WATTSMART COMMUNITIES

UTA

# Energy Action Plan

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ROCKY MOUNTAIN POWER

# Acknowledgements

A special thanks to the following individuals who helped develop this Energy Action Plan.

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# Energy Action Plan

## About this Plan

In 2020 Utah Transit Authority (UTA) partnered with Rocky Mountain Power's Wattsmart Communities program to develop the organization's first energy action plan. This plan builds upon the Interagency Partnership Vision, which was developed between the two entities in order to accelerate the transition to clean energy. The goals and strategies outlined in this plan were developed collaboratively with technical experts from UTA and Rocky Mountain Power, laying the groundwork for a successful long-term partnership.

## Our Energy Vision

Provide an integrated system of innovative and accessible public transportation services that use efficient and renewable energy systems and support the development of strong partnerships to contribute to a healthy environment for the people of the Wasatch Front.

## Sustainability Energy Index

The Sustainable Energy Index was developed to reflect progress made on multiple energy-related fronts. The index combines multiple metrics into one score that reflects overall performance. UTA will strive to maintain the Sustainable Energy Index in the green showing that they are outperforming peer agencies.

### 2018 Baseline Score

**Breakout**

### Air Pollutants Avoided

Ratio of transit air pollutants emitted to avoided personal vehicle emissions


### Building Efficiency

kbtu/ sq. ft.


### Greenhouse Gas Emissions Avoided

Ratio of transit GHG emissions to avoided personal vehicle emissions


### Vehicle Efficiency

MMBtu/revenue miles


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# Strategy Summary

The UTA Energy Action Plan has four focus areas, each with a set of strategies intended to work toward the overarching plan vision. The following table lists the strategies included in the plan, organized by strategy type.

| | | | Policies & Programs | Demonstration Projects & Research | Capital | Real Estate |
|---|---|---|---|---|---|---|
| Energy Demand & Use | Energy Efficiency | 1-1: Continue LED lighting upgrades* | | | ■ | |
| | | 1-2: Continue installation of building automation systems* | | | ■ | |
| | | 1-3: Share best practices in energy efficiency | ■ | | | |
| | | 1-4: Refresh employee energy efficiency campaign | ■ | | | |
| | | 1-5: Optimize building use | | | | |
| | | 1-6: Improve efficiency of snowmelt systems | | ■ | | |
| | | 1-7: Incorporate energy efficiency into grant funded electrification projects | ■ | | | |
| | | 1-8: Establish energy efficiency standards for new equipment | ■ | | | |
| | Electric Vehicles | 2-1: Develop vehicle charging schedules | ■ | | | |
| | | 2-2: Partner with other organizations to acquire electric buses | | | ■ | |
| | | 2-3: Promote benefits of electric buses to the public | ■ | | | |
| | | 2-4: Optimize the size of the white fleet | ■ | | | |
| | | 2-5: Evaluate the total cost of ownership when purchasing new vehicles | ■ | | | |
| | | 2-6: Pursue grant funding to replace white fleet vehicles with EVs and employee EV charging stations | | | ■ | |
| | | 2-7: Convert direct current (DC) drives in TRAX vehicles with alternating current (AC) drives* | | | ■ | |
| | | 2-8: Identify a location for a multiuse charging hub* | | | | ■ |
| Electrical Supply | Electrical Infrastructure | 3-1: Implement substation upgrades | | | ■ | |
| | | 3-2: Explore wayside storage systems at TRAX stations | | ■ | | |
| | | 3-3: Utilize a portable substation to improve system resiliency | | ■ | | |
| | Grid Resilience | 4-1: Increase participation in RMP Blue Sky program* | ■ | | | |
| | | 4-2: Organize tours of the Intermodal Hub and EVR Research Facility | ■ | | | |
| | | 4-3: Develop a bus charging algorithm | | ■ | | |
| | | 4-4: Research the intelligent integration of vehicles, the electric grid, and solar | | ■ | | |
| | | 4-5: Integrate on-site solar and microgrid technologies | | ■ | | |
| | | 4-6: Investigate rooftop solar opportunities* | | | ■ | |

*RMP programs or incentives are available to support this strategy

# 1 Decide to Thrive: Energy Action Plan Background and Planning Process

Utah Transit Authority (UTA) and Rocky Mountain Power (RMP) are continually making major investments in Utah's transportation and power infrastructure. Both entities are committed to using clean energy to power Utah's future and recognize the greater potential in collaborating to achieve mutual clean energy goals. For these reasons, the two entities developed the Interagency Partnership Vision document, establishing a long-lasting partnership for working together to power Utah's future.

To support the implementation of the Interagency Partnership Vision, UTA partnered with Rocky Mountain Power's Wattsmart Communities program to develop the agency's first energy action plan. Wattsmart Communities is Rocky Mountain Power's newest program within the Wattsmart portfolio. This program broadens Rocky Mountain Power's energy efficiency and renewable energy programs delivered to entire communities, or entities such as UTA, with the commitment to support the unique needs of the entity toward achieving its sustainable energy goals.

As part of the Wattsmart Communities energy-planning process, UTA stakeholders were identified and invited to participate on an Energy Planning Team for three planning workshops where their input on UTA priorities were gathered to help answer three essential questions (Figure 1): Where are we now? Where do we want to go? and How will we get there?


*Figure 1: Wattsmart Communities Planning Process*

Figure 2 highlights an interactive planning exercise to discuss team member roles and perspectives – with the intended result of having a well-informed and supported plan. The stakeholders will be essential in leading the strategies identified and in engaging the entire agency for the greatest impact.

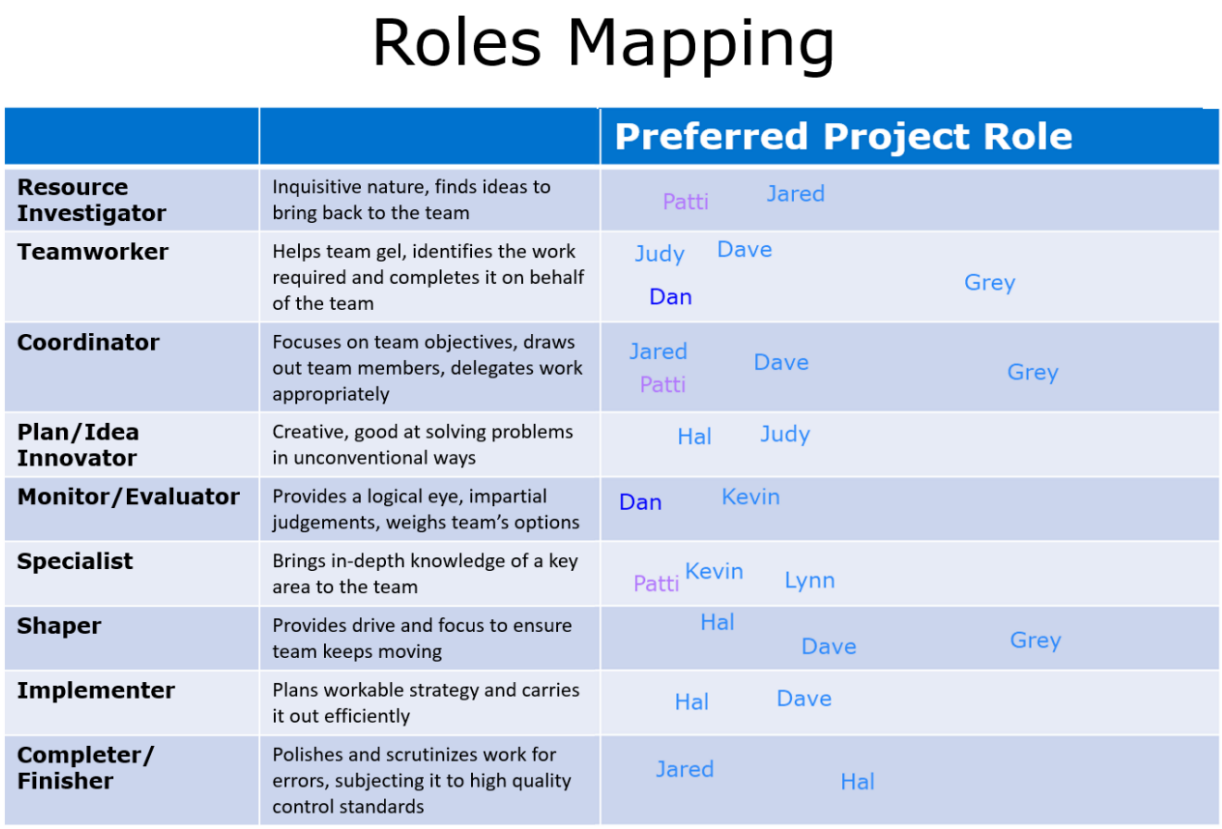


*Figure 2: Roles Mapping Exercise from Workshop 1 Showing Participants Desired Role in the Energy Action Plan*

## Plan Organization

This plan follows the structure of the Interagency Partnership Vision that is organized around five *focus areas* to accelerate the transition to clean energy. The Energy Action Plan provides actionable goals, targets, and implementation strategies for each focus area. Figure 3 highlights the interrelationship between the plan focus areas. Through the *Energy Efficiency* and *Electric Vehicles* focus areas, this plan addresses energy demand and use at UTA through the smart and efficient use of energy in buildings, stations, and vehicles as well as the transition of diesel and other transportation fuels to electricity. The *Electrical Infrastructure* and *Grid Resilience* focus areas ensure this new electrical load is supplied by reliable clean electricity. The fifth focus area, *Research & Grants*, supports the other four focus areas by providing funding and innovation to advance initiatives.

