices. Meeting State of Maine requirements is of course required but not qualifying for federal standards for renewability in its heating plant implementation is not without its long-term risks.

Question 3. If the current campus steam plant produces 500 billion BTUs each year to create and circulate heat to about 90% of campus buildings, what number of BTUs would need to be generated to supply ground source geothermal heating of water at much lower temperatures and presumably with much less distribution heat loss?

Energy Team Response:

a. We assume that the same number of BTUs would be required at the buildings

Subcommittee Follow Up:
This does not come across as a rational response. A centralized heating plant currently needs to raise the temperature of water to well beyond boiling to create and circulate steam. Using heat pumps means that the temperature of circulating water has already been raised (or lowered if cooling) by pumping it through pipes in the subsurface using electric power (also known as geothermal heating) and then raising the temperature to only that needed in the buildings served. Physics suggests that a much lower temperature for heating should require far fewer BTUs.

Additionally, if the source of heat for steam is by fossil fuel or biofuel, it makes some sense to accomplish the combustion at a single point (i.e., the steam plant) in order to closely control fuel combustion and meet pollution control standards.

The steam is then circulated through many miles of steam pipes on campus. However, geothermal heat is available underground everywhere on campus. It probably makes little sense to interconnect and pump water all over campus when the heat source is already distributed across the entirety of campus. Using a steam solution, there is a high differential between the temperature of the steam and the temperature of the surrounding ground resulting in substantial energy losses through transport. Geothermal on the other hand is directly using the surrounding underground earth temperature as its heat source. It uses the earth like a battery that has stored heat and thus is gaining BTUs from it rather than losing heat to the surrounding earth. (It uses the opposite process when cooling buildings.)

Under modern heating practices, one would never choose to heat a new home or major building with steam heat. The only reason the university is pursuing the approach is because of current sunk costs in a steam line network. American auto makers Ford and GM are making record breaking investments in non-combustion solutions for transportation. The campus would be wise to seriously consider the same for heating.

For readers of this comment that are unfamiliar with the concepts of heat pumps and geothermal heating, we offer the following brief description:

Heat Pumps and Geothermal Heating:

Heat pumps are devices powered by electricity that gather heat energy from one place and transfer it to another. Although variations exist, a ground source electric driven heat pump mechanically circulates thermally conductive liquid solution (e.g., water) through underground horizontal or vertical pipe loops. After absorbing the ground's thermal energy, the solution goes back into the heat pump and exchanges its heat energy with liquid refrigerant inside the heat pump. That refrigerant is then turned into a vapor and compressed. The act of compressing the vapor increases its temperature. This allows even outside air-based heat pumps to work in very cold weather. Once the vapor is hot enough, it enters a heat exchanger which transfers the heat, typically to the air. That warm air is then circulated throughout a building using standard air ductwork. Distribution of the heat through low temperature hot water circulating throughout a building using radiators is also a possibility.

After a certain point, the weather may become too cold for too long in very cold climates such that there aren't enough BTUs in the ground's thermal energy to raise the temperature to the desired level in a building. Thus, resort to heating through a back-up system may be required but a range of alternatives are available to supplement the geothermal heat. In particular, clean energy geothermal for core heating of campus buildings supplemented by clean energy electric water heating during peak demands warrants much closer investigation.

Thanks to a reversing valve, heat pumps are able to change the flow of refrigerant and thus also cool the building. Geothermal systems provide a proven technology that is widely considered the most energy efficient heating and air conditioning system available. These ultra efficient heating and air conditioning systems save energy and reduce carbon

emissions as well as increase comfort. They may be driven in entirety by solar, wind, and other non-combustion near-zero carbon emission energy sources.

In the event of power disruption from the power network, home heat pump installations might typically use an onsite generator as an electricity backup. In the case of an interruption to the clean electric power network, the campus might consider the use of biofuel turbines deployed at the current steam plant location to provide electrical backup. The steam plant is already using fossil fuels to co-generate a small percentage of the electric energy currently consumed on campus.

b. A low-temperature hot water loop would lose less energy than a steam loop. However, the energy saved would not provide anywhere near enough savings to offset the costs of converting the campus to low-temperature hot water use

Subcommittee Follow Up: Please provide the numbers and the assumptions made. At the very least, we think that all new buildings and major construction projects should utilize non-combustion near-zero carbon emission approaches for both heating and electricity. Further, regardless of whether the university pursues primarily a biofuels heating solution with currently available funding, its highest future priority in pursuing bond money or other substantial funding from the state and/or federal governments should be to pursue funding for electrification conversion of a selected group of existing university buildings to allow their use of wind, solar, hydro, or other non-combustion near-zero energy sources to supply both their heat and electricity. That is, this would be a demonstration Phase One project as a first step in wide spread electrification of the campus.

