

USU GREENHOUSE GAS REDUCTION COMMITTEE

FINAL REPORT



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January 20, 2020

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Cover image: This composite image was generated from two photos shot from the same location on Jan. 7, 2011 (right), a day that Logan had the worst air in the nation, and Jan. 20, 2011 (left). (Eli Lucero/Herald Journal). Reproduced with permission.

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INTRODUCTION

The Greenhouse Gas Reduction Committee was formed to help the University realign operations and activities in order to begin making substantial progress on the 2007 commitment to be carbon neutral by 2050. The desire for a redoubling of efforts to reduce the University's greenhouse gas emissions was articulated in USU Faculty Senate Resolution 2019-01 and USU Student Association Executive Council Resolution ECR 2019-08. These resolutions called for reducing the University's greenhouse gas emissions as much as possible, as quickly as possible, with the minimum acceptable reductions being 10% per year for the next 20 years. For decades, academia has been a leader in advancing our understanding of the causes of climate change and the implications it will have for ecosystems, economies, and vulnerable populations around the world. As the scope and urgency of this problem have increased considerably in recent years, now is a critical time for academic institutions to implement climate-wise decision-making practices and reduce emissions from our activities and facilities. The key performance indicator to evaluate USU's progress on this initiative is the University's total annual greenhouse gas emissions from Logan and Statewide campuses. USU has been measuring this indicator since 2008 and ultimately this indicator most directly represents our impact on the regional and global climate.

The Greenhouse Gas Reduction Committee is comprised of a five-member steering committee and three work groups, focused on USU's energy portfolio, carbon pricing, and education, respectively. To achieve the goal of developing a comprehensive plan to reduce USU's greenhouse gas emissions, the committee:

- Assessed options to increase the percentage of electricity coming from renewable sources and, as soon as feasible, eliminate the need to purchase electricity derived from coal-burning power plants.
- Evaluated and prioritized over 175 potential projects that improve energy efficiency and reduce energy demand.
- Evaluated USU's policies and protocols to track emissions, including on-campus transportation, university-sponsored travel, construction of new buildings and operation of USU facilities.
- Investigated best practices and developed recommendations for pricing carbon pollution in order to assess tradeoffs regarding campus activities and development plans.
- Developed a plan to assist faculty members in communicating the scope, urgency, and challenges of the climate crisis in their courses, research activities, and Extension programs and to reduce carbon emissions in their activities.
- Participated in discussions that the University is conducting with external entities to explore mutually beneficial partnerships that facilitate greenhouse gas reduction activities.

If implemented in earnest, the recommendations in this report should enable USU to meet or exceed the 10% per year reduction in greenhouse gas emissions requested in Faculty Senate resolution 2019-01. There are many unknowns regarding future energy policy, changes in technology, etc., but the need for immediate action is evident. While it is not possible to conduct a detailed accounting of all costs involved, it is expected that taken together these recommendations are budget neutral over a 10-year planning period and will likely result in considerable cost savings to the University over the long term. Nevertheless, additional financial resources from donations could further accelerate energy and carbon reduction efforts and fund projects that offer additional benefits to the campus community.

The committee has actively solicited suggestions and feedback from USU faculty, staff and administrators in order to assess the level of awareness regarding the climate crisis, engage members of our campus community in identifying solutions, and ensure that the recommendations of the committee are broadly supported. A draft version of this report was released to the campus community on December 9, 2019. We received feedback from 1149 members of the campus community and we have revised the report accordingly. Feedback on the report was strongly positive, with 65% agreeing or strongly agreeing that the overall quality of the report was high, as compared to 9% disagreeing or strongly disagreeing that the overall quality of the report was high. The

percentage of respondents agreeing with the recommendations of the energy portfolio, carbon pricing and education sections of the report were similarly skewed to agree/strongly agree. A summary of the feedback received, including responses to comments made by the campus community, is available at the end of the report.

KEY RECOMMENDATIONS

1. Employ best practices to ensure that we have a robust and consistent process for estimating USU's total greenhouse gas emissions. Total greenhouse gas emissions from Logan and Statewide campuses should serve as the key performance indicator to evaluate USU's progress on this initiative.
2. Work with Rocky Mountain Power to purchase a renewable energy portfolio. Continue to engage Logan Light and Power and Price Public Utilities to develop similar opportunities to purchase renewable and carbon-free energy portfolios.
3. Accelerate conversion of lighting on Logan campus to energy- and cost-saving LED lights, to be completed within the next two years.
4. Increase investment in best available energy management technology and energy-saving HVAC commissioning projects for the next ten years.
5. Continue to investigate opportunities to increase solar and wind energy on or near campus, beyond those provided in the renewable energy portfolios that we seek to purchase from public utilities.
6. Improve fuel efficiency of fleet vehicles and conduct a pilot study of integrating electric vehicles into our fleet.
7. Implement a non-binding 'shadow' price on carbon emissions for all major University expenditures.
8. Establish a mandatory carbon offset fee of \$10 per round-trip for all University-sponsored air travel paid by the department, college or index funding the trip. Use funds raised by that fee to pay for projects with the highest return on investment for reducing USU's greenhouse gas emissions and/or improving air quality on and near USU campuses.
9. Develop a fundraising campaign focused on advancing USU's efforts towards sustainability and carbon neutrality.
10. Expand and institutionalize USU's Planetary Thinking in the Curriculum Workshops with a focus on general education courses to ensure that all students graduate with an understanding of the causes, implications, and solutions to climate change.
11. Expand adoption of climate and sustainability-related learning outcomes and assess students' attitudes and understanding of relevant content.

GENERAL CONSIDERATIONS

This report represents nine months of collaborative work by dedicated faculty, staff and students who have come together from disparate parts of campus to ensure that USU has an innovative, comprehensive and practical plan to aggressively reduce greenhouse gas emissions. The report focuses on steps that the University can take to reduce emissions, though in reality every member of the University community has a unique role to play in achieving our broader goals of carbon neutrality and sustainability. We have written the report with a diverse

audience of faculty, staff and students in mind. We hope that all readers can glean useful information from the overall introduction, key recommendations and general context provided in the energy portfolio, carbon pricing and education sub-sections. We provide a high level of technical detail in many of the energy portfolio recommendations, perhaps more than most readers will care to know, but we felt this level of detail is essential for readers interested in understanding the vast number of options the committee has considered, trade-offs among them, and ultimately the complexity of what is being undertaken.

Implementation of the recommendations included in this report will have many positive outcomes for faculty, staff and students. Beyond the overt goal of ensuring that USU does its part to eliminate its contributions to human-caused climate change, developing and implementing an innovative and cost-effective plan of this scale provides myriad education, research and creative opportunities and will have innumerable, untold positive outcomes in terms of USU's reputation, recruiting, enrollment, retention, alumni development, and fundraising. Increased awareness of the threats posed by climate change is one of many factors exacerbating mental health issues, so USU's leadership on this issue may help relieve some of those anxieties locally. And our success on these initiatives will put USU in a better position to be leaders in improving air quality throughout the state.

Nothing in this report inhibits continued growth in faculty, staff or student populations or facilities at USU. Yet, we caution that future growth must be accommodated within USU's commitment to achieve carbon neutrality as quickly as possible. The physics of climate change is simple: the more carbon we put in the atmosphere, the more heat it traps. And the laws of physics do not change according to well-meaning intentions. The physics of the atmosphere will simply respond to the total emissions that we produce. Achieving net zero emissions is an unavoidable imperative. And time is running very short for humanity to begin making progress toward that goal. We believe the recommendations herein establish a new paradigm that will begin USU down a new path toward sustainability and ensure that Utah's public land-grant institution leads the way on this most important issue.

ANNUAL ACCOUNTING OF USU'S GREENHOUSE GAS EMISSIONS

The Environmental Protection Agency under the Clean Air Act requires all large institutions to track their emissions of priority pollutants, including sulfur dioxide, nitrogen oxides, carbon monoxide, particulates and hazardous organic pollutants. Due to the size and levels of air pollution generated at USU, these priority pollutants must be accurately accounted for from every stationary source on the Logan main campus. When USU signed the American College & University Presidents' Climate Commitment in 2007, we committed a much more robust tracking of our greenhouse gas emissions, including all stationary and mobile sources from all facilities owned and operated by USU as well as university-sponsored activities, both on and off campus. Because greenhouse gas emissions arise from every department, every college and every function at USU, raw data required to complete the mass balance equations must be derived from a large variety of sources.

Over the past 12 years the Environmental Health and Safety (EH&S) Office under the Vice President for Research has prepared the carbon inventory for the USU campus. Logan Campus stationary sources account for about 50% of USU's carbon footprint (25% Central Heating Plant, 25% satellite boilers and emergency generators). The other 50% of USU's footprint comes from hundreds of small sources that include, but are not limited to:

1. The vehicle fleet at motor pool
2. Tractors in the College of Agriculture and Applied Sciences
3. Natural gas combustion measured at several hundred meters statewide
 - a. Owned by USU
 - b. Rented by USU
4. Electricity measured at over 300 meters statewide
5. USU's aviation program that runs over 30 airplanes and helicopters everyday
6. Research projects scattered around the world that require
 - a. Airfare

- b. Rental vehicles
- c. On-site equipment
- 7. University sponsored travel for
 - a. Research
 - b. Athletics teams
 - c. Student recruitment
 - d. Professional development
 - e. Conferences, meetings, presentations and seminars

Every year the sources of carbon emissions change, the people responsible for the sources change, and many of those responsible for reporting the sources change. Some sources are occasionally left out of the calculation and each year new sources are added. Tracking the small subset of on-campus stationary sources, as required by USEPA, requires only small part of one person's fulltime responsibilities within the EH&S Office. Calculating a complete carbon budget for the entire USU system, with its many diverse and dynamic sources, requires a much larger, coordinated effort.

The key performance indicator to measure USU's progress towards carbon neutrality is the total greenhouse gas emissions from the entire USU system. Thus, the process to calculate that number must be robust, consistent and as comprehensive as possible, while remaining feasible with a reasonable level of effort. Toward that end, we offer the following recommendations:

1. Identify a single staff member as having responsibility for calculating USU's annual greenhouse gas emissions, obligations should be clearly defined in their job description, and they may require some support staff.
2. Develop clear guidance for the many individuals distributed throughout USU who need to provide annual input data to the staff member responsible for calculating USU's total greenhouse gas emissions.
3. Streamline processes for reporting (e.g., automated forms for reporting should be sent out to cognizant staff members at regular times each year).
4. Automated processes should be developed to facilitate the calculations (e.g., flight data should be provided from ServiceNow in a usable format and automated scripts should be developed to calculate related emissions. Historically air travel data reporting has been incomplete and contained numerous errors and air travel emissions have been calculated using a laborious, manual process).
5. Include in the budget carbon emissions associated with food purchased through Dining Services starting in FY21.
6. Formal reassessment of the sources being considered should be conducted every three years.
7. Raw data and calculations should be made available for review by faculty, staff or administrators upon request.

USU ENERGY PORTFOLIO WORK GROUP

The Energy Portfolio Work Group has a) substantially overhauled USU's energy management plan, b) developed a prioritized list of energy efficiency projects, c) investigated options for increasing carbon-free and renewable energy, and d) participated in discussions with external groups to identify opportunities for mutually beneficial carbon-emission reduction efforts. To evaluate options, we developed a model that accounts for the costs of implementing the various strategies, carbon emissions reductions associated with each strategy, and, where applicable, cost savings. Some options are mutually exclusive, some incur one-time costs while others incur ongoing costs, many pay for themselves within the project lifespan, and the options each differ in their feasibility, impact and uncertainties. Our assessment of some options is subject to numerous unknowns, assumptions, and estimates, but this report summarizes our understanding at this time. Nevertheless, we have researched all opportunities to the extent possible and present them as a tiered menu of options that begin to enable the University to achieve its goal of carbon neutrality. Tier 1 options are being actively pursued. Tier 2 options will continue to be considered, but require additional information or will be pursued if some Tier 1 options are determined not to be viable.

While we are encouraged by our estimates of the progress that can be attained over the next five to ten years, it should be emphasized that there are no easy solutions for achieving the goal. Continued progress toward changes in personal attitudes, behaviors and public policy, as well as advances in technology and energy markets are required to reach the goal of climate neutrality.

TIER 1 OPTIONS

Energy Supply Options

1. Purchase renewable energy portfolios from Rocky Mountain Power

Rocky Mountain Power (RMP) offers two renewable energy portfolios, referred to as Rate 34 and Rate 32, which some large energy users have been able to utilize at a small to negligible cost premium. RMP provides electricity to most USU campuses, with the exceptions being Logan and Price campuses. RMP Rate 34 is only available to Rocky Mountain Power customers who exceed 5 MW of aggregated power demand on an annual basis. This high threshold severely restricts the number of RMP customers who may participate in this rate offer. Rate 34 enables eligible RMP customers to procure nearly all of their energy from renewable sources at market price, less RMP's avoided energy cost. Notably, the market price for renewables has been declining rapidly in recent years. RMP recently released a public statement indicating that they plan to develop an additional 7,000 MW of renewable energy by 2025. **By opting into Rate 34, USU may be able to reduce its total carbon footprint by over 12,000 metric tons of CO₂, or 11.8% (relative to 2017 baseline year), at an estimated cost of around \$83,000 per year.** This is the single largest and most cost-efficient potential CO₂ reduction strategy from all model options at the time of this report, at a low cost of about \$6.71 per metric ton of avoided CO₂ emissions (MTCO₂). At current estimates, this option represents an 8.2% increase per kWh for statewide campuses, but provides a large reduction with minimal effort and low risk.

USU has only recently been declared eligible to receive power from RMP under Rate 34. USU is also eligible for an alternate renewables option, RMP Rate 32, described in more detail below. While RMP Rate 32 can provide for delivery of renewable energy to USU, it is a much more complex rate structure that would also not allow USU to achieve 100% renewables on its RMP supply, as could

Rate 34. To remain economical, Rate 32 supplies may be limited to about 50% carbon reduction on total RMP power purchased. While Rate 32 might actually reduce power costs from RMP, some current RMP customers have experienced little or no cost increase under the 100% renewable Rate 34.

USU is planning to issue a Requests for Proposals (RFPs) and to solicit consulting services as needed to fully evaluate RMP Rates 34 and 32 within the next few months. Currently, the model predicts that Rate 34 has the better overall impact on carbon reduction and cost when compared to Rate 32 (11.8% versus 2 to 8%, and \$6.71/MTCO₂ versus \$17.38-\$68.91/MTCO₂ respectively). As such, Rate 32 is considered a “fallback” project in the current CO₂ model (additional details provided below). These rates are mutually exclusive, so if USU enters into contract with RMP under Rate 34, USU would not elect to pursue Rate 32, and vice versa.

In our CO₂ model, a Rate 34 option is evaluated assuming 100% of our total 2018 RMP energy procurement in kWh at an incremental cost increase of \$0.0045 per kWh. This incremental cost increase is on the high end of examples provided to USU. Some customers currently utilizing Rate 34 report not having experienced any cost increase relative to the conventional RMP energy portfolio. USU results might differ significantly. If USU secures a Rate 34 or Rate 32 contract with RMP, it would be ineffective to pursue solar or other renewable energy projects on those Statewide campuses served by RMP. Thus, these options will only be considered for those campuses if it is determined that Rate 34 or Rate 32 are not feasible. However, due to the uncertainty regarding outcomes of ongoing discussions with RMP and the RFP initiative to evaluate Rate 34 participation, it was recently decided that USU will continue to pursue solar options for the new facility to be constructed at the Moab campus. Proposed Moab solar arrays would provide 100% of the facility’s power requirements and could be eligible for an RMP Blue Sky grant. It was determined that the University did not want to lose out on a grant opportunity, given that it is still unsure of the timeframe for locating a viable Rate 34 option. Removing Moab power demand is not expected to result in USU falling below the 5 MW threshold required to participate in Rate 34 on a statewide level. If USU ultimately acquires power under Rate 34 prior to building the Moab facility, the university should have an option for either purchasing power at Moab under the green tariff, or continuing to pursue onsite solar. Although, should USU begin purchasing power under Rate 34 statewide through RMP, this could affect our grant eligibility in the RMP Blue Sky program.