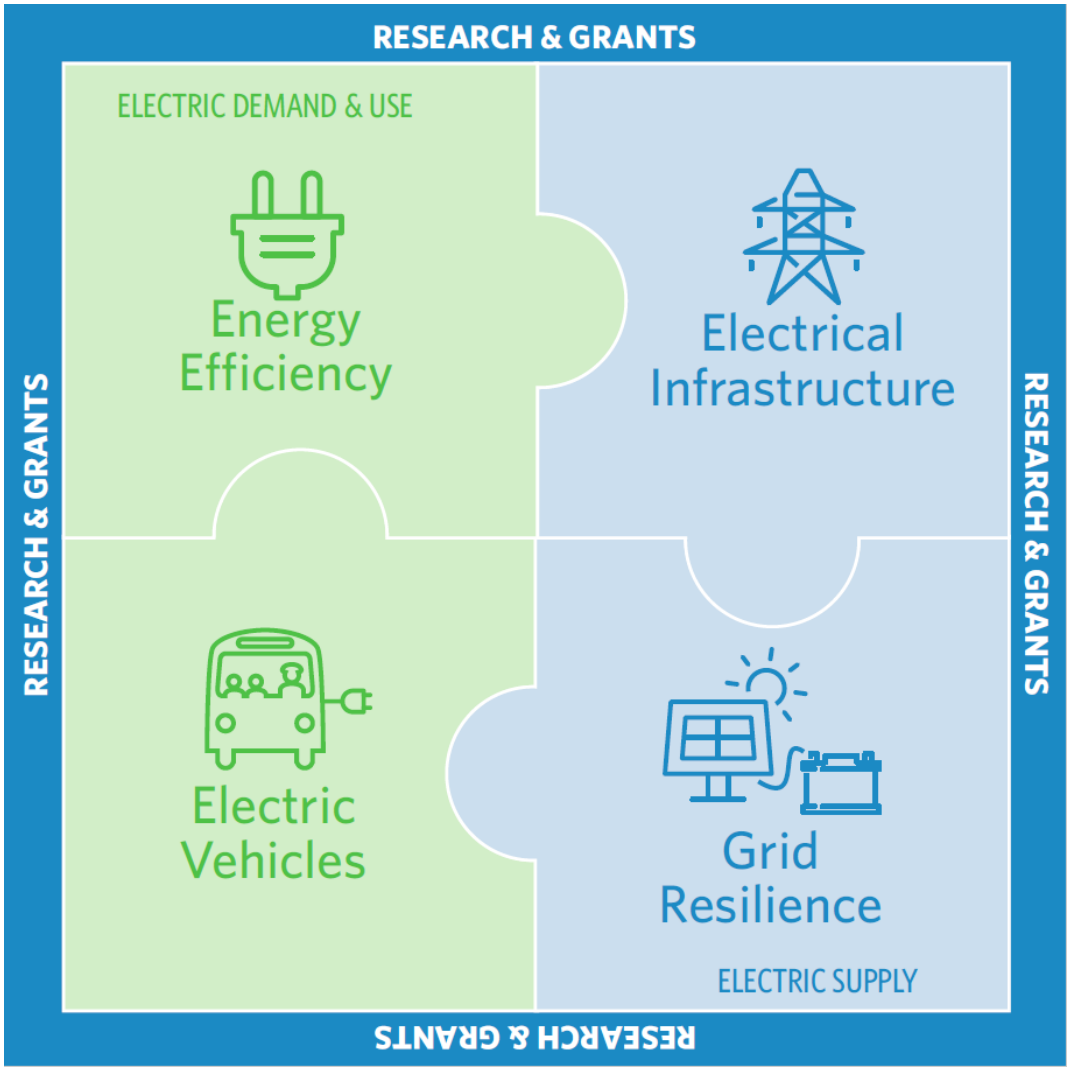


*Figure 3: Interagency Agreement Focus Areas*

The Energy Action Plan also fits into UTA's larger sustainability initiatives by laying out sustainability goals specific to energy use across the agency. These goals will be incorporated as UTA refreshes its overarching sustainability plan.

# Where Are We Now? Energy Baseline and Current Initiatives

The first step in the Wattsmart Communities planning process is to explore the agency's energy profile that provides a picture of UTA's current energy landscape. Wattsmart Communities facilitators analyzed and presented electric energy consumption data to illustrate the electricity baseline as a framework for developing the targets and actions in this plan. The energy profile illustrates historic stationary and transportation energy use, helps identify potential opportunities, and supports decision making during the planning process. Three years of data (2016-2018) were used for analysis, with 2018 established as the baseline against which to compare future progress toward the energy goal UTA set as part of the planning process. Data to support this analysis were supplied by RMP and UTA.

UTA's overall energy profile is illustrated below. Additional baseline data and existing initiatives specific to each focus area are presented in the respective section of the plan.

## Energy Use Baseline

To get a better picture of overall energy use at UTA, stationary and transportation use were examined together as shown in 4. From this evaluation, we can clearly see that overall energy use is dominated by transportation energy, which is currently includes diesel fuel for buses and FrontRunner commuter rail; gasoline and diesel for white fleet vehicles; and electricity for the Trax line. Note that in this summary CNG use for buses is reported as part of diesel use as it is a relatively small percentage of overall fuel use. CNG use is broken out separately on the Electric Vehicle Dashboard. As part of its sustainable energy future, UTA is considering electrification of both buses and FrontRunner. This overall picture of the agency's energy use helps show that this transition would significantly increase the electrical use of the agency and highlights the importance of the interagency partnership.

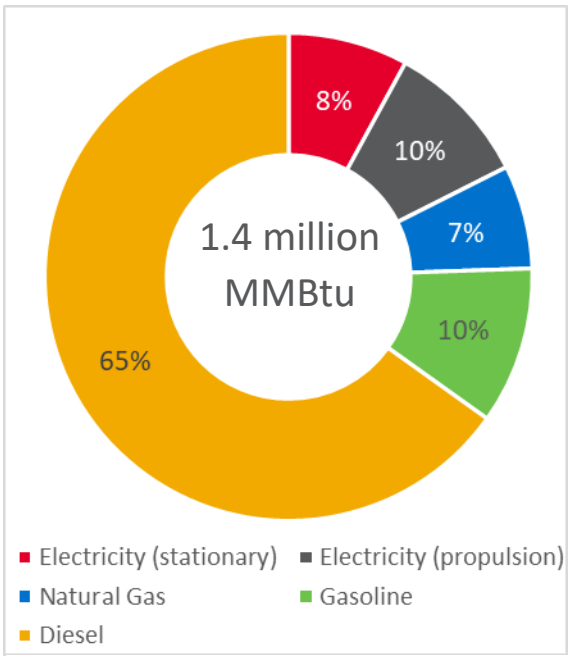


*Figure 4: Total 2018 Baseline Energy Use (MMBtu)*

The total cost of all fuels was also estimated, to help provide a baseline for capital investments that impact the agency's energy use. RMP provided electricity cost for the buildings and stations within RMP service territory, which makes up approximately 97% of the total electricity use for the agency. The average unit cost of electricity from these data were used to estimate costs from the remaining electricity use. The estimated fuel costs for other fuel sources - with the exception of gasoline, which used a state-wide unit cost estimate (US Energy Information Administration, 2020) - were estimated based on unit costs provided by UTA. Since fuel costs were estimated based on unit costs, this data should only be used to understand relative proportions and order of magnitude of fuel costs. More detailed data should be used to inform decision making on specific capital investments. As shown in Figure 5, electricity makes up a significant portion of total energy costs. This highlights the importance of working with RMP as buses and trains are electrified, to understand how the additional electricity load and timing of electricity use will impact utility costs. Electricity demand costs can significantly impact electricity costs, so controlling energy demand can be an effective strategy for managing utility costs. As transit agencies across the country have started to electrify, partnerships and coordination with local electric utilities have shown some early success with agreements that help the utility manage electric demand while also providing cost savings to the transit agency.

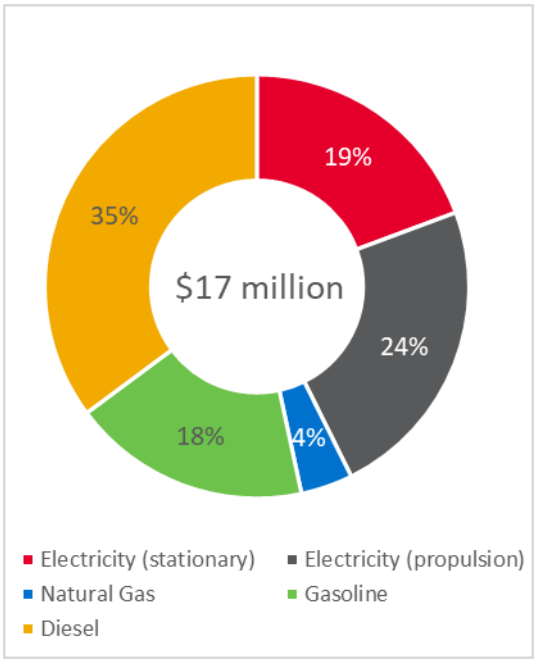

*Figure 5: Estimated 2018 Baseline Energy Costs*

Finally, the environmental impacts of fuel choice were examined. UTA reported total organizational Greenhouse Gas (GHG) emissions through 2017 but did not report in 2018. The 2017 emissions are shown in 6. As with energy use, GHG emissions are dominated by mobile sources. This highlights the potential impact that electrification of bus and commuter rail could have on the organizational environmental impact, especially as RMP continues to reduce the carbon intensity of the electricity generation sources through the Energy Vision 2020 initiative.

