# Truckee Tahoe Airport District
## GHG Reduction Plan

**November 2018**

**Prepared for:** **Truckee Tahoe Airport District**
**10356 Truckee Airport Road**
**Truckee, California 96161**

**Prepared by:** **First Environment, Inc.**
**770 L Street, Suite 950**
**Sacramento, California 95814**

TABLE OF CONTENTS

# Executive Summary

Truckee Tahoe Airport District (TTAD) conducted a greenhouse gas (GHG) emissions inventory for airport activities in emission year (EY) 2015. The inventory identified Scope 1 emissions of 158.60 metric tonnes carbon dioxide equivalents (MTCO2e), primarily from stationary and mobile combustion, and Scope 2 emission of 138.09 MTCO2e, resulting from electricity consumption. The majority of the District's Scope 3 emissions of 2099.22 $MTCO_2e$ were from aircraft operations at the airport.

Since the inventory was performed, development at the District has included the construction of several new buildings as well as the expansion or improvement of existing facilities. Additional development is planned to meet the needs of airport users and the community. As a result, Scope 1 and 2 emissions are expected to increase 64 percent and 32 percent, respectively, by 2025.

Recognizing its responsibility to minimize its impacts on the environment, the District is committed to reducing its GHG emissions, even as it grows and develops. After considering different actions to mitigate its GHG emissions, the District intends to reduce Scope 1 and Scope 2 emissions by 50 percent by 2025, relative to its EY2015 base year emissions. The District believes even higher reductions may be possible.

To reach its reduction target, the District expects to implement 10 emission reduction projects. The projects were evaluated to estimate their emissions reduction potential as well as other aspects of project execution. Comparisons of these project's reductions relative to the 2025 emissions projections suggest that the District's reduction target is reasonably achievable.

In addition to implementing the emission reduction projects, the District is considering next steps for GHG management. These steps include studying property sequestration potential, refining emissions projections for aircraft operations, and exploring voluntary carbon offset programs to mitigate Scope 3 emissions. Updating the District's GHG Inventory in 2020 is also suggested to measure its progress toward the reduction target and re-assess its environmental impacts and goals.

# TTAD's Emission Year (EY) 2015 GHG Inventory

Truckee Tahoe Airport District (TTAD) conducted a greenhouse gas (GHG) emissions inventory for airport activities in EY2015. The GHG inventory assessed emissions of six greenhouse gases (GHGs):

- carbon dioxide ($CO_2$)
- methane ($CH_4$)
- nitrous oxide ($N_2O$)
- hydrofluorocarbons (HFCs)
- perfluorocarbons (PFCs)
- sulfur hexafluoride ($SF_6$)

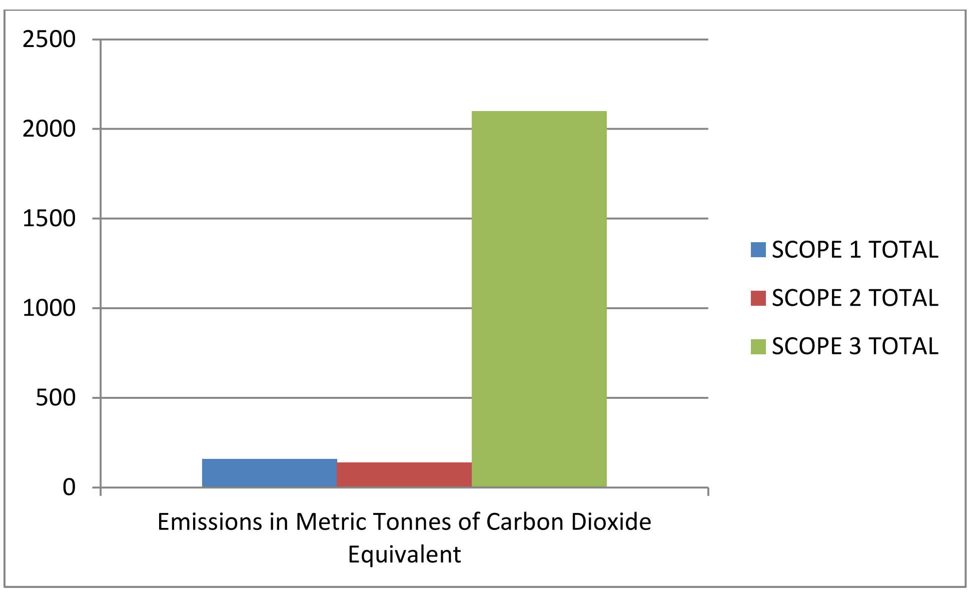
The scope of the inventory included all emissions sources under TTAD's operational control. This consisted of TTAD's Scope 1 "direct" emissions from stationary combustion, mobile combustion, and fugitive gas (e.g., refrigerant) releases, as well as Scope 2 "indirect" emissions from the purchase of electricity. The inventory also quantified TTAD Scope 3 emissions from airport tenants' activities including stationary and mobile combustion, fugitive emissions, and purchased electricity emissions as well as methane emissions resulting from the disposal of airport-generated waste at third-party landfills. Finally, the inventory also quantified TTAD Scope 3 emissions produced by aircraft operations at the airport.