2. UAMPS and Logan Light & Power Renewable and Carbon Reduction Goals

Logan Light & Power (LL&P) is the exclusive provider of purchased electricity on the USU Logan City campus, providing about 51% of the campus’ power consumption each year. LL&P is a member of Utah Associated Municipal Power Systems (UAMPS), which sells and delivers power to the LL&P system. UAMPS and LL&P have each developed initiatives to reduce carbon emissions of their power supply inventory. Small modular nuclear reactors and renewable projects such as solar, wind, thermal and hydro have all been considered by UAMPS and LL&P at different times. LL&P has established its own renewable portfolio goal of 50% by the year 2030. The evaluation of this initiative in the model attempts to account for carbon reduction in the overall USU supply of power from LL&P due to their changes in supply inventory over time. As we are not anticipating a 100% renewable option from LL&P that would be similar to RMP rate 34 at the time of this narrative, reduction in carbon from LL&P inventory changes is not considered mutually exclusive to other LL&P supply options being considered. As USU is not in a position to require an inventory change by the supplier, there is no annual cost related to this option in our model. Nevertheless, USU has expressed interest in a renewable portfolio, should one be offered by these suppliers and will continue to engage these external partners toward that goal.

A CO₂ reduction option not presently shown in the model would be a renewables subscriber program provided to USU by LL&P that is similar to Rocky Mountain Power Rate 34. LL&P does not offer a renewable option like Rate 34 at this time. **Recently, LL&P has accepted an offer by USU to pay for a non-binding rate design study that would evaluate the viability of a subscriber renewable rate that LL&P could offer to USU.** USU has offered to pay for the study because we are the only LL&P customer in our exclusive rate class. USU has also proposed that the rate study, if initiated, could also evaluate a new rate design or a PPA for NuScale (described below under Tier 2 options) power allocations, should USU elect to participate in that power supply initiative. The goal of the rate design study is to explore how multiple renewable power options might be delivered to USU by LL&P at a reasonable cost to USU, and without negatively impacting LL&P. Likewise, USU has posed to LL&P that development of renewable subscriber programs for larger LL&P customers could help accelerate the LL&P goal of 50% renewables by 2030. Through two LL&P community advisory councils, it is also known that at least two other large LL&P customers are interested in renewable energy subscriber programs.

Priority Energy Saving Projects

Energy efficiency of existing and future buildings and campus equipment will be essential to achieving carbon neutrality. These projects not only reduce carbon emissions, but improve the campus environment, reduce energy costs, and reduce ongoing maintenance. Avoided energy costs may also fund future carbon reduction and energy efficiency projects. Of energy use in commercial buildings, HVAC equipment accounts for approximately 45% and lighting accounts for 20%.

Facilities has already planned to complete many of the projects listed below. However, as a result of the work of this committee additional emphasis and funding have been shifted to these projects, projects have been prioritized according to the magnitude and cost-effectiveness of their CO₂ emissions reductions, and the timelines for implementation have been significantly accelerated.

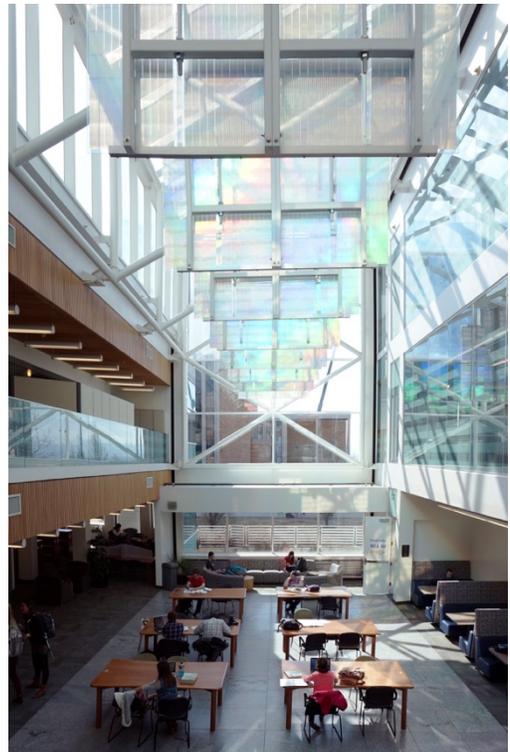
To develop the priority list for energy efficiency projects, facilities staff have calculated the cost, energy savings, and carbon reduction associated with upgrading lighting to Light Emitting Diode (LED) lamps and fixtures throughout Logan campus and much of USU-Eastern campus. Most Statewide campuses have already been converted to LED, with the exception of the Space Dynamics Lab, in North Logan. Further, we have calculated the cost, energy savings and carbon reduction of many other building and energy efficiency projects that could be completed. This information will be useful to guide investments that are likely to have the greatest impact in reducing our emissions, while also reducing overall energy use and utility costs.

3. Complete LED lighting retrofits for USU Logan campus in FY20 and FY21

Light emitting diode (LED) lighting reduces energy use by nearly two thirds while providing light output that is equivalent to conventional fluorescent and metal halide lighting. Recent enhancements of the Fine Arts building included HVAC and lighting improvements that reduced total annual energy usage by nearly 25% compared to the consumption prior to the building enhancements. Another example of the impact of energy efficiency projects is the LED lighting retrofit of the Merrill Library. The project has been completed in three phases over the past several years and is now substantially complete. We estimate this project will reduce USU's carbon emissions by 564 MTCO₂ per year, and based on the most recent electrical consumption data, it is on track to save approximately \$49,000 of electricity per year. During FY20 lighting upgrades and controls installation will occur in the Natural Resources, HPER, Vet Science, and Fine Arts Visual Buildings. Facilities Utilities group is partnering with Housing, USDA, and other auxiliaries to complete the following lighting projects: Snow Hall, USU Eastern Campus, Poisonous Plants Facility, Forage and Range, University Inn, and Housing parking lots.

Facilities had originally planned to convert the Logan campus to LED lighting over a 6 to 8 year timeline. **Considering the energy, cost and CO₂ reduction benefits of these projects, facilities has developed a plan to accelerate these conversions to be completed over the next two years.** The caveat in accelerating our conversion to LED lighting is the potential for many of these fixtures to expire and need to be replaced around the same time. But given the long expected-life span of these fixtures (8-10 years in common areas and classrooms and 20 years for offices and other areas only utilized during the typical work week) the committee feels that it is best to move forward with these conversions and to approach future lighting replacements as a capital cost as opposed to a maintenance cost. Given that there will likely be new and even better lighting technologies available when the LED lamps begin to fail, this change in planning strategy seems appropriate.

LED conversions to be completed in FY20 and FY21 are expected to result in 7,500 metric tons of avoided CO₂ emissions, equal to a 7.5% reduction relative to our 2017 baseline. The estimated cost is \$1,826,000, with a 5-year simple payback on avoided energy costs, and a Net Present Value (NPV) of \$1.2 million over 10 years. For energy projects, the Net Present Value (NPV) calculates in today's dollars, the total value of a project option when taking into consideration first cost, ongoing costs, and avoided cost savings over the project lifecycle. While most projects with positive NPVs are considered desirable, project NPVs can be used in some cases to prioritize multiple project options when funding is constrained. NPV evaluations are also referred to as lifecycle cost analyses. A discount rate of 5% is used in all NPV calculations in the CO₂ model. These costs are currently budgeted under utility and deferred maintenance funding within the existing facilities budget.



4. Invest \$500,000 per year in energy efficiency projects for the next ten years

Facilities staff have identified and prioritized numerous energy efficiency projects that can be completed over the next ten years. During FY20, facilities will install temperature and light controls capable of providing the most energy efficient control strategies. Control upgrades are planned for the Edith Bowen, Biomolecular, and Vet Science Buildings. **These energy efficiency projects are expected to result in 6500 metric tons of avoided CO₂ emissions, a 6.3% reduction relative to our 2017 baseline.** Total estimated cost for these projects is \$5,000,000, with 7.5-year average simple payback on avoided energy costs, and an NPV of \$1.5 million over 10 years. Costs for these projects are budgeted under utility funding within the existing facilities budget.

A concept paper has been submitted for a DOE funding opportunity to gather data and evaluate demand side management opportunities across campus coupled with renewable resources such as solar. The objective of the proposed research project is to align the campus time-of-day electrical usage more closely with available renewable resources, thus avoiding the need to rely on carbon-emitting resources to cover the daily peak energy demand. The concept paper has been categorized as "promising" from the DOE and a full proposal was requested. A full proposal has been submitted and award notification will occur in early 2020. Funding from this opportunity would help the

University reduce the amount of coal peaking power required and increase onsite renewable resources.

5. Continuous commissioning of building HVAC systems

As building HVAC equipment, controls, and operation are improved through recommissioning and other efforts, substantial energy and carbon reductions can be realized. The following buildings have recently been re-commissioned: North End Zone Training Facility, Hillyard ADVS Building, Wellness Center, and a portion of the Taggart Student Center. We hope to achieve annual savings of 295,000 kWh and 684 DTH equating to 684 metric tons of CO₂ from these recent efforts. A recent recommissioning project requiring little capital expenditure reduced energy usage by half in the Strength and Conditioning building, saving 397,195 kWh and nearly 1500 dth of gas equating to approximately 420 MTCO₂ reduction. Savings of this magnitude are not always the case, but this example illustrates the potential energy waste if a building is not operating properly. Re-commissioning of buildings typically provides energy reductions of 15% or more.

Commissioning efforts are prioritized based on energy usage and the number of 'hot' and 'cold' calls that come in to customer service. These hot and cold calls often indicate excessive energy usage due to improper operation of the system. This often can result in occupants bringing electrical heaters into their office or other measures are taken that can increase energy usage. **Proposed commissioning projects are expected to result in a total of 5,300 metric tons of avoided CO₂ emissions, a 5.1% reduction relative to our 2017 baseline.** Costs for these projects can be absorbed through Utilities operational budget.

Related to HVAC commissioning, USU is currently testing a laboratory air exchange system that could reduce our energy use considerably. USU operates and maintains approximately 800,000 square feet of laboratory space. Air exchange within these labs comprises a considerable amount of energy use. In order to reduce energy expenditures associated with laboratory air exchange, Zac Cook, Patrick Belmont and Alexi Lamm wrote a proposal and received a \$220,000 grant from the Edwards Mother Earth Foundation to implement an innovative demand-control ventilation system in laboratories. Implementation is underway on three separate systems at the College of Agriculture, BNR north wing, and the Life Science Buildings. This system monitors air quality to ensure a safe laboratory environment while reducing energy usage associated with conditioning ventilation air. If implemented throughout campus labs, this system has the potential of reducing USU building energy usage by 49,620,000 kBTU and reducing CO₂ emissions by 6300 metric tons annually (6% reduction from 2017 baseline year).

6. Transportation Initiatives

6.1 Electric fleet vehicles and improving fuel efficiency of USU fleet vehicles

Electric fleet vehicles appear to produce positive returns on fuel costs while having a nominal impact on CO₂ reduction at 0.15% of baseline. Unlike power procurement options, electric vehicles would have the added benefit of improving air quality in Cache Valley. There are operational and maintenance impacts yet to be considered between electric vehicles and gasoline combustion engines. Likewise, there remain range-of-travel constraints that might for a while, limit electric vehicle use for long distances in cold weather. As many fleet vehicles have limited uses within the local Cache Valley area, the Committee recommends that USU begin purchasing a few (3-5) electric vehicles so that lifecycle costs and operational issues can be determined. Further, we recommend that Transportation Services develop a plan to improve the fuel efficiency of our fleet as much as possible over the next five years.

6.2 Commuter Transportation Options

A 2016 Transportation Master Plan commissioned by USU highlighted numerous strategies that could improve safety and connectivity of campus, while reducing congestion and greenhouse gas emissions. The plan focused on controlling traffic and transit operations, but also included some greenhouse gas reduction strategies. The data and assumptions used to calculate the numbers provided in the report are not explained and it was not feasible to scrutinize or re-analyze information contained in the report within the scope of the committee's charge. Nevertheless, we included the information from the report in our CO₂ model, present options that will result in cost savings or have no net cost in Tier 1, and present options that currently have unfavorable cost/benefit ratios below under Tier 2.



1. Education and Awareness: Education and awareness initiatives could be highly impactful in reducing the personal emissions of USU employees, students and our local community and are thus discussed extensively below in the Education work group section. Specific initiatives could involve bolstering the online presence of USU sustainability efforts, providing relevant materials for new hires and students prior to arriving on campus, and education for campus users. We recommend that a few high-quality videos be produced that concisely summarize the scope and urgency of the climate crisis, implications for ecosystems, the economy, and social structures, and solutions at global and local scales. To our knowledge there are no significant barriers to faculty developing such videos, but additional resources from central administration may improve the quality of such videos and demonstrate more of an institutional commitment to the issue. Reviewing the videos could be compulsory for incoming faculty, staff and students, but at the very least the videos should be made easily accessible to the campus community on an ongoing basis. Education for campus users could also include an expanded version of Aggie Blue Bikes' "Let's Look Out for Each Other" campaign. All of these efforts contribute to creating a healthy campus culture of climate and energy awareness.
2. Increase Parking Fees: Commuting represents a considerable portion of our carbon footprint and is a dominant contributor to poor air quality conditions in the winter. This problem can only be addressed by a combination of actions that improve alternate transport options, incentivize carpooling, walking and biking, and enables telecommuting in situations where that is feasible, yet respects the needs of those who must drive to campus. USU's parking fees are among the lowest of all our peer institutions.

The 2016 Transportation Master Plan study estimated how commuters might respond to an increase in parking permit fees. The assumptions behind their calculation are unclear, but this option disincentivizes use of personal vehicles to travel to campus and simultaneously generates funding for CO₂ reduction initiatives, so there is no direct cost to the University for implementation. The Transportation Study recommended aligning parking fees with the full cost of providing parking space, but do not specify how parking fees at USU would be changed in that scenario. Based on observations from other universities, the Study claims that substantial increases in parking fees (15-20%) have reduced parking demand significantly (>5%), but modest price increases (3-7%) have generated little change in parking behavior. USU has very low parking fees compared to peer institutions, so it is unclear how commuters would respond to increases. In any case, simply using the information provided in the Transportation Study we estimate a CO₂ reduction of 579 metric tons of avoided CO₂ emissions, or 0.56% reduction relative to the 2017 baseline when evaluated over a 20-year planning period. As with Energy Management Projects, a diminishing return on carbon reduction is applied over a 20-year planning period. Alternatively, USU could progressively increase parking prices over the next 20 years to increasingly deter personal vehicle commuting and use those funds to increasingly incentivize low- to zero-carbon commuting options, but this scenario is not included in our current model.

In making decisions about parking fees, it is important to consider our University mission and special cases that may require faculty, staff or students to drive to campus. Any changes in parking fees could be made in combination with other efforts that incentivize alternate transport, commuting, and rare car use for individuals that are willing to predominately commute by other means. Working with Logan City to improve bike lanes and bus routes may also reduce personal vehicle commuting.

Other parking-related options that could not be investigated within the scope of this committee, but may be worth pursuing in the future, include increasing the number of electric car charging stations and/or offering solar-panel-covered parking. It is possible that these improvements could be cost-neutral to the University over a 20-year planning period if the costs are integrated into the relevant parking permit fee.

7. Landscape operations and maintenance

The USU Facilities department is working to reduce fuel consumption in its Landscape Operations and Maintenance (LOAM) division. Over the next two years, the department will construct several remote equipment storage buildings on the Logan campus and on the Innovation Campus. These strategically located facilities will eliminate hundreds of trips used to haul mowers, weedwhackers, leaf blowers and other equipment around the campus each day. The new satellite equipment facilities will include extra power outlets for rechargeable equipment, as Facilities believes that before the end of this decade, most if not all commercial-grade landscape equipment will be electric and rechargeable and we plan to transition to electric equipment as soon as feasible.

LOAM currently uses a GEM (Global Electric Motorcar) to haul campus food waste to the USU compost facility. And, within the next year, LOAM plans to purchase its first electric tractor mower. While battery weight and runtime limits have kept most electric landscape equipment in the residential market, Facilities continues to carefully survey the market for equipment is seeing greater

penetration of rechargeable equipment in the commercial market, especially in larger equipment where battery weight is less of an issue than for hand-held equipment.