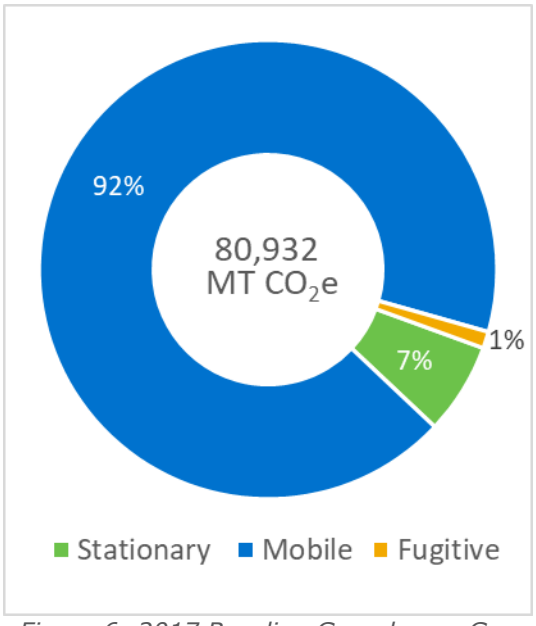

*Figure 6: 2017 Baseline Greenhouse Gas Emissions*

Along the Wasatch Front, local air quality is an especially important environmental issue, and UTA operations have a significant impact on local air pollutants. As such, UTA tracks the net impact of transit operations on criteria air pollutants. This analysis estimates expected air pollutants that would have been emitted if transit riders had driven personal vehicles and subtracts air pollutants emitted from transit vehicles - to get net air pollutant savings as shown in Figure 7.

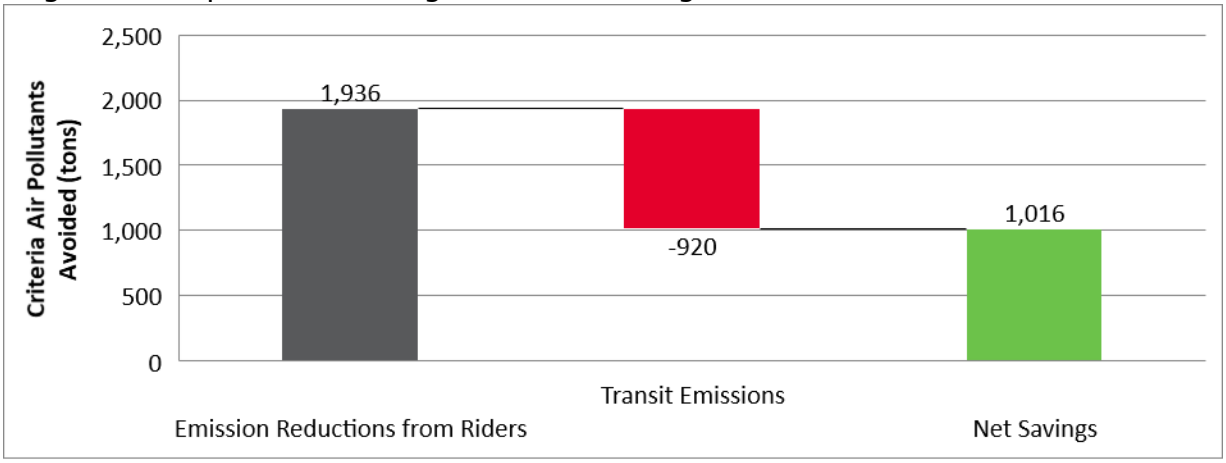


*Figure 7: 2018 Criteria Air Pollutants Mitigated*

This shows that UTA can reduce the total air pollutants emitted from transportation by more than half as compared the emissions that would have been produced if the riders chose to drive personal vehicles. As UTA replaces diesel buses and trains with alternative fuel options, air pollutants from transit vehicles will continue to decrease.

## Related Plans

For this Energy Action Plan to have the greatest impact, it must fit into other planning efforts and initiatives currently underway at UTA. The current planning landscape was summarized by reviewing the most relevant agency and regional plans, which are summarized below, to provide a baseline on which to build the strategies and goals identified in this plan.

### UTA 2040 Strategic Plan

This plan outlines the vision for the future of UTA. Energy-related objectives that are supported through the energy action plan include:

- Use groundbreaking technology and *data-driven* decision making to allocate resources in a way that improves UTA's products, service delivery, and passenger experience.
- Enhance *alliances* with regional corporate and nonprofit agencies, to achieve shared transportation goals and jointly lead out and identify new services and funding sources.
- Continue to create *long-range strategies* and *short-range pilot projects* for integrating evolving technology and alternative transportation options as a means of creating future mobility solutions.

## Regional Transportation Plans

Other related plans that were considered during the planning process include the Wasatch Front Regional Council 2019-2050 Regional Transportation Plan and the MAG TransPlan50, which outline planned transit routes throughout UTA service territories. These planned route expansions present good opportunities to build out electric bus and rail infrastructure from the start, which is more cost effective than retrofitting existing infrastructure.

## Current UTA Sustainability Initiatives

UTA has been working to advance sustainability within its organization through various internal and collaborative initiatives. Some key initiatives include:

- Clean Air Champion
- American Public Transportation Association Sustainability Commitment – Bronze Level
- International Union of Public Transportation - sustainability charter signatory
- Climate Registry reporting through 2017
- UTA Environmental Management System
- International Organization for Standardization (ISO) 14001:2015 participation

This plan aims to build on the successes of these programs, to continue advancing sustainable energy use at UTA. As shown in Figure 8, energy initiatives are just one of the metrics tracked as part of UTAs organizational sustainability efforts.

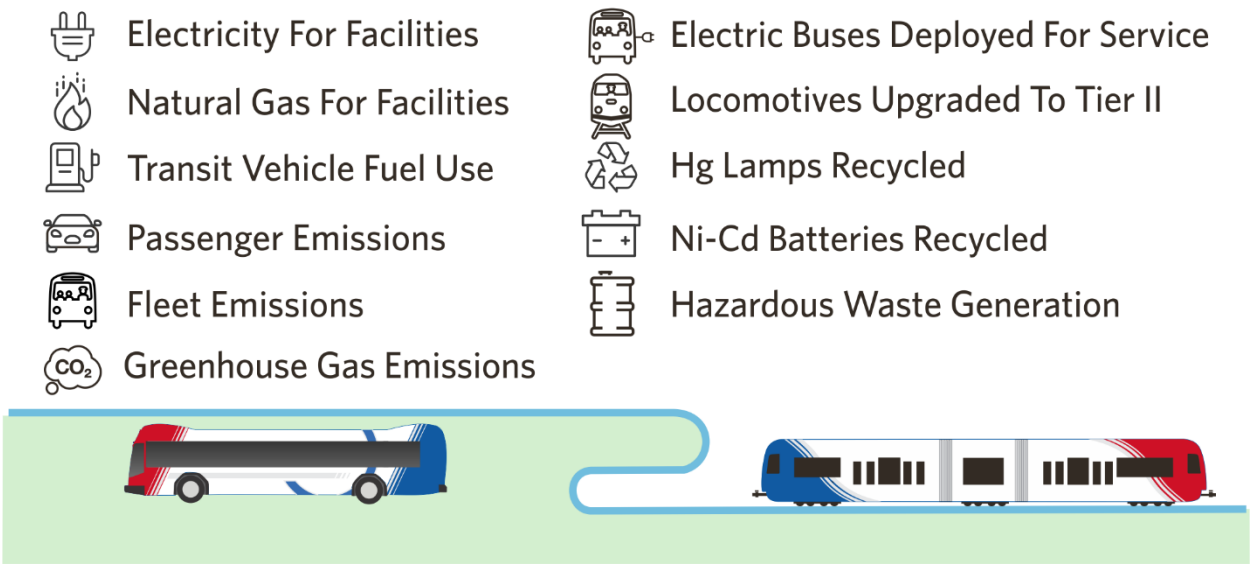


*Figure 8: Sustainability Initiatives at UTA*

# 3 Where Do We Want to Go? Energy Vision, Goal, and Focus Areas

Understanding UTA's energy baseline and existing initiatives sets the stage for determining where UTA and RMP want to go on their shared clean energy journey. This section of the plan answers the question of Where to from here? with a vision statement, goal, and targets for each of the plan focus areas.

## Energy Vision

An energy vision is an aspirational description that aligns with UTA's core ideals and values to inspire work toward achieving its energy goals. UTA's Energy Planning Team developed the following vision statement that aligns with UTA's overall mission and vision to guide its energy future:

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*Provide an integrated system of innovative and accessible public transportation services that use efficient and renewable energy systems and support the development of strong partnerships to contribute to a healthy environment for the people of the Wasatch Front.*

---

Based on feedback from the stakeholder group during workshop 1 (Figure 9), this vision statement was derived from UTA's organizational vision statement. It was modified slightly to describe UTA's energy future by incorporating a focus on renewable energy as well as highlighting the importance of partnerships in realizing this vision.