Question 4. Have detailed costs for building-by-building conversion to ground-source geothermal powered by solar, wind, and other near zero energy sources been calculated?
(No. However, our consultants ruled out the possibility of campus-wide conversion to low-temp hot water early in the UMEC process)

Subcommittee Follow Up:
Local building codes in numerous jurisdictions across the nation are mandating the use of air or ground-based heat pump systems for new construction. Numerous government incentive programs across the nation exist to encourage their deployment in existing structures. Because the rest of the country is converting to electrification for heating driven by non-combustion near-zero carbon emission energy, we believe it was a mistake to summarily dismissed this approach. Much greater exploration of alternative means for deploying this proven technology needs to be pursued for the campus. As such, whether or not biomass combustion is used as a primary means for near-term elimination of fossil fuel use on the campus, we believe this further exploration might be best accomplished through the design processes for all new buildings and through a major proposal to fund a Phase One demonstration project in converting a group of existing buildings. These experiences might then be expanded to wide spread electrification of the campus through later phases as societal and legislative changes occur.

If so, how many buildings on campus and which ones could be converted at the equivalent cost to that planned to be expended on a steam plant upgrade?

(If we assume that the average cost to convert a large building to low-temp hot water is $1,000,000 – then we could afford to convert 100 buildings with $100,000,000)

What would be the cost to minimally maintain the steam plant during a long-term transition?

(The steam plant is past its useful life and must be replaced asap – it is also cheaper to build a new steam plant than to renovate the old one)

Subcommittee Follow Up:

The response that the steam plant is past its useful life is not responsive. We know that the American Society of Civil Engineers claims that thousands of bridges in the U.S. are well beyond their design lives yet they are not all being replaced at once. Many have undergone replacement of concrete and steel members until such time as major funding is available to schedule their replacement. We assume that the steam plant is not under eminent failure and collapse status. If this is not true, we would like to see the emergency report. By decentralizing heating through distributed reliable heat pump systems the threat of campus-wide catastrophic failure might be significantly decreased in future years. As noted in the whitepaper, a redesigned steam plant should continue as a co-generation facility in order to qualify under recently proposed federal regulations as a renewable energy facility and should substantially increase its electric power generation fueled by biomass or gas/liquid biofuels. That power production would then act as a backup in times of power outages and could supplement cold weather heating during extended extreme cold weather periods.

Question 5. If taking the position that burning wood biomass and/or other biofuels is the best option for the campus to pursue, how will you ensure through contract, technological controls, auditing, standards adherence, and other methods that burning fuels for heating on the campus in practice will not be open to the same critiques of similar operations in the U.S. and elsewhere across the globe? What are the conditions you propose to enforce and how?

Energy Team Response:

We are not proposing to burn wood pellets - please see attached doc: Renewable Biomass for UMaine Heating

Subcommittee Follow Up: It is not clear what kind of wood waste processing that is intended to be used under the currently planned biomass combustion approach. By reference to transfer of “green tons of biomass fuel” in the attached document we are assuming that the wood waste will be burned in the form as lifted from the forest floor. The pollution concerns are far greater for this form of material that has high variation in moisture content than would be the case for wood pellets. Regardless, the types of contract controls, technological controls, auditing, and standards adherence which have been raised in other wood burning energy operations have already been addressed by us under item Question 2(e) above.

Question 6. If woody biomass fuel use in the steam plant is advocated as meeting renewable energy needs, how will new construction and remodeling of buildings be incentivized or required in order to ensure use of heating infrastructure powered by solar, wind, or other non-combustion near-zero carbon emission energy sources?

Energy Team Response:

By request of President Ferrini-Mundy, all new building construction will be designed to minimize carbon footprint. This may be accomplished by using low temperature hot water for space heating and domestic hot water where feasible, and by applying net-zero carbon construction methods.

Subcommittee Follow Up: Use of the term “where feasible” in your response indicates that the answer is no. That is, no mandate is intended to be imposed. If it is cheaper to pursue water heating with heat exchange from steam generated from the steam plant, there will be little to no incentive for those designing new structures to raise the funds to deploy ground or air source heat pumps that would allow them to immediately transition entirely to solar, wind, or other non-combustion near-zero carbon emission energy sources to meet their core energy needs.

Question 7. Has the issue of prioritizing long-term funding in support of near zero carbon emission energy sources for the campus over other needs been seriously advocated?

Energy Team Response:

a. We already have committed to a 20-year NEB Credit program that incentivizes off-campus renewable electricity generation

b. The UMEC project is 100% focused on building a renewable energy facility for the majority of UMaine’s heating needs

Subcommittee Follow Up: We acknowledge and strongly support the twenty-year commitment to the NEB Credit program supplying off-campus solar and other non-combustion renewable electricity generation to support a portion of the campus electrical needs. We have already raised the issue that the current campus biomass combustion plans as we understand them to date would not meet the current federal requirements for renewability. As noted, this raises some risks under potential federal carbon trade and carbon tax programs that may take effect in coming years as well as potential non-qualification for some federal funding programs. In order to take a first step in prioritizing long-term funding in support of near zero carbon emission energy sources, see our response to Question 3 (b).