TIER 2 PROJECT OPTIONS – DEFERRED OR LOW IMPACT OPTIONS

1. Solar energy

Solar panels represent a rapidly growing component of the global renewable energy portfolio. The technology and efficiency of solar panels have increased dramatically over the past decade and the costs have decreased substantially. There is considerable potential to increase solar power as part of USU's energy portfolio and any of the renewable portfolios USU is currently pursuing with RMP, LL&P or Price Public Utilities would likely include solar power. However, there are numerous challenges and limitations with implementing on campus solar projects. For example, assuming we are able to obtain renewable energy portfolios through RMPs Rate 34 initiative, it would negate the need for solar on Statewide campuses (excluding Logan and Price). Solar projects to reduce the carbon footprint on the Logan or Price campus would likely need to be located on USU property and tied into our existing energy infrastructure because we would incur additional fees and lose energy in transmission if we were to build a solar array outside our power sub-stations. Second, we are restricted under our connection agreement with LL&P in the amount of electricity we can export from campus to the power grid that is managed by them. When export does occur, unless we are taking equivalent power at the other substation, we receive no revenue for the power export; if we are taking power that is equivalent to the export at the alternate substation, we pay LL&P a wheeling charge for using their transmission system. Thus, we would need to ensure that under peak production conditions, we would not produce more electricity than we could utilize on campus. Third, solar power is intermittent, depending on the season, time of day, and weather conditions, so substantially increasing our solar power generation on campus reduces our energy reliability and complicates our energy management operations. Battery storage could help overcome this reliability problem, but while battery storage technology is improving rapidly and may be a cost-effective solution within the next few years, we do not feel that the technology is ready for large-scale implementation at this time. Lastly, there are logistical challenges. Retrofit rooftop installations are relatively expensive and are often limited by structural/architectural or regulatory considerations. Ground-based solar arrays are typically more cost-effective, but require extensive areas (approximately 4 acres for a 1 MW array). Nevertheless, multiple arrangements could be considered to increase solar power for Logan and Price campuses including a) operation of USU-owned and operated systems, b) contracting for an external entity to operate solar arrays on campus and selling the power to USU via a power purchasing agreement (PPA), or c) contracting with an external entity that operates a solar array off-campus via a power purchasing agreement.

Subsidized small-scale solar projects on campus

Two solar arrays have been installed on the Fine Arts Visual roof and the Electric Vehicle Research Facility, amounting to 134 kW of capacity. These two arrays will produce an estimated 218,843 kWh and eliminate 163 metric tons of CO₂ from being emitted each year in the future. Other energy efficiency measures account for an estimated reduction of 616,245 kWh and 3,992 DTH (694 metric tons of CO₂). Small scale solar projects (< 300 kW) are estimated to have minimal impact equal to a 1% reduction of the 2017 baseline. Small scale solar projects tend to have a negative Net Present Value, but may be viable when subsidized by grants. Unfortunately, grants for solar installations are limited in number and small in award amount.

Future investments in small scale solar were evaluated in our CO₂ model by doubling the current investment in small scale solar that has taken place at USU in the past eight years. The resulting cost of CO₂ reduction includes local funding and matching grants, as well as the avoided energy costs, which is then divided by the estimated CO₂ reduction rate from past solar projects. While the Net Present Value is not typically favorable, we acknowledge that subsidized small solar projects may make good demonstration projects for educational purposes and raise awareness of USU's carbon reduction initiatives. If USU is successful in pursuing large scale Rate 34 acquisitions of renewable power, small scale grants, mostly from the Rocky Mountain Power (RMP) Blue Skies program may no longer be desirable, or even potentially available, at least for Statewide campuses. Likewise, as Logan Light and Power (LL&P), does not offer a comparable incentive program as does RMP for small scale solar, the CO₂ reduction impact of self-funded local Logan campus solar projects is substantially diminished.

Large Scale Solar – USU as an investor or contracting with a third party via a Power Purchasing Agreement

Contracting with Rocky Mountain Power via Rate 34 or a similar renewable portfolio that could be offered through UAMPS or Logan Light and Power would likely provide the most cost-effective and low-risk way for USU to obtain carbon-free, renewable solar energy. However, the committee also considered several options for developing our own large scale (2 MW) solar array on campus. USU could invest in a large solar array that we would maintain, or we could contract with a solar energy developer via a Power Purchasing Agreement (PPA).

USU attempted to establish a large solar array via a PPA with a developer and external financier. Financial viability of the project relied heavily on receiving market rates through net metering with RMP that would not have extended through the complete lifecycle of the project. This uncertainty in future net metering rates exceeded the level of risk that USU could reasonably accept, so the project was deemed infeasible at that time. Recent changes in net metering have made such projects even less viable.

LL&P has recently indicated that it is possible to wheel power across both the RMP and LL&P wires to the USU substations, which makes it theoretically possible for USU to obtain renewable power through a quasi-Rate 34, or from a USU or privately-owned renewable outside of our substations. However, the complexity of such an arrangement may be problematic and the willingness of LL&P and RMP to allocate space on their transmission systems and negotiate reasonable wheeling prices, is an unknown, and could take considerable time and effort on the part of USU to negotiate. Due to the economies of scale of renewables currently being developed, combined with USU's relatively small requirements for renewables in the market as a whole, and because regulated Utilities have an overarching mission of reliability and cost-effectiveness to their customers, it is stressed that the more USU works within existing available programs being supported by the Utilities, the more successful, as well as cost and time-efficient we are likely to be.

From an LL&P perspective, obtaining a PPA or rate design option to subscribe to renewables that UAMPS acquires, invests in, or purchases from other sources, is also preferable to USU building its own large-scale renewable assets. Renewable assets at the time of this narrative would need to be constructed inside of USU substations such that they are not distributing excess power to LL&P. Other than for a large wind turbine, unallocated USU-owned land that is located inside of its two substations to accommodate solar installations, would be limited. Also, self-owned renewable assets on a large scale imply new maintenance and capital renewal responsibilities for USU Facilities which are not well known, but would not be trivial. These costs are not included in the current model.

2. Wind Turbine on or near campus

Idaho National Laboratory conducted a study for USU and Chevron Energy Solutions in 2008 evaluating wind data from the mouth of Logan Canyon to determine the cost-viability of a wind turbine. USU was considering investing in the project via a financier and PPA. While energy output from this site was determined to be on the lower end for commercial sites, the close proximity to the USU substation would reduce connection costs. The executive summary indicates that a “strong” PPA (advantageous to USU), together with USU financial and construction participation as well as state subsidies may be needed to ensure the cost-effectiveness of the project. Citizen’s concerns about placing a turbine at the mouth of Logan Canyon was also potentially problematic. For these reasons, the University did not pursue the wind project.

USU Facilities intends to update the original cost estimates found in the study and evaluate viability under the assumptions of self-financing or PPA, with little or no power export. The option for a wind turbine located at the entrance of Logan Canyon does not include additional costs that would be associated with finding meaningful work that the power from the wind turbine could perform. As most of the power output from the turbine would occur at night or early morning hours, which is during USU’s lowest power consumption period, the wind power could not easily be utilized to reduce our carbon footprint until cost-effective strategies for energy storage are developed. Electrical battery storage, and chilled water or ice production and storage are methods to utilize wind power generation when it is not otherwise needed on campus. However, these storage options would add millions of dollars in cost to an overall system that is already very expensive when comparing its cost (\$861 per metric ton of avoided CO₂ emissions) to other project options. Local area concerns about the appearance of a large turbine in the canyon, and how LL&P might treat this addition of USU power generation in its partial requirements rate structure remain unknown factors to be addressed. Aside from the cost-effectiveness of wind power, qualitative benefits of investing in wind power could include educational, research, carbon reduction, and campus recruitment. Unlike exterior LED replacement or a steam driven chiller, there are no operational advantages for implementing a large-scale wind project on main campus at this time.

3. Purchase Rocky Mountain Power Rate 32 renewable portfolio

Rate 32 is a renewable energy portfolio rate structure offered by Rocky Mountain Power, similar to Rate 34 discussed in the Tier 1 options above. Both of these rate structures would provide renewable energy to all Statewide campuses except Logan and Price. Rate 34 is preferable for reasons discussed above, but in the event that Rate 34 is determined not to be viable, USU will consider entering into a contract with RMP under Rate 32. Renewable energy can be provided from Rocky Mountain Power under Rate 32 via solar power, which is subject to variable production depending on season and weather conditions, or geothermal, which provides a reliable baseload output.

Variable Solar

Due to how Rate 32 is set up and the inherently variable nature of solar power generation, solar is a relatively poor performing option under RMP Rate 32, under USU evaluations. Under Rate 32 this option could provide fair CO₂ reduction at 1.9% of baseline, although it has a high cost of implementation at \$68.91 per avoided metric ton of CO₂ emissions. As noted previously, USU has negotiated a consulting agreement to evaluate Rate 34 options through an RFP should ongoing efforts to obtain a Rate 34 supply without an RFP fails to produce results. The consultant has urged USU to allow them to perform detailed economic analysis for Rate 32, to be performed concurrently with Rate 34 evaluations under an RFP scenario. Because the consultant claims to have clients who have achieved carbon reductions under a Rate 32 solar option, and which also reduced their overall power costs, USU has agreed to have the consultant perform the Rate 32 evaluation if an RFP is issued by USU. While the Rate 34 option is preferred at the time of this report, and for reasons explained above, data based on actual renewable offers will provide a potential Rate 32 fallback option, should a Rate 34 option prove not to be viable from the RFP process.

Geothermal

With constant output, geothermal outperforms variable solar under RMP Rate 32, resulting in greater CO₂ reduction at a better cost per MTCO₂ (8% reduction relative to our 2017 baseline and \$17.38 per MTCO₂, respectively). As Rate 34 also has a lower cost, at \$6.71 per MTCO₂, and also has greater potential for CO₂ reduction, Rate 34 participation appears at the time of this narrative to be the superior option. Comparisons between Rate 34 and Rate 32 will be more accurate once USU acquires more specific cost and CO₂ reduction numbers from the RFP that Facilities is prepared to issue, as noted earlier. Participation in RMP Rate 34 and Rate 32 is generally considered to be mutually exclusive, as participation in either one rate structure would likely preclude participation in the other.

4. Contracting for carbon-free power from an off-campus small modular nuclear reactor

NuScale is a collection of 50 MW small modular nuclear reactors proposed for assembly on-site at Idaho National Laboratory. NuScale is perhaps the most substantial single initiative of UAMPS (Utah Associated Municipal Power Systems) toward decarbonization of their power supply inventory. LL&P (Logan Light and Power) receives its power through UAMPS, which currently obtains 50% or more of its power supply from coal-fired power plants. Utah State University purchases about 51% of its electrical energy (kWh) from LL&P. LL&P may pledge to purchase a 5 MW allocation from NuScale at a fixed rate of \$0.055 per kWh. USU has approached LL&P with a proposal to purchase an allocation of this power through a rate 8 modification or PPA (Power Purchase Agreement). LL&P has agreed in principal to having PPA discussions regarding NuScale allocation. However, no formal meetings have taken place, as NuScale is not expected to be commercially available until the year 2027. As NuScale is also a controversial project with some public pushback, senior USU administrators will need to determine if USU would participate in the project. Public relations and community engagement efforts may be needed to educate the campus community and general public regarding the value and safety features of this new generation of small modular nuclear reactors.

Evaluation of the role NuScale might play in USU achieving its carbon neutrality goal is significantly hindered by numerous variables and unknowns. As to not overstate the amount of potential CO₂ reduction USU might achieve from participation in NuScale, our CO₂ Model allocates only 10% of the energy USU purchases from LL&P to be sourced by NuScale. The 10% annual energy equivalent from NuScale would be comparable to the amount of hydro power that USU currently procures through LL&P. Actual allocations of NuScale power and the incremental price paid by USU should be negotiable with LL&P. However, as USU is itself a power generator, and procures a partial power requirement from LL&P that is mostly related to meeting campus power demand, it is anticipated that NuScale allocations as well as subscriber renewable allocations may be limited or fixed in amounts that LL&P would be willing or able to offer.

5. Ground source heating and air conditioning systems

Facilities is investigating the feasibility of ground source heating and air conditioning systems on the Logan and Moab campuses. A four-hundred-foot test well was recently completed in the parking area north of Nutrition and Food Sciences Building. Results of the Logan Campus thermal conductivity test are pending, but results from the Moab test well were positive, indicating that the soils under campus can be used to store energy. Water source heat pumps are among the most efficient HVAC equipment currently on the market and have the potential for significant energy usage reduction in building use. The energy usage intensity of a building utilizing this type of system in Logan is approximately 30 – 35 compared to 50 – 55 kBtu/ft² for a building with a traditional

mechanical system. These systems are not new, but have typically been used in small scale commercial and residential buildings. Recently other large institutions have begun utilizing them with success. Challenges arise with these systems as the construction costs are often higher, the required land space for vertical well fields can be significant, and long-term maintenance reliability is less known.

6. Transportation Initiatives

In Tier 1 above, we presented several transportation options that currently have favorable cost/benefit ratios. Here we summarize several other transportation related options that do not appear to be favorable at this time, but may be considered in the future. Cost and CO₂ reduction estimates are derived from the 2016 Transportation Master Plan study.

1. Expand Aggie Shuttle: Appears to be a very expensive initiative at \$1,605 per metric ton of avoided CO₂ emissions, for minimal impact of 0.05% MTCO₂ reduction relative to the 2017 baseline.
2. Expand Commuter Club: The Transportation Study explored the idea of expanding the commuter club. USU currently provides free lockers and emergency rides for Commuter Club Members who take non-single occupancy transportation at least three days a week. Members without a parking pass can check-out a bicycle for a year. Current membership is approximately 100 people. Expansion would require funding to provide services to more people and more staff time to support the services offered to members. Expansion of this option could also include the guarantee a free ride home to employees who commute without a car. In the case of emergency, the employee would be reimbursed the cost of a taxi ride. This appears to be an expensive option at \$500 per metric ton of avoided CO₂ emissions for a negligible impact of 0.06% MTCO₂ reduction.
3. Flexible Work Schedules: This option would involve flexible schedules for non-shift employees or compressed work week. This strategy primarily reduces congestion as it would reduce the number of peak period commute trips. While this option has a negligible cost for the University and there may be other reasons to consider flexible work weeks, this option is relegated to Tier 2 because it produces minimal CO₂ reduction and may create unintended scheduling conflicts. This option would require administrative deliberation and policy creation to be offered on a comprehensive scale at the university.
4. Electric Buses: Staff from Facilities and Parking & Transportation have evaluated electric busses for the Aggie Shuttle system. An electric bus costs more than a comparable compressed natural gas bus. With the relatively low mileage of the campus system, the cost per metric ton carbon saved would be approximately \$2,000. For comparison, a metric ton of carbon emissions avoided by solar photovoltaic panels would cost approximately \$25. Electric busses may make sense for specific higher mileage routes, in collaboration with Logan City, or if grant funding becomes available, but will likely be low on the priority list for actions the University can take to reduce emissions.

CARBON PRICING WORK GROUP

Carbon dioxide occurs naturally in the atmosphere. Production of carbon dioxide through combustion and its role as a greenhouse gas, however, led the EPA to classify CO₂ as a pollutant that, “may reasonably be anticipated both to endanger public health and to endanger public welfare.” Thus, USU Environmental Health and Safety reports on emissions from the Central Energy Plant along with their other programs managing biological hazards, radiological hazards, and hazardous waste. Like other pollutants, the University can manage and mitigate the effects of carbon dioxide produced through its operations and travel. The Carbon Pricing Work Group evaluated a price on carbon emissions as a tool to offset carbon produced and to discourage behavior that produces carbon pollution.