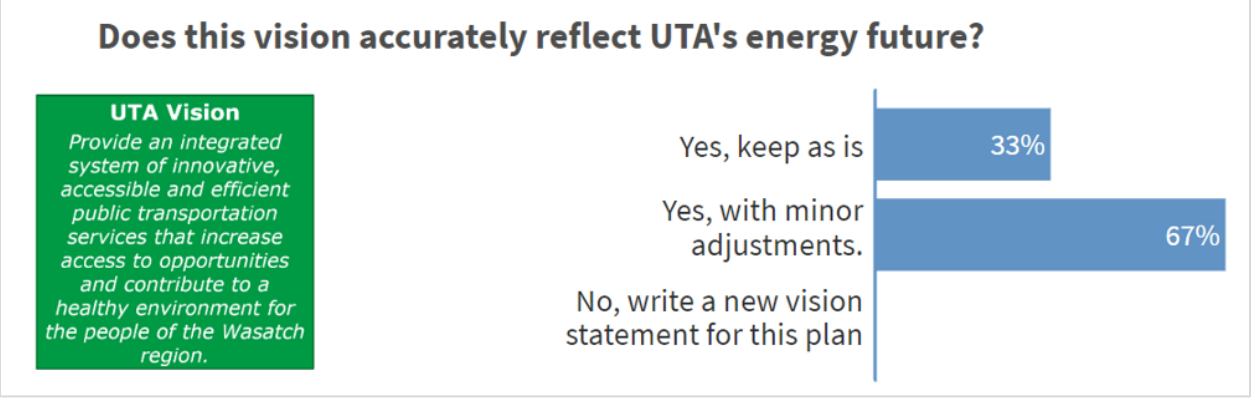


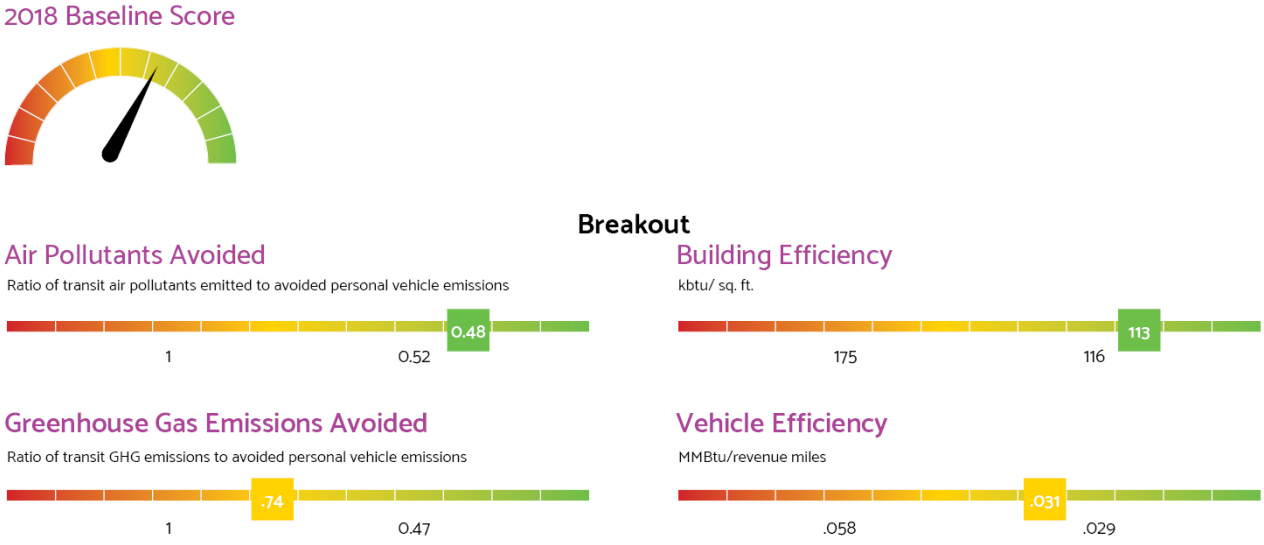

*Figure 9: Energy Vision Poll Question*

## Energy Goal

To reflect progress being made on multiple fronts, while still providing a clear metric to share with UTA's stakeholders, the Energy Planning Team developed a Sustainable Energy Index. This approach combines multiple metrics into one score that reflects overall performance and can be easily communicated. The four metrics included are:

1. **Air Pollutants Avoided**: This is a ratio that shows the transit air pollutants emitted as compared to the air pollutants that would have been emitted if the passengers chose to drive personal vehicles. Strategies in the electric vehicle focus area will improve this metric.
2. **GHG Emissions Avoided**: This is a similar ratio to the first metric but looks at GHG emissions rather than local air pollutants. Strategies in the electric vehicle and grid resiliency focus areas will improve this metric.
3. **Building Energy Efficiency:** This metric is the average energy use per square foot of all the Agency's buildings. Strategies in the building energy efficiency focus area will improve this metric.
4. **Vehicle Fuel Efficiency:** This is the average fuel use per revenue mile for the Agency's vehicle fleet. Strategies in the electric vehicle focus area will improve this metric.

The organizational dashboard for the 2018 baseline is shown below.




UTA will strive to maintain the Sustainable Energy Index in the green showing that they are outperforming peer agencies. See Appendix A: Sustainable Energy for additional details on the index.

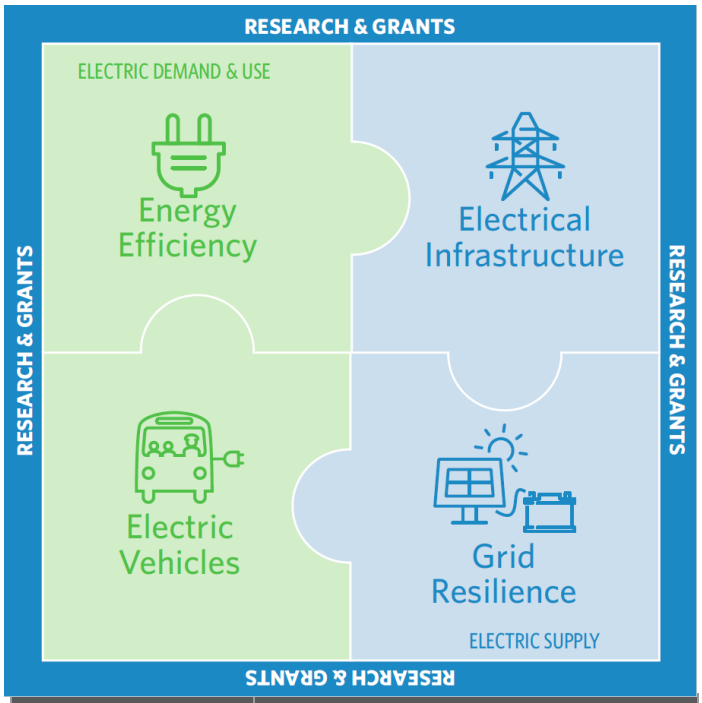
## Focus Areas

To make progress toward the ideals and values in this vision statement, the Energy Planning Team selected four focus areas from the Interagency Partnership Vision, designating the fifth as a cross-cutting theme. Focus area group interviews were conducted to help identify existing initiatives, targets, and potential strategies. These focus areas are listed in Table 1, along with information about interview participants.

Following the focus area group interviews, the Energy Planning Team finalized focus area targets and prioritized strategies. Strategies are categorized by strategy type as outlined below.

- **Policies & Programs** – Guidance for procurement, budgeting, and sustainable practices
- **Demonstration Projects & Research** – Studies, tours, demonstration projects, and other research activities
- **Capital** – Infrastructure improvements, vehicle purchases, and other capital investments
- **Real Estate** – Management of real estate assets and public-private partnership development opportunities

Focus area details are presented in the following section.




| Focus Area | Expert Team |
|---|---|
| **Focus Area 1: Stationary Energy Efficiency** | • Dan Locke, UTA<br>• Kevin Anderson, UTA<br>• Clay Monroe, RMP<br>• Becca Stock, Facilitator |
| **Focus Area 2: Electric Vehicles** | • Hal Johnson, UTA<br>• Kyle Stockley, UTA<br>• James Campbell, RMP<br>• Becca Stock, Facilitator |
| **Focus Area 3: Electrical Infrastructure** | • David Osborne, UTA<br>• Jared Scarbrough, UTA<br>• Hal Johnson, UTA<br>• Travis Jones, RMP<br>• Judy Dorsey, Facilitator |
| **Focus Area 4: Grid Resilience** | • Dan Locke, UTA<br>• David Osborne, UTA<br>• Rohit Nair, RMP<br>• Judy Dorsey, Facilitator |
| **Cross-cutting Theme: Research and Grants** | • Alma Haskell, UTA<br>• Hal Johnson, UTA<br>• Patti Garver, UTA<br>• Tracy Young, UTA<br>• James Campbell, RMP<br>• Lynn Coppedge, Facilitator |

*Table 1: Focus Area Interview Participants*

## Focus Area 1: Stationary Energy Efficiency

The Stationary Energy Efficiency focus area addresses energy use from buildings and other stationary sources such as transit stops. Baseline data for this focus area and the agency's target are summarized in the Stationary Energy Efficiency Dashboard below.

### Stationary Energy Efficiency Dashboard

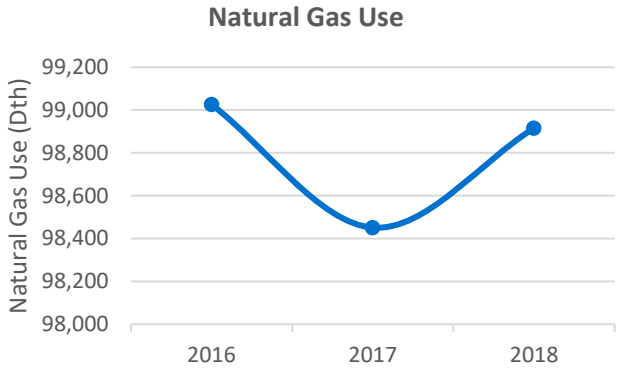
**Key Takeaways:**

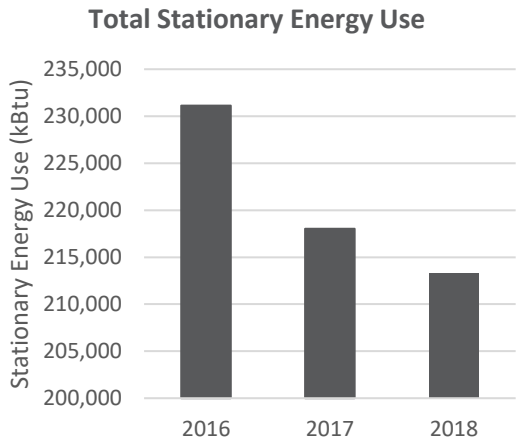
1. Natural gas use fluctuated slightly, with a variation of less than 1%.
2. Electricity use steadily decreased, with overall reduction of 13%.
3. Overall trend of decreasing stationary energy use of about 4% per year.

