USU GREENHOUSE GAS REDUCTION COMMITTEE
Draft Final Report

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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.

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. This draft report is being released with the intent of updating the USU community on the committee’s findings and recommendations. We welcome feedback and suggestions on this report prior to December 31, 2019 and will release a revised, final report prior to January 13, 2020.

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 provided by 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 improving air quality on and near USU campuses.

9. 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.

10. 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. Formal reassessment of the sources being considered should be conducted every three years.

6. Raw data and calculations should be made available for review by faculty, staff or administrators upon request.
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 over the next twenty years.

**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. Education for campus users could be a bigger 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:** 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 fees.
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.

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.

**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-owed 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 fail 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 gases 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 ‘shadow’ carbon price of $40 per ton 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 Colombia 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” on carbon is a price the university could use to make purchasing decisions in a life cycle analysis. 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 price, 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 university-implemented travel fees 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?

![Survey Results Graph](chart.png)
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 of 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.

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<th>Carbon Price by energy use</th>
<th>Proxy/Shadow price</th>
<th>Carbon Payment off the top</th>
<th>Travel Price flat fee</th>
<th>Travel Price by distance</th>
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Table 1. Examples of internal carbon pricing mechanisms used by Universities
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<tr>
<th>Example</th>
<th>Scope 1 &amp; 2 (produced, purchased)</th>
<th>Scopes 1, 2, 3 (produced, purchased, indirect)</th>
<th>Scopes 1, 2, 3 (produced, purchased, indirect travel)</th>
<th>Scope 3—indirect travel</th>
<th>Arizona State considered it, but it was not compatible with their system.</th>
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<tr>
<td>Yale, Swarthmore</td>
<td>Yale charges $40/MT</td>
<td>Princeton, Smith, Swarthmore</td>
<td>Weber State</td>
<td>Arizona State University, UCLA, University of Maryland, Whitman (students)</td>
<td>ASU charges $8/RT flight, which will increase to $18</td>
</tr>
<tr>
<td>Price</td>
<td>Swarthmore pays $23/MT.</td>
<td>Smith uses $45/MTCO2e</td>
<td>Weber effectively pays $5/MT for Scope 1 &amp; 2.</td>
<td>UCLA $9 domestic/$25 int’l</td>
<td>UCLA and UMD also have processes to offset carbon with the collected fees.</td>
</tr>
<tr>
<td>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.</td>
<td>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.</td>
<td>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.</td>
<td>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.</td>
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<td>Advantages</td>
<td>Challenges</td>
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<td>----------------------------------------------------------------------------</td>
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<tr>
<td>• Scope one emissions are the largest portion of USU’s GHGs.</td>
<td>• Auxiliaries are self-funded and may find the charge burdensome.</td>
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<td>• USU can directly control scope one</td>
<td>• Units that pay their own bills do not have incentives to reduce energy use.</td>
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<td>• An internal price could provide incentives for units to become more efficient</td>
<td>• Multiple units use buildings, so refunds would be complicated.</td>
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<td>• Provides a funding source to reduce USU’s carbon emissions</td>
<td>• Purchasers would need training to purchase carbon-related items.</td>
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<td>• The only costs are administrative.</td>
<td>• It is important to set the price correctly, and social cost estimates vary.</td>
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<td>• Weights projects that produce less carbon or avoid carbon production</td>
<td>• Administrators may prefer for subunits to pay the carbon price.</td>
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<td>• Addresses the majority of USU’s carbon emissions (scopes 1 &amp; 2)</td>
<td>• Its effect on incentivizing efficiency will be minimal since only VPs will see it.</td>
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<tr>
<td>• Simple</td>
<td>• Travel is only 21% of USU’s emissions, and air travel is about half of that.</td>
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<td>• Less visible, so less controversial</td>
<td>• Departments that require more travel would be more greatly affected.</td>
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<tr>
<td>• Provides a funding source to reduce carbon emissions</td>
<td>• Might discourage study abroad, research, and other travel that supports USU’s mission.</td>
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<tr>
<td>• The charge becomes smaller as USU produces less carbon if paid per ton.</td>
<td>• Not responsive to distance</td>
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<tr>
<td>• Provides a funding source to reduce USU’s carbon emissions</td>
<td>• Travel is only 21% of USU’s emissions, and air travel is about half.</td>
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<tr>
<td>• The charge becomes smaller as USU produces less carbon if paid per ton.</td>
<td>• Departments that require more travel would be more greatly affected.</td>
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<tr>
<td>• Addresses one major source of carbon</td>
<td>• Might discourage study abroad, research, and other travel support USU’s mission.</td>
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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 workshoped 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

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
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 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, are 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.
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 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

<table>
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<tr>
<th></th>
<th>FY21</th>
<th>FY22</th>
<th>Ongoing</th>
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<tbody>
<tr>
<td>Renewable energy contracts</td>
<td>$60,000</td>
<td>$60,000</td>
<td>Y</td>
</tr>
<tr>
<td>High priority energy initiatives</td>
<td>$50,000</td>
<td>$50,000</td>
<td>Y</td>
</tr>
<tr>
<td>Air travel offset re-investments</td>
<td>$50,000</td>
<td>$50,000</td>
<td>Y</td>
</tr>
<tr>
<td>Education program</td>
<td>$110,000</td>
<td>$110,000</td>
<td>For 2 years</td>
</tr>
<tr>
<td><strong>Total annual costs</strong></td>
<td><strong>$270,000</strong></td>
<td><strong>$270,000</strong></td>
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