Carbon pollution is linked to many current and future economic damages as it has already increased, and will continue to intensify heatwaves, extreme storm events, coastal flooding, drought, wildfire, and infectious disease transmission, and threaten the climate and environmental conditions that society relies upon for economic activities. The costs of climate change are very real and foreseeable, yet, are not accounted for in the price of goods and services that produce the carbon. Exclusion of these costs violates a fundamental principle of the market economy, specifically that all costs and benefits are represented in the prices of goods and services. Economists refer to such excluded costs as ‘externalities.’ Carbon pollution is among the most notorious externalities in the global economy. The purpose of putting a price on carbon pollution is to internalize the externalities of greenhouse gases. Pricing or taxing carbon allows producers to pay for the social costs of greenhouse gasses by paying for each ton they produce. Multiple carbon tax bills are currently being considered at federal and state levels. In January 2019, economists released a statement that now has the signatures of over 3000 economists, including 27 Nobel Laureate economists and four former chairs of the Federal Reserve, in The Wall Street Journal stating,

“A carbon tax offers the most cost-effective lever to reduce carbon emissions at the scale and speed that is necessary. By correcting a well-known market failure, a carbon tax will send a powerful price signal that harnesses the invisible hand of the marketplace to steer economic actors towards a low-carbon future.”

It appears likely that a carbon tax will be implemented at the federal and/or state level at some point, but the timeline is unclear. Implementing an internal carbon price at USU would allow the university to begin accounting for the cost of carbon pollution in decision-making, identify the most effective pathways to reduce carbon pollution, and prepare for a future federal or state carbon tax. The carbon pricing work group began by evaluating pricing levels and structures in other universities and jurisdictions. Additionally, the committee surveyed faculty and staff to gauge support from the campus community. Members of the committee also presented ideas to the Department Head Executive Council; Deans’ Council; Janis Boettinger, Vice Provost and Director for Global Engagement; James Morales, Vice President for Student Affairs; and Sami Ahmed, USU Student Association President.

Based on research and feedback from these groups, the carbon pricing work group recommends implementing:

- a) A lifecycle analysis on carbon-intensive purchases that includes a ‘shadow’ price on carbon of CO₂ equivalent emissions for major university expenditures. This is the median of carbon tax proposals at the US federal level in 2019, based on information from the Columbia Center on Global Energy Policy. It is also roughly the price used by the EPA in 2017.
- b) A mandatory carbon offset charge of \$10 per round-trip for all University-sponsored air travel paid by the department or index funding the trip.
- c) Re-invest funds from the air travel offset charge to reduce carbon pollution locally. Based on survey feedback, the group recommends the fund support projects that:

1. Increase energy efficiency
2. Reduce local air pollution from transportation
3. Increase energy supply from renewable or low carbon sources
4. Also help achieve other campus priorities, including safety

CARBON SHADOW PRICING RECOMMENDATIONS

A “shadow price” is a theoretical or estimated cost assigned to carbon emissions that university purchasers could use to evaluate products over their full life cycle. Though the university would not actually pay the price calculated (i.e., no actual money is being spent), the analysis would estimate the carbon emissions produced over the life cycle of the item purchased and the cost of that carbon pollution. By including the cost of carbon pollution, the university would ensure that purchases contribute to the university’s stated goal of becoming carbon neutral by considering both upfront and operating costs over the lifetime of the purchase, includes the costs of energy and associated carbon emissions. Life cycle analysis provides a valuable connection between the capital budget and the operating budget, which can internalize externalities and apply a discount rate on future returns in order to estimate a present value. Adding a shadow price for carbon emissions to the analysis can also help prepare the university in case future legislation at the federal or state level implements a carbon tax or dividend system.

The lifecycle price, including the cost of carbon, can easily be calculated in a spreadsheet developed by Harvard, Swarthmore, and Vassar. The process provides upper and lower limits on how much the university should spend on various options to reduce carbon. It sets a minimum to cover the social cost of carbon pollution. Purchases that do not save an adequate amount of carbon will be priced out. The example Yale provides is triple-glazed windows might reduce greenhouse gas emissions for \$500 per ton in a lightly used building. A \$40 price on carbon would rule out this purchase, while favoring purchases that could reduce carbon for \$40/MT or less.

Implementing the lifecycle analysis with a carbon price would apply to large purchases that could be expected to influence the University’s carbon emissions in the future. Harvard requires lifecycle analysis for new buildings, large renovations, partial building fit-outs (e.g., faculty lab construction or renovation), and limited scope projects with energy and greenhouse gas impacts. The committee would recommend similar guidelines to be worked out with the purchasing department, with the addition of transportation purchases of \$5,000 or more.

Additionally, it is important to identify how to build the shadow price into the decisions of groups on campus, including Facilities, Parking & Transportation, departments choosing energy intensive lab equipment, and others. The lifecycle analysis is especially important for purchases for which the upfront cost and operating costs fall to different groups to make financially responsible decisions for the university and to align incentives when possible.

AIR TRAVEL FEE RECOMMENDATIONS

Air travel is the most unsustainable activity that most USU employees perform as part of their job. Greenhouse gas emissions associated with air travel are exceptionally high. In 2018, USU faculty, staff and administrators are estimated to have flown over 18,000,000 miles in over 5521 trips. An additional 466 trips did not have adequate information to calculate mileage. According to the International Civil Aviation Organization, a UN organization, a trip of the average distance traveled by USU travelers (3,300 miles) would generate approximately 0.5 MT CO₂ per economy-class seat. However, a trip to a more distant location could generate much more. For example, a trip to Beijing could generate closer to one metric ton of carbon, depending on the connections, plane type, and class of travel. Also, layovers increase emissions considerably because much of the energy consumption occurs as the plane is ascending to cruising altitude.

USU currently offers a voluntary carbon offset for air travel at \$10 per round-trip flight. Faculty Senate Resolution 2019-01 recommended a mandatory \$10 fee to be charged per traveler, per round-trip flight, consistent with

other Higher Education institutions. Though \$10 for a half metric ton of carbon is less than the median social price of carbon or the recommended shadow price, it is above the cost of some reputable offsets on the market and is in the range of travel fees implemented at other universities. An immediate doubling of the voluntary carbon offset donation while making it mandatory could be a difficult adjustment for department budgets. Thus, a gradual increase toward the \$40/MT social cost of carbon is recommended.

A flat fee per round-trip was chosen to keep the implementation of the travel fee administratively simple. The fee addresses a major source of carbon at the university, and encourages travelers to consider carbon while generating funds to locally offset the carbon produced by the trip. Several other universities have instituted travel carbon fees for travel, including Arizona State University, UCLA, and University of Maryland.

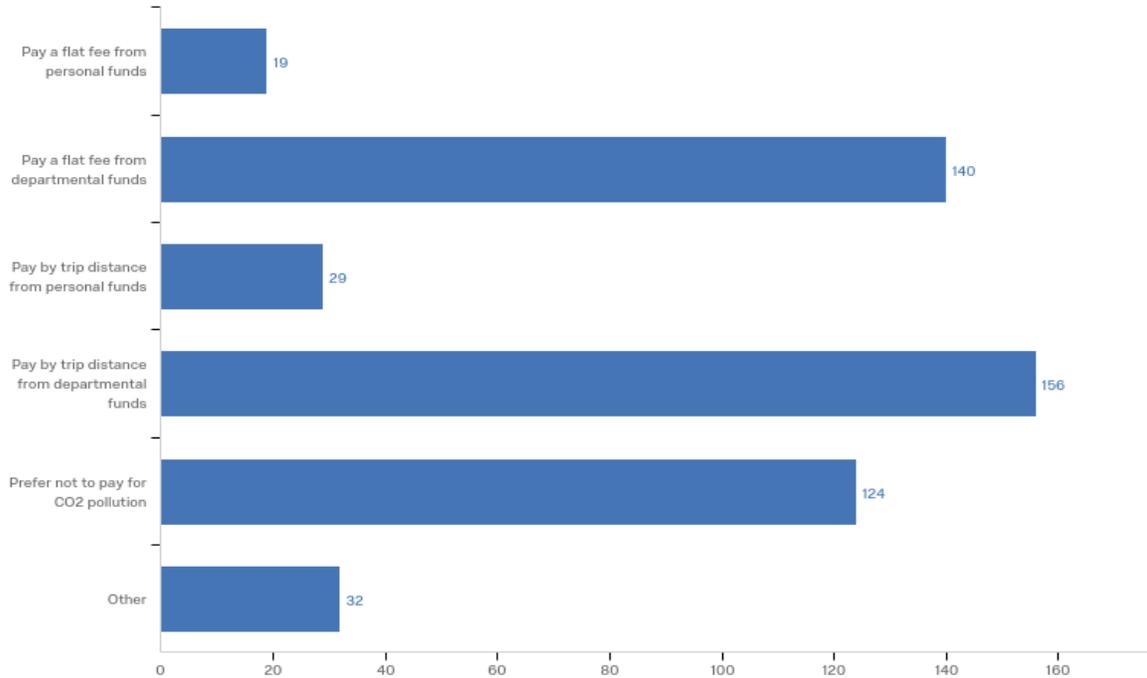
If the carbon pricing program is successful, it could be expanded to apply to fuel consumption for university vehicles. According to the EPA, one gallon of gas produces about 20 pounds (0.0089 MT) of CO₂ emissions, which at the price of \$20 per MT would add about \$4 for a mid-sized car to drive from Logan to Moab and back. The complementary shadow price proposed above would help ensure additions to the university fleet are efficient and not onerously affected by a carbon price on fuel if the university chose to implement a carbon price on fuel in the future. However, the logistics would be complicated by fuel bought from non-university gas stations currently. Additionally, measures should be taken to address the effects on Extension employees and others who serve statewide campuses and rural communities. A carbon tax on fuel is recommended for future consideration but not immediate implementation.

CARBON PRICING DATA COLLECTION

[Greenhouse Gas Committee Feedback Survey](#)

Faculty Senate issued a survey in April to gather feedback from faculty on travel, energy, and carbon pricing. The survey went out to staff over the summer. Over 800 people took the survey, including 542 staff and 276 faculty, mainly from the Logan campus.

Would you prefer to pay for carbon emissions generated by USU travel with a price that increases with the distance of the trip or a flat fee?

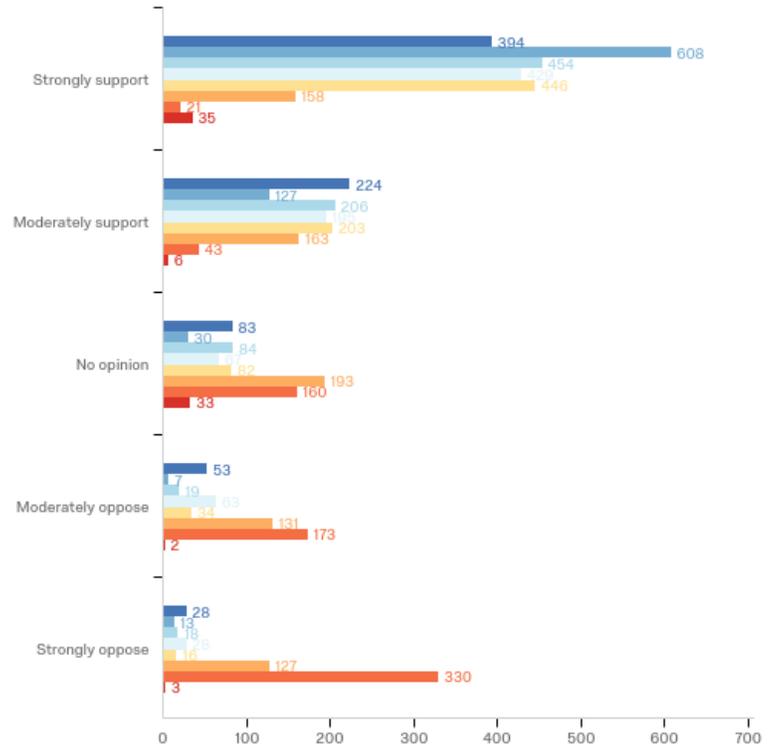


The results indicated faculty and staff support renewable energy options, with the most support for roof-mount solar. Faculty and staff most strongly opposed not changing from the current energy portfolio. Additionally, the results indicate faculty and staff are generally supportive of paying a carbon fee, with 69% choosing one of the survey’s pay options. The most popular option was the department paying a price determined by distance. If the people surveyed chose where the money went, they would allocate the largest percentage to energy efficiency projects, followed by projects that address local air quality through transportation and low carbon energy projects.

USU obtains over 30% of its electricity from power plants that burn coal. USU further obtains 55% of its electricity from natural gas. Coal and natural gas are fossil fuels, which produce greenhouse gas emissions and other pollutants.

With this in mind, please state your willingness to support the following energy options.

- ground-mount solar on USU property
- roof-mount solar on USU property
- solar from a remote location
- wind power on USU property
- wind power from a remote location
- small, modular nuclear power
- no change from the current electricity sources
- other

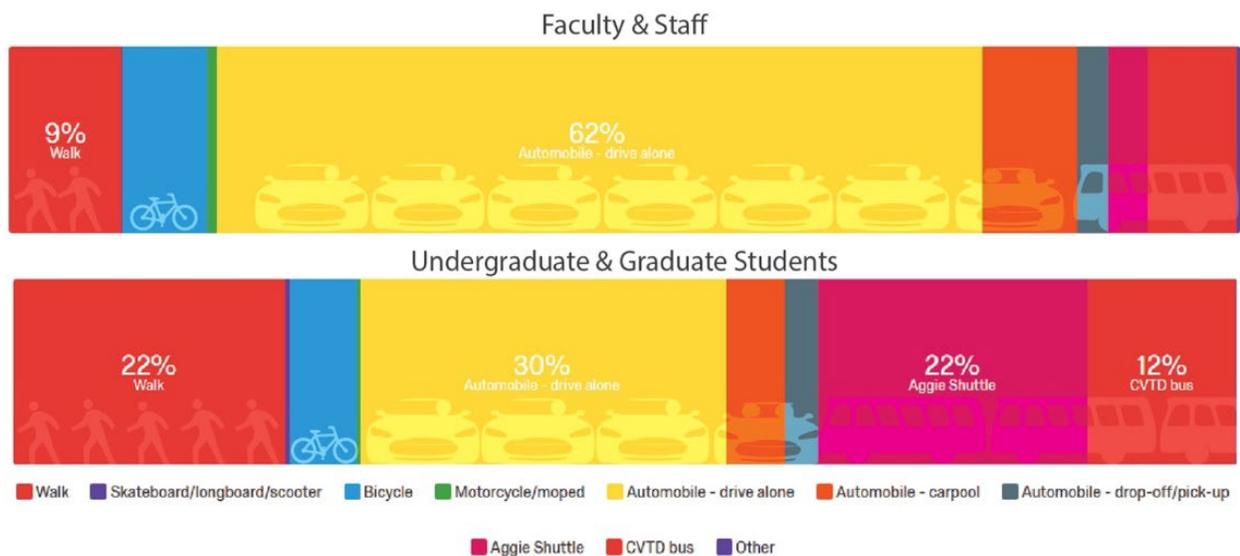


For a given trip, what percentage of the carbon price would you want to fund options below? You may allocate any amount from 0-100 to each option if the total of all options is 100%.



Transportation Survey

In April 2019, Parking and Transportation sent out a survey that will help improve estimates of commuting in the GHG inventory. Additionally, the new travel system that came online in February will provide more accurate data for university-related travel. Participants in the transportation survey who identified as faculty and staff were most likely to come to campus via a single-occupancy vehicle, followed by bus, foot, carpool, and bicycle. Bus, Aggie Shuttle or Cache Valley Transit District, was the most commonly identified form of transportation for undergraduate or graduate students' campus commute. Single occupancy vehicle, walking, and cycling followed. Together these emissions are estimated to contribute 5% of USU's carbon emissions—a number that a regular transportation survey should help refine in the future.



Air Travel

In 2018, the university funded 5521 trips that had enough information to calculate miles and an additional 466 trips that had insufficient data to calculate, according to data collected for the greenhouse gas inventory. The average air trip length was approximately 3,300 miles. According to the university's greenhouse gas inventory, these trips account for 10% of USU's carbon footprint, more than commuting (5%) or university-provided land transportation (7%). The new travel system should help refine these numbers in the future. This estimate could be a lower but still substantial number since the International Civil Aviation Organization, a UN organization, estimates carbon produced by flights lower than USU's current GHG inventory. This discrepancy highlights the need for more robust GHG estimation.