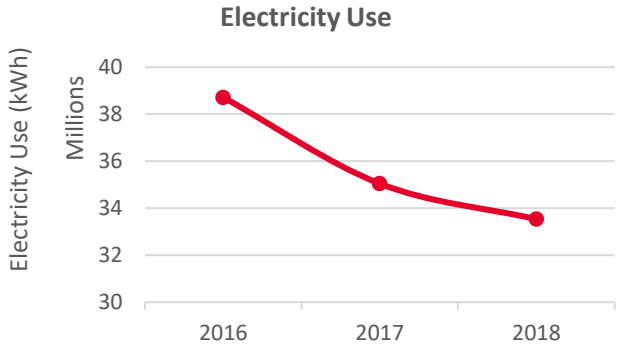
**Target:**

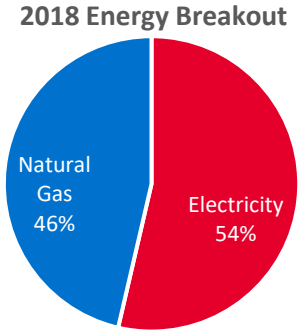
Continue the trend of decreasing stationary energy use by 4% per year over the next two years.

**Data Baseline:**




**Existing Initiatives:**

- ✓ Ongoing effort to install LED lighting in buildings and parking lots
- ✓ Have installed building automation systems in many facilities.
- ✓ Parking lot and office lighting controls
- ✓ Snow melt controls to reduce demand

**Research & Funding Opportunities:**

- ➢ Funding programs
  - ○ RMP Wattsmart energy efficiency incentive programs

## Stationary Energy Efficiency Strategies

Strategies to improve energy efficiency in UTA buildings and transit stations are summarized in Table 2 by strategy type and followed by focus area implementation action plan and strategy descriptions.

*Table 2: Energy Efficiency Strategies*

| | Policies & Programs | Demonstration Projects & Research | Capital | Real Estate |
|---|---|---|---|---|
| 1-1: Continue LED lighting upgrades* | | | ■ | |
| 1-2: Continue installation of building automation systems* | | | ■ | |
| 1-3: Share best practices in energy efficiency | ■ | | | |
| 1-4: Refresh employee energy efficiency campaign | ■ | | | |
| 1-5: Optimize building use | | | | ■ |
| 1-6: Improve efficiency of snowmelt systems | | ■ | | |
| 1-7: Incorporate energy efficiency into grant funded electrification projects | ■ | | | |
| 1-8: Establish energy efficiency standards for new equipment | ■ | | | |

**RMP incentives are available*

### *Stationary Energy Efficiency Implementation Action Plan*

To guide implementation of strategies identified in this focus area, basic information such as leading department(s), timing considerations, and funding resources are outlined below.

#### Leading Department(s):

- Asset Management (Facilities Maintenance)
- Capital Projects & Development

#### Supporting Department(s)/Partner(s):

- Capital Projects & Development (Grants Management)
- Organizational Effectiveness
- Communications (Marketing/Public Relations)

#### Timing Considerations

- Reference five-year facilities budget (updated annually)
- Reference facilities master plan (updated every 2-5 years)

### Grants, Incentives, and Other Resources

- RMP Wattsmart Business program equipment incentives including custom incentive opportunities for energy efficiency measures not included in typical measures incentives

### Research Collaboration Opportunities

- Identification of grants that would allow a portion of vehicle electrification funding to be spent on energy efficiency measures
- Identification of grants for electrification and other building measures

### Implementation Considerations

- Target largest energy users, starting with locomotive and light-rail maintenance shops and followed by bus garages

*Strategy Descriptions*

Each strategy for this focus area is described in more detail below.

### 1-1: Continue LED lighting upgrades*

Replace all lights in buildings, parking lots, and stations with energy efficient LED lighting to realize the benefits of LED installations, including reduced energy use and maintenance costs, short payback periods, and brighter lighting for safer areas.

### 1-2: Continue installation of building automation systems*

Transition to Alerton building automation systems (BAS), for UTA buildings and stations, that allow centralized control and scheduling (including holidays based on calendars). This strategy also includes BAS education for UTA employees.

- Pending funding request approval, BAS system installation planned in 2020

### 1-3: Share best practices in energy efficiency

Collaborate with peers, in the region or the transit industry, to learn and share best practices and available resources. Opportunities for peer learning and collaboration may be through formal organizations such as the American Public Transportation Association (APTA) Sustainability Committee or through informal collaboration with regional or other transit agencies  UTA is collaborating with on other fronts such as vehicle electrification.

### 1-4: Refresh employee energy efficiency campaign

Develop educational materials and activities to encourage employees to save energy, including turning off lights, appropriate temperature settings, closing overhead doors, reducing the use of personal appliances, and implementing computer sleep settings. These communications will be designed to not only reduce building energy use, but also build a culture of sustainability throughout the agency.

### 1-5: Optimize building use

Explore moving employees from very-low-occupancy buildings to other facilities and closing the very-low-occupancy buildings to reduce energy costs and other operational expenses. Target buildings may include:

- Public Safety
- Clearfield Auto Transfer
- Fire Station
- Meadowbrook (main office)

### 1-6: Improve efficiency of snowmelt systems*

Continue to improve controls for snowmelt systems at stations, to maximize effectiveness and minimize energy use. Strategies may include zoning, moisture sensors, and investigating hydronic systems fed by high-efficiency heat pumps.

### 1-7: Incorporate energy efficiency into grant funded electrification projects

This strategy explores opportunities to reserve portions of electrification grant funds for energy efficiency, unless limited by the grant requirements.

### 1-8: Establish energy efficiency standards for new equipment*

Develop comprehensive new equipment standards to reduce energy use and lifetime equipment costs. Having standards in place helps ensure that the proper equipment is chosen - even during emergency replacement situation. Target systems include HVAC, lighting, motors, and appliances. RMP and other utility rebates are available for much of this equipment, so this policy should also include information about how to apply for energy efficiency rebates as applicable, to reduce the agency's upfront investment. This strategy will require coordination across departments to develop and maintain consistent standards that will optimize the agency's investment in new equipment for long-term energy savings.

## Focus Area 2: Electric Vehicles

The Electric Vehicle (EV) focus area addresses electrification of UTA buses, white fleet vehicles, and rail trains. Baseline data for this focus area and the agency's target are summarized in the Electric Vehicle Dashboard below.

### Electric Vehicle Dashboard

**Key Takeaways:**

- Diesel is the primary fuel type.
- The relative proportion of each fuel type has remained relatively constant over the last 3 years.

**Target:**

Pilot 35 electric buses on a variety of routes over the next 5 years to better understand the vehicle performance, maintenance requirements, and charging strategies - to inform long-term planning for electric buses across the agency.

**2018 Data Baseline:**

**Buses: 721 Buses**

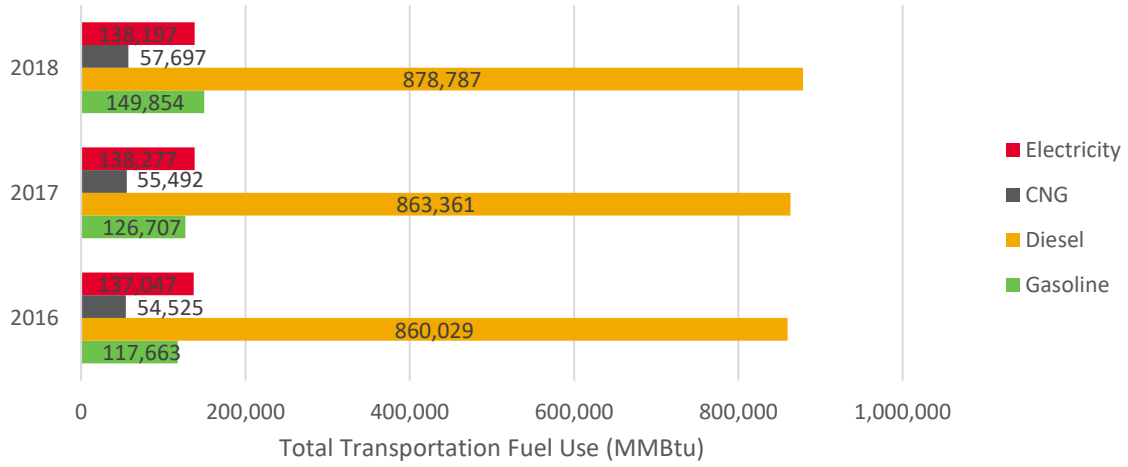
27 Hybrid
47 Compressed natural gas (CNG)

**White Fleet: 683 vehicles**

84% Gasoline (5 hybrid)
14% Diesel

**Train**

TRAX electric
FrontRunner diesel




**Existing Initiatives:**

- ✓ Three battery electric buses (BEBs) in service in 2019, 11 on order for Ogden, 2 buses in partnership with Park City, with 20 additional purchases scheduled leveraging VW grant funds
- ✓ Completed a study to review opportunities to electrify FrontRunner

**Research & Funding Opportunities:**

- ➢ Research topics
  - EV heating and drive systems
  - Electric on-demand transit
  - In-route charging
- ➢ Funding programs
  - Congestion Mitigation and Air Quality Improvement (CMAQ) program
  - Low-No program
  - Rocky Mountain Power (RMP) EV infrastructure program

## Electric Vehicle Strategies

Strategies to electrify UTA's buses, white fleet vehicles, and rail trains are summarized by strategy type in Table 3, followed by focus area implementation action plan and strategy descriptions.

*Table 3: Electric Vehicle Strategies*

| | Policies & Programs | Demonstration Projects & Research | Capital | Real Estate |
|---|---|---|---|---|
| 2-1: Develop vehicle charging schedules | ■ | | | |
| 2-2: Partner with other organizations to acquire electric buses | | | ■ | |
| 2-3: Promote benefits of electric buses to the public | ■ | | | |
| 2-4: Optimize the size of the white fleet | ■ | | | |
| 2-5: Evaluate total cost of ownership when purchasing new vehicles | ■ | | | |
| 2-6: Pursue grant funding to replace white fleet vehicles with EVs and install employee EV charging stations. | | | ■ | |
| 2-7: Convert direct current (DC) drives in TRAX vehicles with alternating current (AC) drives* | | | ■ | |
| 2-8: Identify a location for a multiuse charging hub* | | | | ■ |

**RMP incentives are available*

### *Electric Vehicle Implementation Action Plan*

To guide implementation of strategies identified in this focus area, basic information such as leading department(s), timing considerations, and funding resources are outlined below.