CARBON PRICING

The Carbon Pricing Work group researched carbon pricing on the global market and among other institutions of higher education in the United States. These carbon prices varied greatly, based on the design and use of the carbon markets and funds. The group evaluated the options that are most compatible with USU's travel, billing, and other systems while considering feedback from faculty and staff through a survey. The following are the primary methods of pricing carbon the group has researched:

1. Social cost

A social cost on carbon estimates the damage, both economic and environmental, that carbon is predicted to produce over its lifecycle.

- Median: \$23/MT
- Mean: \$45/MT

2. Carbon Offset Pricing

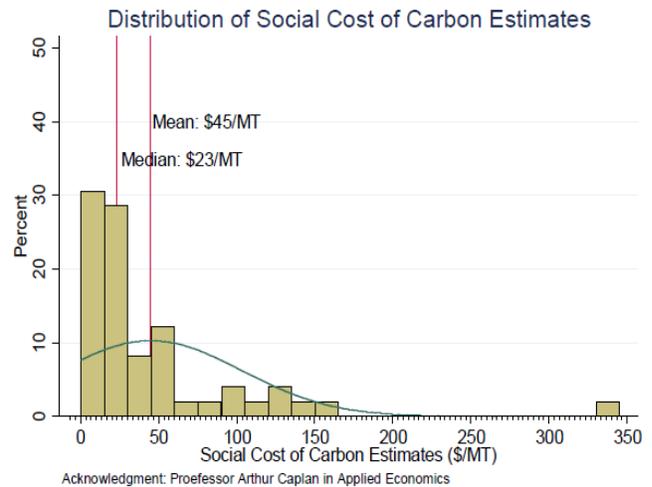
Consumers can buy carbon offsets from organizations that organize projects that avoid carbon production and sell rights to claim the carbon by the metric ton. Projects include planting trees, developing low carbon energy, improving grasslands, etc.

- Market price = \$13-15/MT

3. Carbon Fees and Taxes

The group also evaluated other carbon taxes set by countries and other universities. At least 16 jurisdictions apply direct carbon taxes: British Columbia; Chile; Costa Rica; Denmark; Finland; France; Iceland; Ireland; Japan; Mexico; Norway; South Africa; Sweden; Switzerland; and the United Kingdom (World Bank Group 2016). These carbon tax rates vary from \$2 US per metric ton of carbon dioxide equivalent in Japan to greater than \$100 US per metric ton of carbon in Sweden. Several universities have also implemented carbon pricing. These vary from shadow prices used to make purchasing decisions to prices placed on carbon produced through energy use or transportation.

- Carbon taxes around the world = \$2/MT - \$130/MT
- Carbon taxes proposed at the U.S. Federal level = \$15/MT-\$52/MT
- Carbon tax proposed in Utah with the Clean Air Carbon Tax Act = \$11/MT
- Prices used at universities = \$8 per trip - \$100 per metric ton shadow price



BENCHMARKING WITH OTHER UNIVERSITIES

Many other universities have implemented carbon pricing. The systems vary in the structure and scope of emissions that they target. Scope one and two emissions are related to the campus heating, cooling, electricity, and university-owned vehicles. Scope three emissions are indirect emissions, which in the context of carbon pricing, often refer to university-funded air travel and commuting but could also include the carbon emissions related to purchased goods and services, capital goods, and waste, among other things.

Two options focus on scope one and two emissions. Yale and Swarthmore charge units based on carbon produced through the operation of their buildings. Yale rebates the money back to units based on their energy use compared to other units at the university, and Swarthmore funds carbon reduction and sustainability efforts with the money. The advantage of focusing on scope one and two emissions is that they compose the majority of the university's emissions. The Yale model also provides a rebate and therefore incentive for units to reduce energy use. The main disadvantage is the system is administratively complicated. At USU, multiple units are in the same

buildings, and Facilities maintains and pays for the energy in the majority of buildings. Billing and rebating would occur in the same department and have little influence in academic units.

Other options focus on university-funded travel to price carbon. At Weber State, a vice president implemented this program to fund carbon reduction up to an administratively designated monetary amount. In this case, the responsibility of each unit is based on the portion of travel the unit was responsible for in the initial year of the fund. The distribution of responsibility could also be based on other factors. The main advantage of this system is administrative simplicity it provides in funding carbon reduction. The disadvantage is that the carbon price is not related to the cost of abatement or social price of carbon. Additionally, it does not raise awareness of carbon-producing activities or discourage high carbon or inefficient practices.

Two other options also focus on travel. Pricing carbon produced by travel by mode and distance would be most accurate, and it is preferred by USU faculty and staff according to survey results. Yet, few if any other institutions have adopted this system due to its complexity. A travel price by distance would evaluate the carbon produced by a trip based on whether the trip was by land or air and by the specific number of miles, landings, and takeoffs. Many travel authorizations do not include enough information to evaluate this information. Additionally, in the current system, the estimate would be manually calculated.

Thus, the simpler option is to charge a flat fee for a trip. USU already has a voluntary carbon offset fund that is a flat fee per trip. Travelers can opt-in to donate \$10 of their reimbursement to the fund, which has accumulated approximately \$3,000 per year. The travel form used until spring 2019 had a link to the sustainability website explaining how funds were spent. Donors also received a thank you note with information about the fund. However, the new travel system has made donation considerably more difficult, so donations to this fund are expected to decline significantly under the newly implemented system unless changes are made.

Other universities have also adopted a flat fee system. Some universities have tiered the charges based on domestic versus international or land versus air travel. To keep the system simple, the USU Carbon Pricing Work Group recommends a flat \$10 charge on air trips only. The advantages of this system are that it is administratively simple and directly tied to a carbon-producing activity. The raised funds could offset the carbon produced through university travel, and by targeting air travel, the system would avoid discouraging Extension agents or others who drive for work from performing work duties that produce much less carbon per trip than air travel. The main disadvantage is that it only prices carbon from air travel, which is approximately 10% of USU's carbon emissions.

The committee recommends the \$10 per round-trip price should be reevaluated every three years, based on current social cost estimates of carbon and the carbon offset market. Additionally, the carbon price should be reevaluated in the case of a local, state, or national legislation that implements a carbon tax affecting university-funded travel or any purchases included in the shadow pricing proposal.

Table 1. Examples of internal carbon pricing mechanisms used by Universities

	Carbon Price by energy use	Proxy/Shadow price	Carbon Payment off the top	Travel Price flat fee	Travel Price by distance
Example	<ul style="list-style-type: none"> • Yale • Swarthmore 	<ul style="list-style-type: none"> • Princeton • Smith • Swarthmore 	<ul style="list-style-type: none"> • Weber State 	<ul style="list-style-type: none"> • Arizona State University • UCLA • University of Maryland • Whitman (students) 	Arizona State considered it, but it was not compatible with their system.
Scope	Scope 1 & 2 (produced, purchased)	Scopes 1, 2, 3 (produced, purchased, indirect)	Scopes 1, 2, 3 (produced, purchased, indirect travel)	Scope 3—indirect travel Could include other travel	Scope 3—indirect travel Could include other travel
Price	<ul style="list-style-type: none"> • Yale charges \$40/MT • Swarthmore pays \$23/MT. 	<ul style="list-style-type: none"> • Princeton uses \$45/MTCO_{2e} • Smith uses \$70/ ton CO_{2e} • Swarthmore uses \$100/MTCO_{2e} • \$23/MT (median social cost) 	<ul style="list-style-type: none"> • Weber effectively pays \$5/MT for Scope 1 & 2. 	<ul style="list-style-type: none"> • ASU charges \$8/RT flight, which will increase to \$18 • UCLA \$9 domestic/\$25 int'l • UMD purchases local carbon offsets. • Whitman \$5 for student short land trips/ \$40 air • USU \$10 voluntary donation from travel reimbursements 	

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Description</p>	<p>Yale charges for carbon produced by 250 university-owned buildings. Each unit has budget lines for a carbon charge and rebate, which is based on its energy use compared to the university. Swarthmore's assesses a charge on CO₂ from scope 1 and 2 emissions. The fund collects approximately \$300K annually or 1.25% of each department's budget.</p>	<p>Smith uses a proxy price of \$70/ton CO₂e (rising at 2.5% per year) to evaluate renewable energy projects and for lifecycle analysis. Swarthmore uses a proxy price of \$100 per ton CO₂e in lifecycle cost calculator for purchasing decisions. The price is reassessed every 3 years.</p>	<p>Weber's VP of administrative affairs started the fee at \$30K and escalated it to \$100K. VPs pay by their division's percentage of travel in the analysis year.</p>	<p>ASU implemented a flat fee on air travel in 2018 that will escalate each year. They chose a flat fee to reduce the burden on study abroad and other international travel. For research, it comes out of a local department account. It funds the ASU Carbon Project. UCLA and UMD also have processes to offset carbon with the collected fees.</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Advantages</p>	<ul style="list-style-type: none"> • Scope one emissions are the largest portion of USU's GHGs. • USU can directly control scope one • An internal price could provide incentives for units to become more efficient • Provides a funding source to reduce USU's carbon emissions 	<ul style="list-style-type: none"> • The only costs are administrative. • Weights projects that produce less carbon or avoid carbon production 	<ul style="list-style-type: none"> • Addresses the majority of USU's carbon emissions (scopes 1 & 2) • Simple • Less visible, so less controversial • Provides a funding source to reduce carbon emissions • The charge becomes smaller as USU produces less carbon if paid per ton. 	<ul style="list-style-type: none"> • Simple • Tested • Addresses one major source of carbon • USU already has half the system in place. • Over 60% of surveyed faculty & staff support paying for travel carbon • Provides a funding source to reduce USU's carbon emissions 	<ul style="list-style-type: none"> • Price adjusts in proportion to the carbon produced • Addresses one major source of carbon • Over 60% of surveyed faculty & staff support paying for travel carbon • Provides a funding source to reduce USU's carbon emissions

Challenges	<ul style="list-style-type: none"> • Auxiliaries are self-funded and may find the charge burdensome. • Units that pay their own bills do not have incentives to reduce energy use. • Multiple units use buildings, so refunds would be complicated. 	<ul style="list-style-type: none"> • Purchasers would need training to purchase carbon-related items. • It is important to set the price correctly, and social cost estimates vary. 	<ul style="list-style-type: none"> • Administrators may prefer for subunits to pay the carbon price. • Its effect on incentivizing efficiency will be minimal since only VPs will see it. 	<ul style="list-style-type: none"> • Travel is only 21% of USU’s emissions, and air travel is about half of that. • Departments that require more travel would be more greatly affected. • Might discourage study abroad, research, and other travel that supports USU’s mission. • Not responsive to distance 	<ul style="list-style-type: none"> • Complicated • Travel is only 21% of USU’s emissions, and air travel is about half. • Departments that require more travel would be more greatly affected. • Might discourage study abroad, research, and other travel support USU’s mission
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EDUCATION WORK GROUP INITIATIVES FOR USU FACULTY AND STUDENTS

Climate change now comprises a global emergency for organized human civilization. Urgent, transformative action is vital. Adapting to continuing, intensifying, and compounding disruptions, and mitigating further change, will continue for the foreseeable future and involve every facet of our society. No thread of human experience will remain untouched. Food, water, and energy; architecture and transportation; public health, immigration, national security, and the economy will be impacted by the changes occurring to our climate regime. Climate change is not simply an issue to be dealt with, it is every issue. Climate change is the era in which we live. It is therefore not only appropriate, but critically important, that students emerge from their undergraduate experience at USU with a coherent, holistic understanding of the landscape they will inhabit, navigate and even shape in the coming decades. This means understanding not only the basic science of climate change, but the origins of this challenge; its monumental scale; and its sweeping context. Fully interwoven with the science are social, economic, political, and cultural dimensions that can only be explored through the full breadth of a student's academic program, whether they are in the physical sciences, social sciences, humanities, or fine arts. Ultimately, it is worth considering that responding to climate change, within the full context of human sustainability and vibrancy, should be a core organizing principle of USU's undergraduate curriculum and experience.

RECOMMENDATIONS

1. Expanding / Institutionalizing USU's Planetary Thinking in the Curriculum Workshops.

Increasing exposure of USU students to a coherent, holistic picture of climate change necessarily begins with increasing the knowledge base of their instructors across the full university curriculum. As a first step in this regard, the work group recommends expanding and institutionalizing the existing Planetary Thinking in the Curriculum program. Destinations: Planetary Thinking in the Curriculum is a faculty-originated, faculty-driven development workshop focused on integrating climate change and sustainable systems knowledge and perspectives into existing courses.

The workshop educates faculty on these topics, invites them to strategize how this material might be naturally incorporated into their existing courses, serves as a resource for implementing their strategies, and provides a modest stipend for their efforts. Planetary Thinking in the Curriculum workshops have been conducted once each year over the past four years, with 66 faculty members from a broad spectrum of departments participating. These participants have now taught over 6,500 students in classes they workshopped through Planetary Thinking.

Goals:

In expanding the Planetary Thinking program, the committee recommends the following goals:

- An initial target of training 200 USU faculty over the course of two years.
- Recruiting faculty from the full spectrum of disciplines and departments, but with a particular focus on faculty who teach the full suite of breadth courses
- Expansion to four sessions per year, each accommodating ~25 faculty and including regional campuses.
- Refreshing and formalizing the workshops through content and resource development
- Training 200 faculty who teach general education breadth classes will allow over 5000 USU students per year to be exposed to science-based information on the causes and impacts of climate change. These breadth classes will span the diversity of general education courses such that almost all USU undergraduates will have an opportunity to study the effects of

climate change on our planet's energy budget, ecosystem dynamics, and social and economic activities.

- The focus on climate change in our breadth courses will allow many students to become aware of the multiple ways in which climate change will impact our lives. Infusing sustainability goals at several points in a curriculum will enable students to take appropriate action to reduce their own carbon emissions and communicate with others about the problem and solutions.

Resources:

Faculty / staff time and funding are required. To date, the Planetary Thinking workshops have been planned and conducted as an essentially volunteer effort on the part of faculty and staff. Modest support from various colleges and the Provost's Office have funded stipends for participating faculty. Institutionalizing and expanding this program, per the above goals, will require institutional investment. We recommend the following investments

- Support for a faculty director (3 months of salary)
- Support for staff assistance (3 months of staff salary)
- Support for faculty participation (\$500 per participant)
- Operating budget for room reservations, food, transportation, etc. (\$5000 per year)

2. New Faculty Orientation Programming.

The work group recommends exposing new faculty to the Planetary Thinking framework from their earliest moments on campus. Adding a segment to the New Faculty Orientation Program is an obvious place to start. This recommendation was field-tested in the new faculty orientation conducted on campus in August, 2019. A session entitled "Unveiling the Anthropocene" was added to the options participants could attend, though it was not required. The goal of this recommendation is to expose all new faculty to USU's Planetary Thinking philosophy upon their arrival, introduce them to the resources currently available and under development, and invite them to actively participate in growing and improving these efforts. Lectures, videos, and documents developed for this purpose could also be made available to staff that are interested in learning more about the issue and USU's philosophy and efforts in developing solutions.

3. Informational Videos for Existing Faculty and Staff.

The feedback we have received in recent surveys indicates that there is a considerable number of existing faculty and staff who are concerned about climate change and would like to know more about the causes, implications, and solutions at global, national and local scales. USU has internationally renown faculty working at the frontier of climate science and the many aspects of our environment, ecosystems, economic and social structures that will be affected by climate change. We have faculty that are developing technologies of the future including renewable energy, nuclear energy, electric vehicles, battery and energy storage technologies, and energy efficiency technologies. These faculty could be utilized to develop short informational videos for existing faculty, staff and students to ensure that the entire campus community understands the scope and urgency of the problem and what USU is doing to make progress on this issue.

4. "Environmental Attitudes and Literacy" Assessment.

To get a better sense of both faculty and student attitudes and literacy, we recommend an assessment be conducted of faculty attending the Planetary Thinking workshops as well as students in general education courses that are subsequently influenced by the Planetary Thinking workshop faculty. Our purpose here is twofold: (i) evaluate the effect of the Planetary Thinking program through an assessment of the students and faculty changes of attitude towards environmental issues; and (ii) create a feedback process to identify effective practices and adjust less effective ones. The office of Analysis, Assessment, and Accreditation might be helpful in the design and implementation of these assessment tools.