#### Leading Department(s):

- Asset Management (Fleet Engineering/Maintenance of Way)

#### Supporting Department(s)/Partner(s):

- Capital Projects & Development (Capital Projects/Project Development)
- Communications (Marketing)
- Real Property and Transit-Oriented Development

### Timing Considerations

- Reference annual plan for bus purchases

### Grants, Incentives, and Other Resources

- RMP EV Infrastructure Program
- RMP custom Demand Side Management (DSM) program (for converting DC to AC drives)
- Congestion Mitigation and Air Quality grants
- Federal Transit Authority (FTA) Low or No Emission grant program
- FTA Bus and Bus Facilities grant program
- County transportation funds

### Research Collaboration Opportunities

- Identification of grants for new electric buses, in partnership with other organizations
- Identification of grants for funding white fleet EVs and associated charging infrastructure
- Ongoing partnership with Utah State University (USU) to study bus charging, including software to modulate chargers
- Collaboration with RMP to coordinate bus charging schedule, to use excess renewable energy production if possible.

### Implementation Considerations

- Incorporate infrastructure costs in grant applications and other funding efforts.
- Diversify energy use, aiming for equal parts electric, CNG, and diesel-fueled buses

*Strategy Descriptions*

Each strategy for this focus area is described in more detail below.

### 2-1: Develop vehicle charging schedules

Develop and periodically update a charging schedule for each UTA fleet, in coordination with RMP, to optimize frequency of charging, the amount of time required to recharge vehicles, and energy costs.

### 2-2: Partner with other organizations to acquire electric buses

Partner with municipalities, universities, and other organizations served by UTA to electrify buses serving those routes; coordinate with other transit agencies, including SunTran and TriMet to help inform battery electric bus (BEB) procurement.

### 2-3: Promote benefits of electric buses to the public

Raise awareness and educate the public about the benefits of BEBs, including improved air quality and quieter operation, through bus wraps, social media campaigns, and partnerships with other local sustainability initiatives.

### 2-4: Optimize the size of the white fleet

Review vehicle types and uses throughout the white fleet to reduce both the number of internal combustion engine (ICE) vehicles in UTA's white fleet and the associated operational costs, as well as minimize air pollutant and vehicle GHG emissions.

### 2-5: Evaluate the total cost of ownership when purchasing new vehicles

Update procurement guidelines and processes to consider total cost of ownership (TCO) when purchasing new fleet vehicles. This will allow the Agency to identify potential opportunities for EV purchases with lifetime cost savings. TCO includes acquisition cost, fuel costs, maintenance costs, and expected salvage value.

### 2-6: Pursue grant funding to replace white fleet vehicles with EVs and install employee EV charging stations

Secure grant funding for vehicle purchases and infrastructure installation to accelerate the transition of UTA's white fleet to EVs.

### 2-7: Convert direct current (DC) drives in TRAX vehicles with alternating current (AC) drives*

Convert DC drives, in TRAX vehicles with AC drives, for significant increases in vehicle efficiency and elimination of AC-to-DC conversion losses.

### 2-8: Identify a location for a multiuse charging hub*

Partner with RMP to identify a location for, then install, a multiuse charging hub to support in-route bus charging as well as public use - leveraging RMP funding for EV infrastructure.

## Focus Area 3: Electrical Infrastructure

The Electrical Infrastructure focus area addresses safely and efficiently powering UTA's existing electric rail (TRAX), increasing its electric bus fleet charging infrastructure, and adding future Frontrunner electrification.

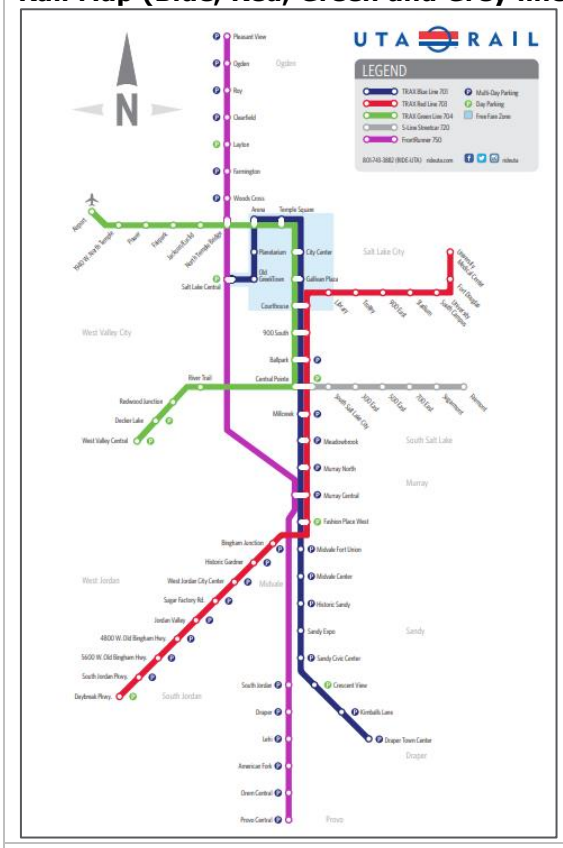
### Electrical Infrastructure Dashboard

**Key Takeaways:**
The rail power system and electric bus charging infrastructure has kept pace with fleet electrification.

**Target:**
New charging infrastructure installation will consider electric fleet procurement plans over the next 5 years while incorporating strategies to future-proof infrastructure installations.

**Baseline:**

**Rail Map (Blue, Red, Green and Grey lines are electric)**




**Rail Power System**

- ~50 substations
- 45 miles of overhead catenary wire

**Bus Charging Station Locations**

- Salt Lake Central Hub
- University of Utah
- Depot District Clean Fuels Technology Station

**Existing Initiatives:**

- ✓ 2018 Future of FrontRunner Plan includes rail electrification
- ✓ 2040 Strategic Plan includes rail expansion
- ✓ Assessment of substations for rehab
- ✓ Joint-development transit-oriented development (TOD) projects
- ✓ Bus charging infrastructure planning efforts
  - Depot District Clean Fuels Technology Station
  - Ogden Bus Rapid Transit
  - North Temple Transit Hub
  - Wasatch/3900 South

**Research & Funding Opportunities:**

- ➢ Research topics
  - Wayside storage systems
  - Portable substations
  - Wireless meter reading
  - Utility-managed smart charging
  - Peak demand management studies
- ➢ Funding programs
  - CMAQ program
  - Low-No program
  - RMP EV infrastructure program

## Electrical Infrastructure Strategies

Strategies to safely and efficiently power existing electric rail (TRAX), increase electric bus fleet, and electrify future Frontrunner are summarized in Table 4 below, followed by the implementation plan and strategy descriptions.

*Table 4: Electrical Infrastructure Strategies*

| | Policies & Programs | Demonstration Projects & Research | Capital | Real Estate |
|---|---|---|---|---|
| 3-1: Implement substation upgrades | | | | |
| 3-2: Explore wayside storage systems at TRAX stations | | | | |
| 3-3: Utilize a portable substation to improve system resiliency | | | | |

**RMP incentives are available*

### *Electrical Infrastructure Implementation Action Plan*

To guide implementation of strategies identified in this focus area, basic information such as leading department(s), timing considerations, and funding resources are outlined below.

#### Leading Department(s):

- Asset Management (Facilities Maintenance/State of Good Repair)

#### Supporting Department(s)/Partner(s):

- Capital Projects & Development
- WSP (consultant supporting substation upgrades)
- RMP

#### Timing Considerations

- Reference existing five-year plan for upgrading 18 substations (contractor will begin substation upgrades in Fall 2020)

#### Grants, Incentives, and Other Resources

- Bonding or other funding resources to complete the project (existing funding for 6-8 substation upgrades over the next 2-3 years)
- State or federal funding have been used in projects at other agencies

#### Research Collaboration Opportunities

- Work with USU and RMP to identify short segment, for wayside storage system, to test technology
- Work with RMP to explore battery storage for peak management

### Implementation Considerations

- Coordinate train energy use with bus charging to manage demand, focusing on high powered chargers and on providing controls from substations rather than from a separate controls system.

*Strategy Descriptions*

Each strategy for this focus area is described in more detail below.

#### 3-1: Implement substation upgrades

Identify necessary substation upgrades and work with RMP and WSP to implement identified upgrades and acquiring load flow data from RMP and Murray City Power. As budget allows, this strategy may also include upgrading feeder cables while substations are offline.

#### 3-2: Explore wayside storage systems at TRAX stations

Identify opportunities for wayside storage systems at TRAX stations, for peak demand management, which may include regenerative breaking or other technologies.

#### 3-3: Utilize a portable substation to improve system resiliency

Leverage the temporary, mobile substation designed to facilitate upgrades in strategy 3-1 to improve system resiliency by providing temporary power supply during emergency or planned outages, supporting future maintenance work, and helping to integrate distributed or renewable energy generation.

# Focus Area 4: Grid Resilience

The Grid Resilience focus area addresses reliability, cybersecurity, microgrids, and new technologies.