5. Wider adoption of climate and sustainability-related learning outcomes.

Currently, about 10% of students graduate from a program that requires an understanding of sustainability (e.g. LAEP; conservation and restoration ecology; civil engineering; OPDD; and nutrition, dietetics and food science). Goal: Adoption of climate and sustainability-related outcomes in all academic programs. Resources: Faculty / staff time with commensurate funding required.

6. Promotion & Tenure Recognition.

Climate change and sustainability content is inherently challenging to integrate into course materials because the issues are complex, often intertwined with a multitude of other issues that span multiple disciplines, and require well-developed, real-world examples that students can relate to their own lives. When integrated in a robust manner, climate change and sustainability issues provide powerful opportunities to develop critical thinking skills, interdisciplinary perspective, combine quantitative and qualitative information, and engage students in real-world problem solving. It takes a considerable amount of work to do this well. To enhance faculty efforts toward expanding the presence of sustainability and climate change concepts into the curriculum, the work group recommends creation of a Promotion & Tenure metric that meaningfully credits faculty for their efforts. For example, novel approaches in coursework that change student perceptions and behavior about climate change in faculty would be noted in the tenure and promotion documentation. Faculty could also receive credit for demonstrating how their teaching and research substantially advances society towards global or Utah-specific sustainable development goals. Goal: Further incentivize faculty participation in introducing climate change coherently and holistically into the curriculum. Resources: Some faculty / staff time required; no funding required. Updates to the faculty code may be necessary, and subsequent education of the promotion and tenure committees.

We believe that adoption of the five recommendations will allow all students enrolled at USU to gain a better understanding of the causes, implications, and solutions to our current climate crisis. The current generation of students' lives will be defined by how society deals with mitigating and adapting to climate change. We need to provide the educational foundation and moral perspective to assist them in their roles as voters, participants in our carbon-based infrastructure, and informed members of society. Our goal is to expose all undergraduates to the best science-based information on the causes and impacts of climate change through comprehensive, meaningful and impactful courses.

Our institution's approach to climate change and sustainability issues is important to both recruiting and retaining students. Climate change, in combination with the broader suite of interconnected ecological and social issues, is a prime concern of today's youth. Weaving a more complete, nuanced, and accurate picture of climate change into the undergraduate experience has the potential to reach well beyond our campus and influence our broader societal response. Utah State University's response to the need for reduction of greenhouse gas emissions will define our role as the land-grant institution of higher education in Utah.

BUDGET AND BUDGET JUSTIFICATION

The table below shows the budget request to assist in the adoption of the greenhouse gas reduction strategies outlined in this report. We request an appropriation for the next two fiscal years. Progress in reducing USU's carbon footprint will be apparent after two years and adjustments in the program's funding will need to occur. Following is a short description of the use of these funds.

- Facilities needs to have access to funds to participate in a variety of **renewable energy projects** with energy providers. Ongoing discussions with Logan Light & Power and Rocky Mountain Energy indicate that such options will likely be available in the near future. Providing facilities with a source of funding to take advantage of such opportunities is appropriate.
- Our report outlines a number of high priority energy-saving initiatives. An ongoing modest increase in the USU Facilities annual budget of \$50,000 would allow faster adoption of these options as timing and technological improvements occur.
- **Air Travel offset re-investments** of \$10 per traveler, per round-trip flight would be paid by the college, department or index supporting each university-sponsored flight. These funds would be utilized for on-campus projects that reduce our greenhouse gas emissions and improve local air quality.
- An **education program** to assist faculty with integrating relevant climate- and sustainability-oriented information in their classes will require funding to expand the Planetary Thinking Across the Curriculum to most "breadth" classes in our general education program. The funds would support a faculty member to direct the program, staff to assist with scheduling and logistics of the workshop, a stipend for 8 workshop leaders, and participant costs to encourage and reward faculty participation and outcomes.

Budget Request for Greenhouse Gas Reduction

	FY21	FY22	Ongoing
Renewable energy contracts	\$60,000	\$60,000	Y
High priority energy initiatives	\$50,000	\$50,000	Y
Air travel offset re-investments	\$50,000	\$50,000	Y
Education program	\$110,000	\$110,000	For 2 years
Total annual costs	\$270,000	\$270,000	

FEEDBACK FROM FACULTY, STAFF AND STUDENTS

A draft of this report was circulated to all faculty staff and students on December 9, 2019 and feedback was obtained via a survey that was distributed to all faculty, staff and students along with the link to the report. We received feedback from 1,149 individuals (Figure A1), including 196 faculty members, 301 staff and 606 students, and 30 individuals identifying as 'other' many of which were postdoctoral researchers or fall into two categories (typically student employees).

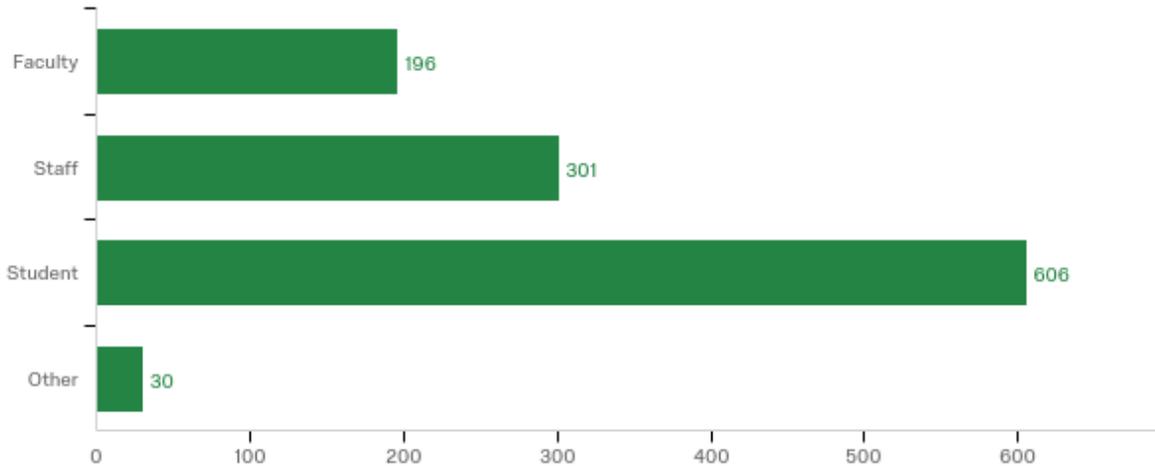


Figure A1. Number of respondents for the survey, grouped by self-identified affiliation with the University.

Feedback on the report was strongly positive, with 65% agreeing or strongly agreeing that the overall quality of the report was high, as compared to 9% disagreeing or strongly disagreeing that the overall quality of the report was high (Figure A2). The percentage of respondents agreeing with the recommendations of the energy portfolio, carbon pricing and education sections of the report were similarly skewed to agree/strongly agree.

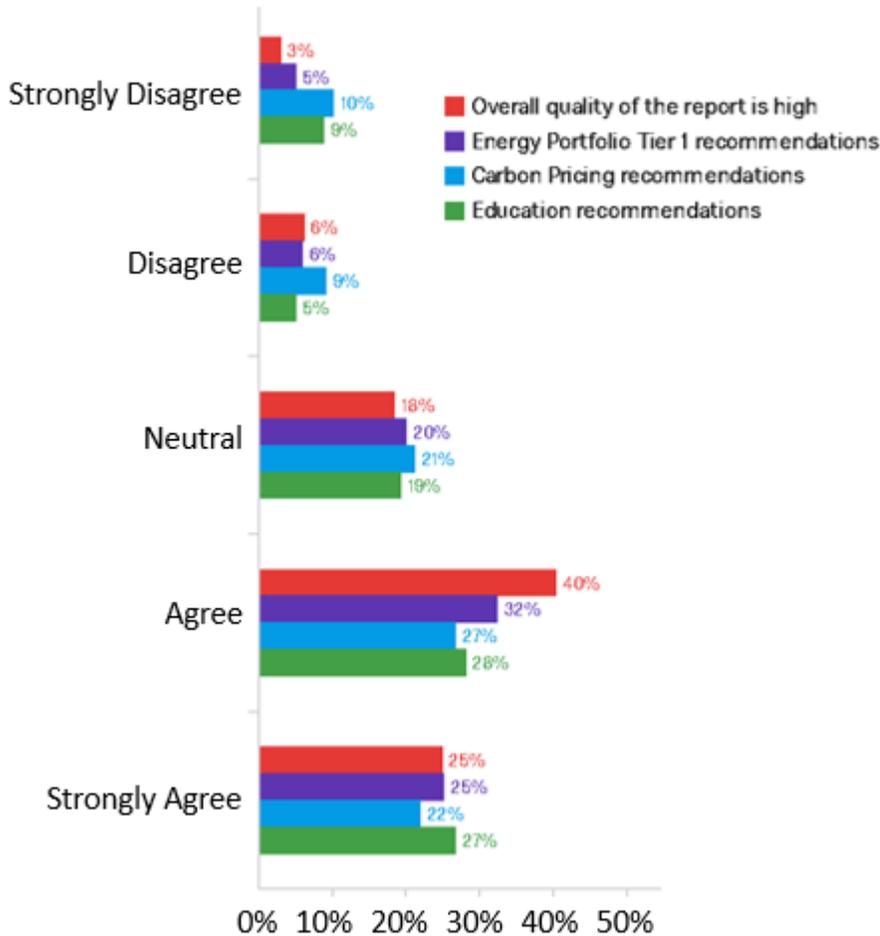


Figure A2. Percentage of survey respondents that strongly disagreed, disagreed, agreed, strongly agreed or were neutral regarding the statement that the overall quality of the report is high (red), and with the recommendations of energy portfolio (dark blue), carbon pricing (light blue), and education (green) sections. Not shown were the percentage of respondents that abstained from judgement of the overall quality of the report (6%), energy portfolio (9%), carbon pricing (9%), and education recommendations (10%).

We requested comments on the overall report as well as the three main sections of the report. Rather than including many, and often lengthy, comments provided, we have concisely summarized the comments below, indicated the number of respondents that made remarks related to each comment (indicated by numbers to the right of each comment), and provide replies to many of the comments.

GENERAL FEEDBACK ON THE REPORT

Number of people that made each comment shown here

General accolades

37

Engage Logan City, CVTD, and other potential partners in Cache Valley

9

- Yes, the committee recognizes the value of reaching out to other partners. Charles Darnell in particular has been working to develop a network of large energy users in

Cache Valley, which will be helpful in working with LL&P, and another network of public universities in Utah that will be helpful in working with Rocky Mountain Power. Much work remains to be done, but we are fully committed to continuing to expand our network and finding mutually beneficial ways to work with our partners to reduce emissions.

The plan needs to be more aggressive

3

- The plan is quite aggressive and should result in emissions reductions of more than 40% over the next five years. There are many, many considerations that have gone into the current recommendations and many more options that are being considered. New possibilities will inevitably emerge over the next few years as technologies and policies continue to evolve. We will evaluate those new options as they emerge.

This report was a tremendous waste of time and effort

1

- We respectfully disagree. This plan greatly reduces carbon pollution, reduces energy costs substantially over the next 5-10 years, and demonstrates a major transition in our campus culture regarding our commitment to sustainability. It has been well worth the large effort invested by committee members and many other faculty, staff and students. Our survey of the campus community indicates strong support for our efforts and recommendations.

Climate change is not real or not caused by humans

7

- The physics of global warming is quite simple and has been understood for over 150 years. At this point we understand the basic physics of global warming just as well as we understand the physics of gravity. And it is known with very high confidence in the scientific community that anthropogenic emissions are causing global warming. It is unfortunate that this issue has been politicized, and in some cases, misinformation has been deliberately circulated, often by those who stand to gain financially from continued sales of fossil fuels. If there were compelling science indicating that climate change was not real or was not caused by humans, scientific theories would rapidly adjust accordingly. But the evidence overwhelmingly indicates that climate change is indeed real, is caused almost exclusively by human emissions of greenhouse gases, and the implications of continued greenhouse gas emissions range from moderately detrimental (under the most aggressive future greenhouse gas reduction scenarios) to potentially catastrophic. For additional information we recommend talking with any of

our excellent climate scientists and/or reading any of the peer-reviewed literature or reports referenced in the USU Faculty Senate Greenhouse Gas Reduction Resolution (publicly available in the February 2019 Faculty Senate meeting minutes).

Convert to carbon-free energy sources before electrifying campus more 2

- This is a very good point. Purchasing electric vehicles and electric leaf blowers, etc. does not do any good if we are still purchasing energy derived from coal, or even natural gas, power plants. We are recommending a phased adoption of electric vehicles and other electric equipment. This phased approach will allow time for us to greatly expand our renewable energy portfolio and allow transportation services time to figure out any logistical challenges with bringing these into our fleet.

The plan does not extend to Statewide campuses 2

- This plan does cover Statewide campuses. We are pursuing a 100% renewable energy portfolio for all Statewide campuses. The one exception to this is the Price campus, which receives its power from Price Public Utilities, but we are engaging with Price Public Utilities to determine how to transition the energy portfolio of that campus over to renewable energy. See Energy Portfolio Tier 1 options.

Cost too much 2

- On the contrary, the vast majority of the energy saving recommendations are being done within the existing Facilities budget and over the long term are expected to save the University money. As an example of the cost savings that can be achieved, the Merrill Cazier library is saving \$5000 per month in energy costs because 85% of the lights in the building were converted to LEDs during 2018-2019.

Costs seem very reasonable 4

Don't waste tax payer dollars 1

- We could not agree more. USU is constantly working to invest taxpayer dollars for the best return on investment. These recommendations reduce pollution and ultimately save the University money.

Don't increase costs for students 13

- USU continues to work incredibly hard to keep costs low for students. The renewable energy and energy saving recommendations require some up-front investment and shifting resources around, but taken together, will result in cost savings to the University and should not increase costs for students. The one recommendation that could result

in a cost increase to students would be parking fees. However, we are not recommending any substantial increase in parking fees. USU has among the lowest parking fees of all of our peer institutions, charging less than half of what many of our peer institutions charge. So while raising parking fees is not one of our primary recommendations, the committee believes it should remain one of many options for managing our carbon pollution.

Students should have access to the raw data and calculations used for the report 1

- Any students interested in working with the raw data and calculations used for this report should contact members of the steering committee.

Please make a shorter version of the report 2

- The key recommendations represent our most concise explanation of the recommendations. Our goal with this report was to provide sufficient detail to allow the University community to understand the complexity of these problems and the wide variety of options that are being investigated. Future explanations of what actions are being taken and why will be more concise.

More or better figures/visuals would be helpful 5

- We appreciate the feedback and agree that additional time and effort could be dedicated to developing additional figures and visuals for this report. However, we feel the time and effort of the volunteers working on this report are better spent on beginning to implement these recommendations and developing effective visuals to communicate progress on these initiatives to the campus community.

USU should divest from fossil fuels 2

- The purpose of this report is to make recommendations that directly reduce USU's carbon footprint. We acknowledge that many other Universities and institutions have divested from fossil fuels for reasons of financial risk and ethics. However, this issue falls outside the scope of our report.

Internal grant program to support decarbonization research 2

- It is conceivable that cost savings from implementing our energy reduction recommendations could be reinvested in this way. However, it is generally preferable that research funding be obtained from external grants. Many external grant opportunities exist for research related to decarbonization and the impacts of climate

change. USU faculty, staff and students have already demonstrated great success in competing for those funds. We commend their efforts and encourage them to continue seeking those external grant opportunities.

Do more sustainability fundraising

2

- Thank you for the suggestion. We agree that sustainability could be the focus of fundraising. We have added text throughout the report highlighting the potential for additional sustainability fundraising.

Get students more involved in sustainability and renewable energy initiatives

7

- There are many opportunities for students to get involved in sustainability and renewable energy initiatives. We recommend interested students contact the Aggie Sustainability Club, USU Green Office Program, Ecohouse, Eco reps, the USU Sustainability Council, SOSNR, USU Food Recovery Network and other organizations. Having said that, as momentum continues to build on campus additional opportunities will emerge and we encourage students to pursue their own sustainability initiatives.