## Grid Resilience Dashboard

**Key Takeaways:**

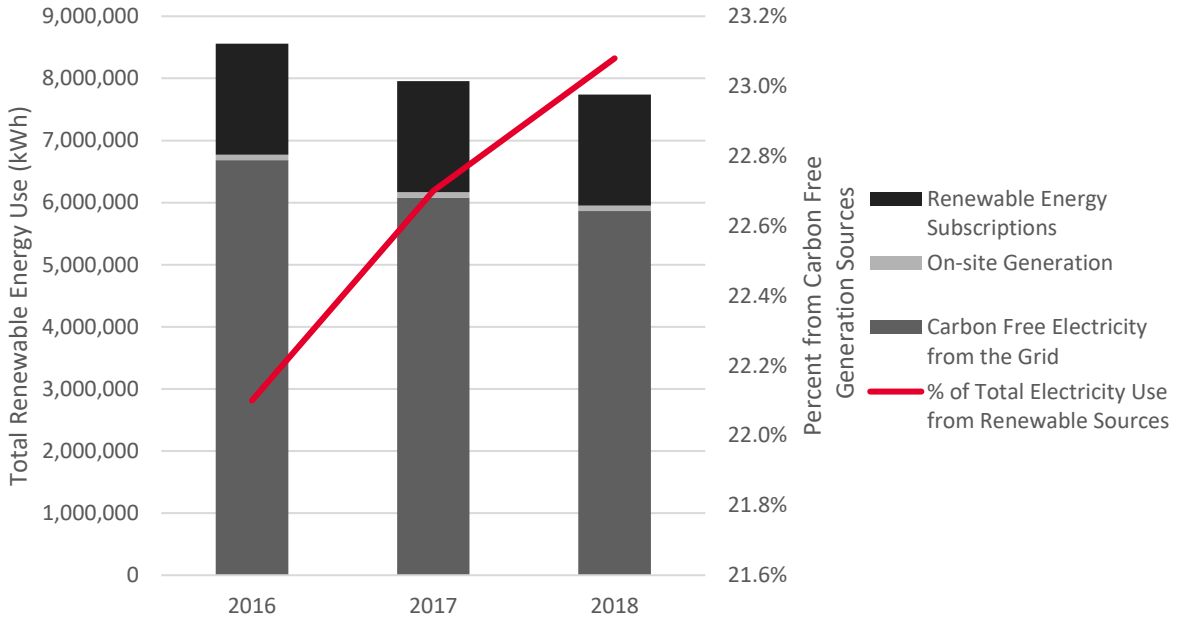
1. UTA's renewable energy commitment through utility subscription programs has remained constant over the last 3 years
2. Renewable energy subscriptions make up over 20% of total renewable energy use
3. The renewable energy percentage has grown due to an increased utility renewable percentage and reduced overall electricity use through energy efficiency.

**Target:**

Increase the percent of total electricity use from renewable energy sources to 25% by 2022.

At least two collaborative, grid innovation (smart-grid, battery storage, backup generation) projects will be in progress each year - with the goal of improving service reliability as we electrify our fleet.

**Data Baseline:**




**3 Grid Innovation Projects Underway**

- Intermodal Hub Smart Charging Research with USU
- Solar and Storage Backup Generator Research with USU
- Solar microgrid opportunities at Depot District Clean Fuels Technology Center

**Existing Initiatives:**

- ✓ Depot District Clean Fuels Technology Station
- ✓ Intermodal Hub project
- ✓ Annual RMP Renewable Energy Subscriptions
  - Blue Sky 16,800 kWh
  - Subscriber Solar 1.77 million kWh

**Research & Funding Opportunities:**

- ➢ Research topics
  - Microgrids
  - Electric Vehicle Supply Equipment (EVSE) and solar integration
  - Bus canopy designs for solar
  - Solar back-up generators
- ➢ Funding programs
  - RMP Blue Sky grant program

## Grid Resilience Strategies

Strategies to improve system redundancies, increase use of renewable energy, and integrate smart grid technologies are described below, followed by focus area implementation action plan and strategy descriptions.

| | Policies & Programs | Demonstration Projects & Research | Capital | Real Estate |
|---|---|---|---|---|
| 4-1: Increase participation in RMP Blue Sky program* | ■ | | | |
| 4-2: Organize tours of Intermodal Hub and Electric Vehicle & Roadway (EVR) Research Facility | ■ | | | |
| 4-3: Develop a bus charging algorithm | | ■ | | |
| 4-4: Research the intelligent integration of vehicles, the electric grid, and solar | | ■ | | |
| 4-5: Integrate on-site solar and microgrid technologies | | ■ | | |
| 4-6: Investigate rooftop solar opportunities* | | | ■ | |

**RMP incentives are available*

### *Electric Vehicle Implementation Action Plan*

To guide implementation of strategies identified in this focus area, basic information such as leading departments, timing considerations, and funding resources are outlined below.

#### Leading Department(s):

- Capital Projects & Development (Capital Projects/Project Development/Grants Management)

#### Supporting Department(s)/Partner(s):

- Asset Management (Facilities Maintenance)
- RMP
- USU

#### Timing Considerations

- Consider installation of on-site solar and microgrid technologies in next phase of Depot District Clean Fuels Technology Center project

#### Grants, Incentives, and Other Resources

- RMP Blue Sky Program
- Schedule 34

### Grants, Incentives, and Other Resources

- US Department of Energy research grant programs

### Research Collaboration Opportunities

- Incorporation of smart grid designs, at Deport District Clean Fuels Technology Center, including smart bus charging
- USU demonstration project

*Strategy Descriptions*

Each strategy for this focus area is described in more detail below.

### 4-1: Increase participation in RMP Blue Sky program*

Increase UTA's investment in renewable energy through RMP's Blue Sky subscription program, beyond current participation, or through Schedule 34 to increase the agency's renewable energy percentage.

### 4-2: Organize tours of Intermodal Hub and EVR Research Facility

Partner with USU to host tours of the Intermodal Hub and Electric Vehicle & Roadway (EVR) Research Facility for RMP and UTA staff to understand current charging, planned scheduling, and opportunities for smart charging techniques as well as applications of microgrid technologies and controls.

### 4-3: Develop a bus charging algorithm

Continue working with RMP and USU, at the Intermodal Hub, to develop and implement a bus charging algorithm to support smart charging options to manage electricity costs for new electric buses.

### 4-4: Research the intelligent integration of vehicles, the electric grid, and solar

Explore opportunities for intelligent integration of vehicles, the electric grid, and solar - to increase system resilience through energy storage and peak demand management.

### 4-5: Integrate on-site solar and microgrid technologies into the Depot District Clean Fuels Technology Center project

Investigate opportunities to integrate on-site solar and microgrid technologies, including lessons learned from the USU EVR Research Facility from strategy 4-2, into the design and construction of the Depot District Clean Fuels Technology Center and other applicable projects.

### 4-6: Investigate rooftop solar*

This strategy explores opportunities for UTA to add rooftop solar to its facilities, which may include the Depot District Clean Fuels Technology Center, Intermodal Hub, and/or new bus or train stations.

# 4 Course of Action: Implementation Roles and Tracking Progress

This plan is just the first step in a series of activities that will be executed over the next two years (and beyond) in support of UTA's energy and sustainability goals. This section includes a description of who is responsible for the implementation of this plan and how UTA will track progress toward plan goals. The key to successful implementation of the strategies outline in this plan will be continued coordination and partnership between UTA and RMP. To facilitate this cooperation, regular check-ins between the two agencies will be scheduled.

## Roles and Responsibilities

Through this planning process, the Energy Planning Team identified key UTA departments and partners who will work together to implement the plan strategies.

**UTA staff** will serve as the lead implementers of this plan, coordinating with internal and external partners to work out the details of strategy implementation. Lead and supporting UTA departments are summarized in Table 5.

*Table 5: UTA Roles*

| Department | Energy Efficiency | Electric Vehicles | Electrical Infrastructure | Grid Resilience |
|---|---|---|---|---|
| **Asset Management** | Lead | Lead | Lead | Support |
| **Capital Projects & Development** | Lead/Support | Support | Support | Lead |
| **Communications** | Support | Support | | |
| **Organizational Effectiveness** | Support | | | |
| **Real Property and Transit-Oriented Development** | | Support | | |

**Rocky Mountain Power** (RMP) will serve as a resource and partner, coordinating regularly with UTA staff to ensure a successful long-term partnership. RMP will bring all available energy efficiency and renewable program offerings to UTA and coordinate available incentives for applicable strategies. In addition, RMP will provide periodic energy and program data to track progress against savings goals as well as to inform project planning. One initiative that RMP is working on that will be critical for the long-term success of UTA's demand management initiatives is the installation of smart meters, which is expected to be completed over the next 3-4 years.

**Additional Partners** includes peer agencies (e.g., SunTran and Trimet), research partners (e.g., USU), and consultants (e.g., WSP). These partners will be crucial for knowledge sharing, resource leveraging, and gaining additional technical expertise.

## Tracking Progress

As the Energy Action Plan is implemented, it will be imperative to monitor progress toward the focus area targets and Sustainability Energy Index goal. This step will involve tracking and reporting on metrics identified in this plan, in coordination with other sustainability reporting efforts. Measuring success over time will enable UTA to refine strategies and inform future planning processes. This iterative implementation process is illustrated in Figure 10.


*Figure 10. Iterative Implementation Cycle*

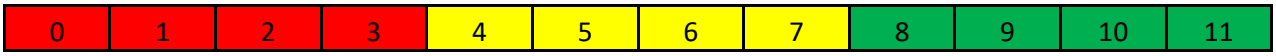
The implementation cycle is meant to accommodate lessons learned and to continue making progress beyond initial activities. Rocky Mountain Power has been excited to participate in the development of this Energy Action Plan and looks forward to supporting its implementation.

# Appendix A: Sustainable Energy Index

The Sustainable Energy Index is a compilation of four separate energy metrics. Each metric is detailed below to show the reason the metric was chosen, how the score was calculated, and examples of the type of actions that will improve performance. Note that all metrics are currently being tracked by UTA.

## Overall Score

To combine all four metrics into one overarching value, the yellow and green ranges defined by metric below are split into quadrants and a score is assigned based on the quadrant in which each metric falls as shown in the range below. A green score means that UTA is performing better than average when compared to peer agencies across the country. A yellow score means the agency is performing below average and should review the efforts in this area and adjust. A red score means that the agency is not meeting basic performance benchmarks and the issues should be reviewed and addressed. The scored metrics are then averaged to create the final index score. Table 6 shows the values for 2018 shown in the 2018 Sustainable Energy Index dashboard.