We need more changes at federal and state levels

1

- Inevitably there will continue to be changes in energy and greenhouse gas regulations at the federal, state levels, and local levels of government. And USU has an important role to play in informing those policy changes. However, we need not wait for those changes to implement common sense and cost-effective practices that will reduce our carbon pollution. As Utah's Land Grant Institution, it is central to USU's mission to conduct research that is continually shaping the frontier of climate science, renewable energy, and electric vehicle development and demonstrating how this science, engineering and technology can be put to work to improve life for citizens of Utah and beyond.

Logan campus has lost too much green space

1

- This committee focused on ways to reduce USU's greenhouse gas emissions. We acknowledge that greenspace has important value on our campuses and none of the recommendations in this report reduce the amount of greenspace available. As the University grows there is potential for more loss of greenspace, but faculty, staff and students are free to voice their opinion on the matter when new structures are being considered.

Logan campus spends too much energy, time and water resources and emissions maintaining non-native grass 5

- The overall aesthetic of the campus has been maintained in a way that is generally favored by the faculty, staff and students. Facilities is constantly working to maintain that aesthetic in a way that is water- and energy-efficient. As our campus culture shifts and we complete some of the other major projects laid out in this report we will continue to consider ways in which campus landscaping can reduce carbon emissions, water and energy usage.

We should be using electric carts and equipment (carts, quads, blowers, edgers, chainsaws, trimmers, etc.) 3

- USU Facilities has been carefully surveying the electric and rechargeable equipment available on the market. Most electric landscaping equipment is only suitable for the residential market, but we are seeing increased penetration of the market for commercial-grade landscape equipment. USU currently uses a Global Electric Motorcar to haul campus food waste to the USU compost facility and we are planning to purchase our first electric tractor mower in 2020. And we are building small satellite storage sheds in a few places across Logan campus to eliminate hundreds of trips used to haul mowers, weedwhackers, leaf blowers and other equipment around the campus each day. We have added two paragraphs under Tier 1 of the Energy Portfolio section of the report to explain these developments and the path forward.

Need to improve recycling/reduce waste 6

- USU has made progress in reducing waste and improving composting and recycling over the past decade. The university began composting pre-consumer food waste in 2015, but we agree that more can and will be done. We have not made that a major component of this report because the recommendations we have focused on will have a larger impact and will be easier to implement. As the campus community sees these improvements and our campus culture shifts we expect the campus community to naturally change procurement and consumption behaviors in such a way that reduces waste and improves recycling and composting efforts.

Cover is confusing/misleading or looks doctored 4

- The photos on the cover were not doctored in any way. These photos were taken by Eli Lucero of the Harold Journal at the exact same location on Jan. 7, 2011 (right), a day that Logan had the worst air in the nation, and Jan. 20, 2011 (left), after the inversion

had cleared. The image was reproduced with permission from Eli Lucero. It is important to point out that there is a distinction between greenhouse gas emissions (which are not visible) and particulate emissions (which cause smog in Cache Valley during inversions). While there is some correlation between the two types of emissions, they have distinct impacts on environmental and human health. But the committee felt that the photo represented a visible reminder of our local air quality problems (in Logan and some Statewide campuses) related to emissions that it was appropriate for the cover.

Need more plant-based food

3

- We have chosen not to make recommendations specific to dining services in this report because we wanted to keep the focus on higher impact actions that are easier to implement. But we agree that lowering carbon emissions associated with dining services is important. As a service-oriented, independent entity, dining services responds to feedback it receives from its customers, so we encourage faculty, staff and students to ensure dining services is aware of your desire to see more plant-based food, less waste and more recycling.

Need a big cultural change, lots of bad habits need to change

10

- We agree that a cultural shift is needed to deter the many habits that create unnecessary waste and excessive energy use on campus. The faculty senate and USUSA resolutions as well as the work of the greenhouse gas reduction committee have built upon many other efforts by facilities, the sustainability council, blue goes green program and many others. Continued efforts are needed to raise awareness, draw attention to problem areas, and celebrate our successes. We believe recent efforts have already started to improve our campus sustainability culture and we expect momentum to continue to build as USU begins to make substantial emissions reductions.

We are far behind other universities...catch up!

3

- It is difficult to make comparisons among Universities with different situations and missions. University of Utah, Weber State and others initiated the process of substantially reducing emissions within the past few years, but if the recommendations in this report are implemented, we expect to match or exceed their emissions reductions within the next 2-4 years.

USU's administration does not appear committed to reducing emissions

2

- USU should provide regular reports on progress towards these goals** 1
- The sustainability council will report on progress annually to Faculty Senate. But we agree that the University should be pursuing multiple modes of communication with the campus community, alumni community, and public regarding our progress on carbon reduction initiatives.
- Seems too complicated to account for our carbon budget annually** 1
- We already have a procedure in place to account for greenhouse gas emissions. As an institution of higher education with strong climate and energy programs we believe that it is essential to continue a robust accounting of our emissions. We make recommendations in the report for streamlining the procedures.
- Need to account for university livestock in our carbon budget** 3
- Livestock are accounted for in our current carbon emissions calculations. We make recommendations in the report for improving and streamlining accounting procedures.

ENERGY PORTFOLIO

GENERAL COMMENTS

- General accolades** 17
- Fails to discuss environmental impacts of renewable energy sources and batteries** 4
- There are environmental impacts of just about any human development. Large solar arrays can impact wildlife habitat. Wind turbines can kill birds and bats, especially if they are poorly located, though windows have been shown to kill many, many more birds than wind turbines. Hydropower dams create barriers to fish migration. However, these impacts are almost negligible in comparison to the myriad of profound impacts from continued use of fossil fuels. We encourage those interested to read any of the citations contained in the Faculty Senate greenhouse gas resolution (available in the Feb 2019 Faculty Senate minutes) to identify key papers discussing the predicted impacts of continued use of fossil fuels.
- We should just be educating students, not doing projects to lower our emissions** 1
- We respectfully disagree. The threats posed by climate change, many of which have been studied extensively by USU faculty, staff and students, require profound reductions in carbon emissions.

ENERGY SUPPLY COMMENTS

Support for Rate 34 (renewable energy portfolio from RMP)	9
Support for working with LL&P to develop more renewable energy	6
Support for solar, wind	17
Support for geothermal	8
Support for hydropower	6
Support for small modular nuclear	8
Oppose small modular nuclear	2

ENERGY SAVING COMMENTS

Support for accelerating LED lights	5
<ul style="list-style-type: none"> Conversion to LED lights are typically the most cost-effective action we can take to reduce overall energy demand. Reducing energy demand not only reduces carbon emissions, but also saves us money. LED conversion projects typically pay for themselves in 2-3 years, while the bulbs last 10-20 years depending on usage. The Merrill Cazier Library is saving \$5000 per month since the lighting was converted to LED in 2018-2019. 	
LEDs won't help much	2
<ul style="list-style-type: none"> We respectfully disagree. LED lighting is a robust and well demonstrated technology and the energy and cost savings associated with converting to LED lights are well known. 	
Support for ground source heat pumps	5
<ul style="list-style-type: none"> Ground source heat pumps can reduce energy demand and avoid fossil fuels altogether if powered by renewable energy. We briefly discuss heat pumps in the report (Section 5 of Tier 2 in the Energy Portfolio Section) and Facilities has recently drilled test wells on the Moab and Logan campuses. The Moab test results were very promising. We are waiting for results on the Logan test well. Heat pumps add some complications in building design, especially for retrofits, but Facilities plans to consider this option moving forward. 	
Consider green roofs	2
<ul style="list-style-type: none"> Green roofs have many benefits including energy savings, storm water mitigation, and reducing localized heat island effects. But, due to the high cost, the investment in green roofs for this purpose is not as beneficial as for ground level landscapes in which much more area and vegetation may be developed for the same cost. But we appreciate the 	

comment and have brought it to the attention of USU's architectural team and they will continue to consider this option in future building plans.

Support for accelerating recommissioning

5

- Recommissioning projects help to reduce energy demand for buildings. Facilities has conducted recommissioning projects on USU buildings on a rotating basis, but will be accelerating efforts considerably over the next 10 years, investing \$500,000 per year.

Be more aggressive in reducing energy use on weekends, holidays

1

- USU has made strides to reduce energy demand at night as well as on weekends and holidays. Decisions to reduce energy use must also be weighed against the need to maintain access to facilities and safety. Nevertheless, facilities will continue to consider options to reduce energy use during these times.

Be more aggressive with energy efficiency in new buildings

4

- USU continues to work towards high energy performance for new buildings for compliance with both LEED Silver (minimum) and the State of Utah's High-Performance Building Standard. Many of USU's newest buildings have achieved LEED Gold. USU also has two LEED Platinum buildings, and is working towards its first net-zero energy building in Moab.
- For existing buildings, USU invests annually in energy projects for lighting retrofits, equipment replacement, and envelope upgrades. Commissioning and re-commissioning is performed at regular intervals on all USU buildings (new or existing) to ensure all systems are functioning optimally. Energy Wars is an annual competition to promote energy conservation and awareness by building occupants. This comment has been brought it to the attention of USU's architectural team and they will continue to work to improve energy efficiency in new and existing buildings.

Be more aggressive with actions that improve air quality

6

- Air quality is affected by many factors, including the levels of ozone, carbon monoxide, particulate matter, sulfur dioxide, and nitrogen dioxide. Leading causes of these pollutants are motorized vehicles and livestock. Several of the recommendations in the energy portfolio and carbon pricing sections will help improve local and regional air quality, including efforts to reduce personal vehicle use. However, because USU

represents only very small fraction of total local and regional emissions, the effects of our actions alone will be proportionately small. The greatest impacts USU can have on local air quality will be in the education of our students and the local communities. We have added text to address this in the revised version of the report.

COMMUTING, PARKING AND GROUND TRAVEL COMMENTS

Support raising parking fees	4
Oppose raising parking fees	19
Don't increase parking fees for people with special situations	4
We need more parking on campus	3
Need to disincentivize personal vehicle travel	2
Develop incentives/options for rare car use, less car commuting	6
Reward carpooling	5

- Parking fees were the most controversial recommendation, with 19 comments opposing raises to parking fees and another four opposing raises for anyone with special circumstances that require them to drive. Four comments supported raising parking fees and two other comments recommended disincentivizing personal vehicle travel. Commuting represents a considerable portion of our carbon footprint and is a dominant contributor to poor air quality conditions in the winter. This problem can only be addressed by a combination of actions that improve alternate transport options, incentivize carpooling, walking and biking, allow for telecommuting in situations where that is feasible, yet respects the needs of those who must drive to campus. USU's parking fees are among the lowest of any of our peer institutions, so it is unclear if 15-20% increases in fees would deter many drivers, even those who live proximate to campus. But it is clear that more discussion, education and consideration is needed to address this important issue. We have revised the report to provide more context and discuss this issue more thoroughly.

Existing mass transit options are not adequate	6
Oppose improving alt transport	1
Provide incentives for alternative transport	7
We need a connection to the UTA train system	1

- Mass transit in Logan City goes beyond the scope of this committee, but we agree that there is room for improvement in Logan City mass transit and there are potentially opportunities for mass transit partnerships between USU and Logan City. We encourage

faculty, staff and students to raise this issue with the relevant city officials. We have revised the report to discuss this issue more thoroughly.

Campus should be closed (or more options for remote work) on bad air days 2

- This may be a difficult option to enact and may come with some unintended consequences. However, in some circumstances this may be feasible and is worth further consideration.

Improve bike lanes and bike storage on campus (more lighting, more signage) 4

- Logan City and USU have both been working to improve bike lanes and expand bike paths in the past few years, but we agree that a considerable amount of work remains to make Logan a more bike-friendly city. USU plans to continue increasing bike storage options on campus. We have included this recommendation in the Energy Portfolio section discussing commuting and parking fees.

Close more roads on campus 1

- The decision to close roads requires consideration of many factors. The primary benefits of closing roads are safety and improving the aesthetic of campus. Implications for greenhouse gas emissions are very small. Considering this option falls outside the scope of this report.

Increase electric vehicles available in our fleet 3

- We have recommended that Transportation Services purchase 3-5 electric vehicles to begin evaluating costs and logistical challenges with transitioning our fleet. Also, it is essential that we transition our power supply over to renewable sources prior to expanding our electricity demand, lest we end up charging electric vehicles with power derived from coal-fired power plants.

Need more staff support for sustainability activities 1

- Additional sustainability staff was requested in the faculty senate resolution and may be helpful as sustainability education and activities expand. However, the decision to hire additional staff resides with the supervisors that determine the need for new personnel versus options to redefine the roles of existing personnel.

There are no references to primary literature in the report 2

- This report was not intended to include references to primary literature. However, we encourage interested readers to the faculty senate resolution passed in February 2019, which includes 27 of the most relevant references. Additional information can be

obtained from members of the Utah Climate Center, the Climate Adaptation Science program and other relevant programs at USU.

- Single pane windows in some student housing and HPER are inefficient** 2
- These will be evaluated and considered for replacement as part of the recommissioning and energy saving projects that Facilities has committed to over the next several years.

- There may be other non-traditional carbon offsets we should consider (e.g., planting trees, soil C fixation)** 5
- Yes, there are several other viable carbon offsets that could be implemented, including planting trees and increasing soil carbon storage. USU owns a considerable amount of land and, as one comment pointed out, there are benefits to planting additional trees on campus in terms of reducing water usage, and potentially energy usage, in nearby buildings if the trees are planted in locations that create shade during the hot summer months. There is an opportunity for faculty, staff and students to work with facilities to determine the most effective ways to implement this strategy.

CARBON PRICING RECOMMENDATIONS

GENERAL COMMENTS

- General accolades** 11
- Did not understand this section** 2
- Opposed to any kind of carbon tax** 3
- The proposed fee on travel is intended to offset the carbon produced by air travel taken as a part of university business. It is similar to other waste produced on campus or chemical disposal on campus, both of which are paid for by the University as part of doing business. The fee proposed would offset carbon pollution by funding projects that prevent carbon production locally.
- I don't understand what a metric ton of carbon is** 1
- A metric ton of carbon dioxide is the weight of atoms in CO₂, which is often used to measure emissions. The easiest way to imagine a metric ton of carbon dioxide is to think of the types of activities that produce a metric ton. For example, according to the U.S. EPA, burning 113 gallons of gas or using electricity in a house for two months would produce one metric ton of CO₂. If you would like to visualize how much carbon dioxide that is, the Environmental Defense Fund describes the size of

one metric ton as the equivalent of a 10-cubic yard balloon full of CO₂ at standard temperature and pressure. Every year since 2007, USU has emitted approximately 100,000 metric tons of CO₂ each year.

Need to educate faculty more about travel pollution

4

- We agree that more education is needed, which is why this report proposes an expansion of the Planetary Thinking program. This program would provide resources to more faculty on campus about pollution produced by travel and other activities conducted as a part of university business. In the past, USU's sustainability coordinator has offered guest lectures in Connections, in courses, and to Planetary Thinking faculty. Rob Davies provided a presentation in new faculty orientation in 2019. This report is one way the university has provided additional education to the university community but we agree that continued and expanded efforts are needed.

SHADOW PRICING

Generally support shadow pricing

7

Misunderstood and thought the shadow price is money that transfers hands

1

- The shadow price is not an actual charge or price paid with money. It is an exercise for large purchases to consider the lifetime cost, including upfront, ongoing costs, and carbon emitted over the lifecycle. No money directly changes hands as a result of calculating the non-binding shadow pricing. The results of the analysis should provide people making purchasing decisions with useful information they can use to save money and reduce carbon emissions over the long term.

Shadow pricing should be planned with stakeholders and not be onerous

2

- Yes, if shadow pricing is implemented, groups that make related purchases will be consulted on forming guidelines and trained in conducting a shadow pricing analysis.

Consider carbon emissions in our all procurement procedures

4

- In order to avoid excessive administrative burden, the shadow price is recommended for carbon-intensive purchases, especially those that are above \$5,000, which is the low dollar limit for small purchases. The university already has an energy policy requiring many types of electronics and equipment are Energy STAR certified, which reduces electricity use of smaller electronics.