To establish the range for each metric the following values were identified and then each quadrant was interpolated or extrapolated from these values

- High (11): This was defied as best in class performance.
- Average (7): This value was defied as average performance across peer agencies.
- Low (3): This value was used to define what would be considered poor performance.

*Table 6: 2018 Sustainable Energy Index*

| Metric | Value | Score |
|---|---|---|
| Air Pollutants Avoided | 0.48 | 8 |
| Greenhouse Gas Emissions Avoided | 0.7 | 6 |
| Building Energy Efficiency | 113 kBtu/sq. ft. | 8 |
| Transit Fuel Economy | 0.031 MMBtu/revenue mile | 7 |
| **Sustainable Energy Index** | | **7** |

## Air Pollutants Avoided

This metric looks at the ratio of air pollutants (CO, $NO_x$, $PM_{2.5}$, $SO_x$) from transit vehicle emissions, compared to emissions if the transit riders chose to drive single-occupancy vehicles instead. This metric was chosen because air pollutants are of special concern in the Salt Lake Valley because the area has been a non-attainment

zone for several air quality factors over the last three years (Environmental Protection Agency, 2020). This is also an understood metric for transit agencies with existing tracking systems in place at UTA. The calculation for the 2018 baseline is shown below and is based on air pollutant data provided by UTA.

$$\frac{Transit\ Air\ Pollutants}{Avoided\ Air\ Pollutants} = \frac{920\ tons\ criteria\ air\ pollutants}{1{,}936\ tons\ criteria\ air\ pollutants} = 0.48$$

This ratio shows that the emissions from transit vehicles are less than half of what would have been emitted if the riders had driven alone.

The ranges used to score this metric are outlined below:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.39 | 1.26 | 1.14 | 1.00 | 0.88 | 0.76 | 0.64 | 0.52 | 0.39 | 0.26 | 0.13 | 0.00 |

1. **Low:** A score >1 for criteria air pollutants means that emissions from transit are equal to or greater than single-occupancy vehicles, meaning there is no benefit from riding transit, due to some combination of low ridership and high transit emissions.
2. **Average**: Based on a study of potential air pollutant impact from transit use, the average ratio of transit air pollutants to avoided air pollutants is expected to be 0.52 (Shapiro, Hassett, & Arnold, 2002).
3. **High**: The maximum score would be achieved if all transit vehicles have zero direct emissions vehicles (electric or fuel cell vehicles). This does not account for indirect emissions from electricity generation.

UTA can influence this metric by increasing the number of riders or distance traveled or decreasing the emissions from transit vehicles through electrification of transit vehicles or other cleaner fuel options. It should also be noted that the methodology for determining avoided air pollutants takes into account that personal vehicles are continually improving emissions, for example, through increased market share of EVs. Therefore, the transit ridership and vehicle emissions reductions will need to outpace improvements in light vehicle emissions to prevent this score from falling.

## Greenhouse Gas Emissions Avoided

This metric is similar to the Air Pollutants Avoided metric, but focuses on GHG emissions ($CO_2$, $N_2O$, $CH_4$) rather than criteria air pollutants. The metric was chosen, in addition to the air pollutants metric, because it includes electricity emissions based on the fuel generation mix, as well as direct emissions from vehicles. This will reflect advances both UTA and RMP make in increasing the renewable energy percentage of their electricity. Like the Air Pollutants Avoided metric, this metric looks at the ratio of transit vehicle emissions, compared to emissions if the transit riders chose to drive single-occupancy vehicles instead. The

calculation for the 2018 baseline is shown below and is based on GHG emissions data provided by UTA.

$$\frac{Transit\ GHG\ Emissions}{Avoided\ GHG\ Emissions} = \frac{90{,}121\ MT\ CO2e}{121{,}552\ MT\ CO2e} = 0.7$$

From this calculation, we can see that transit GHG emissions are about 2/3 of those that would be expected if the riders drove instead.

The ranges used to score this metric are outlined below:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.36 | 1.24 | 1.11 | 1.00 | 0.87 | 0.73 | 0.60 | 0.47 | 0.35 | 0.23 | 0.12 | 0.00 |

1. **Low:** A red score shows that there is no benefit from riding transit or there are more emissions from transit vehicles than there would be if everyone drove their own cars.
2. **Average**: Based on a Federal Transit Administration study, average GHG emissions from a private single occupancy vehicle is about 0.96 lbs. $CO_2$ per passenger mile and average transit GHG emissions are 0.45 lbs. $CO_2$ per passenger mile for an average ratio of 0.47 (Federal Transit Authority, 2010).
3. **High**: The maximum score would be achieved if all transit vehicles have zero emissions vehicles, fuel cell vehicles or electric vehicles powered by reviewable electricity. These emissions do account for any indirect emissions from electricity generation.

To improve this score UTA can transition more transit vehicles from diesel to CNG or electricity, and/or improve the renewable energy percentage of its electricity through onsite installations or utility renewable energy subscription programs. RMP has pledged to increase the renewable energy percentage in its electricity generation mix to at least 20% by 2025 this, in conjunction with UTA's renewable energy efforts, will reduce the transit related GHG emissions from Trax and other electric vehicles. Again, to keep improving this score, UTA will need to work to outpace improvements being made to reduce emissions from passenger vehicles.

## Building Energy Efficiency

This metric looks at energy efficiency of UTA buildings, using a weighted average of energy use per square foot or Energy Use Index (EUI). This is calculated by taking the annual energy use for natural gas and electricity, both converted to kBtu, and dividing by the building area to get an EUI for each facility. This EUI is then multiplied by its respective building area and divided by the area of all buildings combined. Using the weighted average helps prevent small, high-energy use facilities from skewing the average.  EUI is a widely understood and standard metric for benchmarking energy performance for individual buildings. UTA is tracking the data necessary to calculate EUI for its portfolio of buildings.

| Facility Name | Area (sq. ft.) | EUI (kBtu/sq. ft.) |
|---|---|---|
| **Central Facility** | 38,800 | 150 |
| **CNG Fueling Building** | 10,847 | 358 |
| **Meadowbrook** | 225,265 | 107 |
| **Mt. Ogden** | 43,805 | 173 |
| **Timpanogos** | 32,000 | 279 |
| **Riverside** | 35,038 | 203 |
| **Midvale Rail Service Center** | 103,800 | 139 |
| **Public Safety** | 7,884 | 53 |
| **Clearfield Auto Transfer Facility** | 10,800 | 35 |
| **UP Diesel Shop (Warm Springs)** | 280,000 | 124 |
| **Frontline Headquarters** | 46,594 | 144 |
| **SLC Intermodal Hub** | 23,889 | 161 |
| **Jordan River Service Center** | 318,298 | 75 |
| **Mobility Center** | 26,976 | 40 |
| **Fire Station** | 4,135 | 106 |
| **Ogden Intermodal Hub Bldg.** | 8,069 | 204 |
| **Police Station** | 10,988 | 49 |
| **The Factory** | 60,879 | 7 |
| **Weighted Average EUI** | | **113** |

The ranges used to score this metric are outlined below – all values are kBtu/sq. ft.:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 239.0 | 220.1 | 201.2 | 175.0 | 160.3 | 145.5 | 130.8 | 116.0 | 93.0 | 70.0 | 47.0 | 24.0 |

1. **Low:** The low end of the range was set to the bottom 10% of office buildings in the Denver market (Denver Public Health & Environment, 2020). City-wide benchmarking data was used to set the lower limit because nationwide data sets only included the average efficiency. Denver was chosen because Salt Lake City benchmarking data are not currently publicly available, and Denver offers the closest proximity data set for market size and climate zone.
2. **Average**: Average energy efficiency was based on median energy efficiency of office buildings nationwide based on Energy Star data (Energy Star, 2018). The Energy Star data was chosen because it represents a larger dataset than city-wide benchmarking data.
3. **High**: The high value was set equal to the energy target for Net Zero energy offices from a study by the New Buildings Institute (Carbonnier, 2019).

NOTE: Many of UTA's buildings are not offices and might be expected to use more or less energy than a typical office building. Data for office buildings were used to establish this metric, due to data availability.

This metric can be improved by installing more efficient equipment, improving building controls, and encouraging energy smart behavior from UTA employees.

## Transit Fuel Economy

This metric tracks fuel efficiency of UTA transit vehicles by dividing total transit fuel use (diesel, CNG, gasoline, and electricity combined) by the total number of revenue miles for the year. The calculation for 2018, shown below, is based on data provided by UTA.

$$\frac{Transit\ Fuel\ Use}{Revenue\ Vehicle\ Miles} = \frac{1{,}224{,}535\ MMBtu}{39.15\ million\ miles} = 0.031\ MMBtu/mile$$

The ranges used to score this metric are outlined below – all values are MMBtu/mile:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.074 | 0.068 | 0.062 | 0.058 | 0.051 | 0.044 | 0.036 | 0.029 | 0.024 | 0.019 | 0.015 | 0.010 |

1. **Low:** Based on a study of fleet replacement optimization, the low end of diesel bus efficiency is expected to be 2.4 MPG (Figliozzi & Boudart, 2013). This fuel efficiency was converted to MMBtu per mile using typical energy content on diesel. This value is used as a low-end for overall transit efficiency performance because bus efficiency is most likely to change, due to driving conditions or vehicle replacement, over the short term. This score indicates that the overall transit fleet is performing worse that the oldest diesel buses.
2. **Average**: The average fuel efficiency for all reporting transit agencies was calculated using 2018 Federal Transit Authority energy use and revenue mile data (Federal Transit Administration, 2020).
3. **High**: The high score for this range was set to the typical fuel efficiency of new electric buses of 2.84 kWh/mile, which was converted to MMBtu per mile.

This metric can be improved by driving vehicles more efficiently or replacing vehicles with more efficient models.