Need to consider carbon footprint of choices from Dining Services

2

- Food is a large source of carbon emissions, but it falls outside the university's current greenhouse gas emission tracking. A recommendation has been added that Dining

Services evaluates their purchases for carbon emissions, with the intention of including it in the university's greenhouse gas inventory in 2021.

Shadow pricing needs more teeth/should be binding

3

- At this time, the committee chose to recommend shadow pricing as a way to provide more information to purchasers as a non-binding guideline. Currently, it is informational. Though there are no plans to make it binding, the university could choose to give it weight in purchasing decisions.

We should not prepare for the impacts of a carbon tax

1

- Putting a price on carbon emissions is currently being considered by legislators across the political spectrum at state and federal levels. Preparing for a future state or federal carbon tax now with a self-imposed system will enable USU to make better decisions and reduce emissions in a proactive and cost-effective manner. If USU waits to consider the potential costs in the case that a carbon tax is implemented at the state or federal level, we risk having a large increase in energy costs or tax liability.

Did not understand why institutions are adopting carbon pricing

1

- Institutions are adopting carbon pricing because putting a price on carbon discourages carbon-intensive choices and avoids risk associated with future increases in costs associated with fossil fuel consumption. The recommended small fee on work related air travel raises money for local carbon reduction or offset projects. Furthermore, shadow pricing in purchasing decisions helps institutions consider long-term costs of purchases, including energy use and carbon emissions over the lifetime of the purchase. Without directly costing more, shadow pricing provides a more comprehensive lifecycle cost of a particular decision.

TRAVEL FEE

Support air travel carbon pollution fee

17

Increase air travel carbon pollution fee

6

- The \$10 level is meant to partially cover the cost of pollution without being punitive. Also, this small fee serves as a reminder to individual travelers and departments that long-distance travel produces a considerable amount of carbon pollution. The fee is within the typical daily fluctuations of air travel ticket prices. For many departments, this price could be a few hundred to a few thousand dollars a year. For example, the Quinney College of Natural Resources faculty and staff completed 308 round-trip flights in FY18. QCNR Dean Chris Luecke took the initiative to transfer \$3080 to facilities, which paid for installation of motion detection lights for the NR building.

The committee recommends for the carbon price to increase over time to reflect the social cost of carbon recommended for shadow pricing. The price starts at \$10, so the change is not too drastic. An incremental increase over a few years will give departments time to adjust budgets and travel decisions.

Have President Cockett mandate how much travel employees can do 1

- It would go against the core principles of shared governance, academic freedom and good management for President Cockett to simply issue a mandate limiting travel. Further, the committee does not want to ban anyone from conducting their work duties. Our recommended course of action, putting a price on our carbon pollution and raising awareness, gives purchasers a financial indication of the cost of carbon pollution generated by their trip and puts individuals in a better position to make decisions about their own travel and manage their own work activities and budgets. The process of organizing a committee, consulting departments, distributing a survey to collect feedback, and putting the report out for review is meant to build support for initiatives without requiring a presidential mandate.

Supports air travel fee based on distance 1

- The current travel system cannot easily collect all the information required to accurately calculate carbon emissions from a particular trip. In addition to distance, the system would need to include the number of legs, and the type of aircraft. The effort required for travelers or the travel office to collect this information seemed excessive, which is why the flat fee was recommended.

Supports air travel flat fee/ Opposes travel fee based on distance

- We agree that the flat fee is the simplest way to introduce a price on carbon.

There should just be a flat fee for each college for travel offsets 1

- The decision to recommend the flat fee per trip at the department level was to implement the fee as close to the point of consumption as possible, so travelers and departments would associate the charge with flights they were taking.

If departments have to pay travel fee, increase operating budgets 2

- This comment has been noted. The committee does not have information on whether the carbon price will be implemented or whether departments will receive additional funding to pay for it.

A carbon tax will disproportionately affect lower income people or departments 5

- The \$10 air travel fee is an almost negligible cost relative to the cost of any trip requiring air travel. It is unclear how departments or programs would have adequate

funding to support trips that necessitate air travel, but would not have \$10 to account for the pollution associated with that air travel. It seems to be a matter of priorities and whether or not one feels responsible for the pollution created by their activities.

Favor individual decision to donate

1

- The current opt-in carbon offset fund comes from voluntary donations. Approximately, 100 travelers chose to donate, and the fund accumulated less than \$3,000 in 2019. However, the voluntary offset was not raising awareness adequately or raising enough money to offset the amount of carbon produced by work-related travel at USU.

Create a mechanism for employees to donate money for additional offsets

1

- We agree that USU could create additional opportunities for internal and external donations to support carbon reduction and offset efforts. We have added text in the report to further emphasize this point.

Opposes travel carbon pollution fee

8

- Several comments opposed the carbon offset fee if it increased parking permit prices or parking fines. Though the energy portfolio section includes raising parking prices as one option, the proposed carbon offset fee was not recommended in the report to be added to parking passes. It would only be assessed for air travel.
- Other comments were concerned that the carbon price would increase student fees. The travel fee is proposed to be added per person, per roundtrip, and the committee recommends that departments would be responsible for the fee. Students would not pay the carbon price in student fees. If students were traveling on university business, the fee would be covered by the department, program, or index covering their travel. The most likely occasion for students to encounter the fee directly would be in study abroad.
- Over time, the travel fee would contribute toward carbon reduction on campus. Some carbon-reduction projects might reduce fuel or electricity consumption and reduce costs over time.

Could impose new student fees to offset activities that have unavoidable emissions

1

- Students interested in contributing more could donate to the carbon offset fund. There are no plans to create a carbon offset fee targeted at students. Students have already approved fees that support the Student Sustainability Office and grant program. Some of these projects also reduce carbon. Additionally, students have

approved fees to support Aggie Shuttle and Aggie Blue Bikes, both carbon-reducing measures.

Do not deter necessary travel/Travel is mandatory or a perk for faculty 6

- The effects of carbon emissions are serious enough that they should be a consideration in whether the value of a trip is worth the cost. The committee recommended a \$10 fee to draw attention to carbon emissions associated with travel without preventing travel necessary for work. For many departments, this price could be a few hundred to a few thousand dollars a year. For any given plane ticket, the fee is well within the usual fluctuation of ticket prices.

The plane will fly regardless of whether someone from USU is on it 2

- While USU's travel practices will not launch or ground many individual plane trips, the university tracked nearly 6,000 air trips and over 18 million miles in 2018 traveled as a part of operations. It adds up, especially if USU, other institutions, and individuals all consider carbon in their decisions. While individual decisions seem insignificant, in aggregate they matter. The example that USU sets in considering the carbon pollution generated by our air travel sends an important message to the public to do the same, and sends an important message to the airline industry that they should accelerate efforts to minimize the pollution associated with their activities. While we acknowledge the many, many benefits of air travel, airlines are not exempt from the simple physics of global warming and climate change.

Need to make sure the travel fee is going to impactful projects 2

- The committee recommends the carbon offset fund supports local projects that reduce carbon and/or improve air quality. The impact of these projects will be measured or estimated and communicated to the campus community.

Charge an offset fee for commuters and other ground travel 4

- The committee considered adding a fee for ground travel and left the option open for the future. Currently, the committee considered the quantity of trips, lack of ability to track distance and efficiency, and relatively small amount of carbon per trip as issues that would need to be resolved before a ground travel fee could be implemented.

Can grants pay a carbon fee?

- It depends on the grant. For some grants the travel fee would need to be paid out of other funding.

Is the carbon fee per person or per TA?

- The travel fee is per person, per round trip. We have clarified this in the revised version of the report.

What about the aviation program? What about Athletics?

- All travel covered by a TA would be included in the current proposal.

EDUCATION RECOMMENDATIONS

GENERAL COMMENTS

General accolades	24
We need our faculty and admin to have a better understanding of climate change	11
<ul style="list-style-type: none"> • Climate change is an incredibly complex topic and climate science has evolved rapidly over the past decade. Our understanding of the environmental, economic, and social implications of climate change improves on a daily basis. We fully agree that there is a critical need to better educate faculty, staff, administrators and students on climate change and provide mechanisms for faculty to integrate the complex topics of climate change and sustainability into the curriculum. This is precisely the goal of the Planetary Thinking program. 	
There needs to be more education for staff to understand the issue	7
<ul style="list-style-type: none"> • Our recommendation to institutionalize and expand the Planetary Thinking program is intended to improve understanding throughout our curriculum and therefore shift the entire sustainability culture at USU, including faculty, staff, students and administrators. However, we agree that a more direct approach may be needed to engage staff in coming to understand the issue and solutions better. It goes beyond the scope of this report to fully develop that approach, but we have revised the education section to indicate the need for direct engagement of staff. 	
The education section needs more detail	4
<ul style="list-style-type: none"> • We have added additional detail in the revised version of the report. 	
Support for expanding Planetary Thinking	5
The Planetary Thinking program is ineffective	1
<ul style="list-style-type: none"> • No arguments were provided to support this statement. To the contrary, members of the committee who have participated in the program found it to be effective and believe that it would be all the more effective if it were to have a director with a 	

significant portion of their role dedicated to developing and implementing the program. Up to this point, the Planetary Thinking program has been run on a very small and inconsistent budget, by a handful of volunteer faculty and staff.

This will provide students with important knowledge/skills for future employment 1

- Yes, infusing sustainability and climate change into our curriculum provides many opportunities to integrate critical knowledge and skills for future employment.

There needs to be more education for staff to understand the issue 7

Seems like the education efforts are aimed at faculty 1

- The Planetary Thinking program is primarily focused on helping faculty integrate climate change and sustainability concepts into their curriculum. Ultimately the program is all about improving the curriculum for the benefit of the students and the rest of the campus community.

Rather see funding go to directly reducing emissions 2

- The funding requested to support the two-year education program will improve the education for tens of thousands of USU students and could plausibly result in many of those students taking actions to reduce their own carbon footprints and developing innovative new ideas for USU and other institutions to reduce their own carbon footprint.

Support for Environmental Attitudes and Literacy Assessment 1

- The Environmental Attitudes and Literacy assessment could be an important way for us to understand how student perspectives and understanding are evolving over time.

Existing sustainability electives have low enrollment 1

- We do not have data to support or refute this comment. However, our recommendation is not to create new sustainability electives, but rather to infuse sustainability and climate change concepts into a wide variety of courses. Climate change is already, and will continue to impact nearly every facet of our environment, economy, and society. This should be reflected in our curriculum.

Sustainability teaching innovations should not be considered for promotion and tenure 5

- We acknowledge that our explanation of this recommendation was inadequate in the initial draft of the report and we have attempted to clarify this point in the revision. Climate change and sustainability content is inherently challenging to integrate into

classes because the issues are complex, often intertwined with a multitude of other issues that span multiple disciplines, and require well-developed, real-world examples that students can relate to their own lives. It takes a considerable amount of work to do this well. When integrated in a robust manner, climate change and sustainability issues provide powerful opportunities to develop critical thinking skills, interdisciplinary perspective, combine quantitative and qualitative information, and engage students in issues that directly impact their lives and which they in turn can also influence. If done poorly (i.e., just presenting doom and gloom, ignoring interdisciplinary connections, or providing only superficial or partially developed examples), students may glean very little from the content and may become disengaged or even resentful of having to learn sustainability-oriented content. The existing Planetary Thinking program has effectively provided faculty with skills to properly integrate climate change and sustainability content into their courses, but it requires hard work. And that hard work should be acknowledged within promotion and tenure reviews, just as any other teaching innovations would be considered.

USU should not be teaching interdisciplinary courses

1

- We respectfully disagree. Interdisciplinary courses, and disciplinary courses that integrate interdisciplinary content, provide some of the most important opportunities for students to develop critical thinking skills, quantitative and qualitative analytical skills, and perspective to deal with real-world problems.

Sustainability/climate change is not relevant or feasible to teach in some programs

1

- We agree. The proposed education program would be on a voluntary basis for faculty who see the value of integrating sustainability and climate change topics into their course content.

Education piece is most costly, but least proven

2

- Integrating complex and real-world problem-solving into course content is known to be an effective teaching practice. The Planetary Thinking program itself has not been assessed because it has been run with a small and tenuous budget by a group of volunteer faculty and staff. Designating a director with a specified budget over two years will allow for the program to flourish and engage a large number of faculty in a short period of time. The cost of the recommended program is small relative to many

other educational programs on campus, especially considering the number of students that will benefit.

Could be mandatory awareness videos for students and faculty 3

- Yes, we have several internationally renown faculty on campus who could provide short videos for the campus community and beyond. We could also compile a small collection of some of the most effective videos on the topic. To our knowledge there are no significant barriers to faculty developing such videos, but additional resources from central administration may improve the quality of such videos and demonstrate more of an institutional commitment to the issue. It is not unreasonable for such videos to be mandatory viewing for faculty, staff and students, as the threats posed by climate change greatly exceed threats posed by any of the other activities for which training videos have been mandated. Whether and how viewing of such videos should be mandated or encouraged is a decision that can be made on a course-by-course basis by individual instructors, or for the entire University by the Provost or President. We have revised the Education/Awareness section of the Energy Portfolio section of the report to include this recommendation.

Need to overhaul general ed program and integrate sustainability concepts 6

Add climate change literacy to general education outcome criteria 1

- Integrating sustainability and climate change concepts into a wide range of courses is the goal of our education recommendations. General education courses are clearly excellent opportunities to integrate such concepts. The General Education subcommittee of the Education Policies Committee is aware of our recommendations and has already started considering ways this could be done effectively.

Some faculty/programs are already doing this 2

Need to help students think critically about these issues and debunk propaganda 1

Make this empowering for students and not to create more anxiety surrounding this issue 4

Don't indoctrinate students 4

Need to avoid partisan language/bias 4

Sustainability studies should be optional, not mandatory 5

Don't infringe on academic freedom 3

- Yes, some faculty and departments are already doing much of what was proposed. To some extent, that may be an indicator of the success of the Planetary Thinking program, though some faculty or programs may have been exposed to similar concepts by other

means. Nevertheless, we strongly agree with all of the comments listed in this group. Sustainability and climate change concepts naturally lend themselves to developing critical thinking and debunking propaganda. The Planetary Thinking program has a strong critical thinking focus and already touches on issues of avoiding partisan language/bias and enabling students to explore problems and discover solutions for themselves (the antidote to indoctrination). With a dedicated director, the Planetary Thinking program would be all the more effective in these efforts. Lastly, our recommendation is to incentivize, but not require, faculty to participate in the Planetary Thinking program. Participation would be entirely voluntary, so there is no potential for infringement of academic freedom.

Ag literacy is just as important as sustainability 1

Ag college should put more emphasis on sustainable agriculture 3

- Agricultural literacy is an important component of sustainability.

Create a dashboard where people can see consumption data 1

- Multiple alternatives are being considered for the communication plan. We agree that it is important that the entire campus community can easily access information that will allow us to continually assess USU's progress in reducing our greenhouse gas pollution. It goes beyond the scope of this report to specify how that information should be disseminated, but we agree with the need for effective dissemination.

Need better online tools to reduce people having to drive long distances for classes 1

- This comment has been noted. We acknowledge the value of reducing commuting distances and the shortcomings of some of our existing tools for online education. Improving the technological aspects of our online education tools goes beyond the scope of this report, but the topic is worthy of further consideration by the relevant programs.

Important to support faculty and students in rural areas where there is more resistance to environmental protection 1

- We acknowledge that there are unique challenges for presenting sustainability and climate change content in a context-specific and culturally sensitive manner. The Planetary Thinking program is highly adaptable, providing a forum for faculty members to consider their specific course, students and other relevant context and to build curriculum accordingly.

Develop a program of student climate change scholars

1

- This is a wonderful suggestion and is worth further consideration. Committee members will engage the undergraduate research program, honors program and other relevant programs to begin discussions about how such a program could be implemented.

Climate change education may discourage some students from staying at USU

1

- Infusing sustainability and climate change concepts into our curriculum provides opportunities for critical thinking, quantitative and qualitative analysis, and real-world problem solving. We believe that if done in a robust manner, the recommended education program should draw students to USU and continue to improve our rates of student success.