TTAD's EY2015 GHG emissions, reported in metric tonnes carbon dioxide equivalents, were as follows:

**Table 1: EY2015 GHG Emissions**

| | |
|---|---|
| Scope 1 | 158.60 MTCO2e |
| Scope 2 | 138.09 MTCO2e |
| Scope 3 | 2099.22 MTCO2e |

**Figure 1: Total GHG Emissions by Scope**




The "Truckee Tahoe Airport District 2015 Greenhouse Gas Inventory (September 2017)" report provides additional information and details regarding the scope, methods, data, and results of this inventory.

## 2025 GHG Emissions Projections

Since 2015, the District has experienced ongoing development to facilitate meeting the needs of its staff, tenants, and other stakeholders as well as the overall community it serves. This development has included the construction of several new structures, expansion of several existing properties, as well as improvements to existing building conditions and equipment. These changes have produced both increases and decreases in the District's energy use, as well as its GHG emissions.

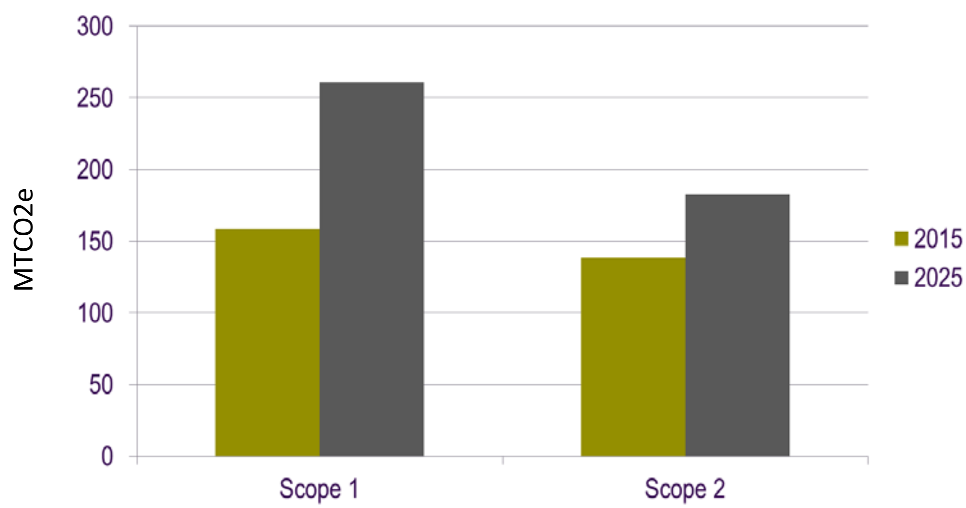
To establish expectations regarding the District's future GHG emissions, energy use associated with these previous improvements as well as planned changes were assessed through 2025. Appendix A identifies the specific District changes considered in this assessment.

The modified energy use estimates were then used to project GHG emissions through 2025. The following table compares District's EY2015 base year emissions to the 2025 GHG emissions projections:

**Table 2: 2025 GHG Emissions Projections**

| | 2015 Base Year Emissions ($MTCO_2e$) | 2025 Emissions Projections ($MTCO_2e$) | Change in Emissions |
|---|---|---|---|
| Scope 1 | 158.60 | 260.74 | 64% increase ↑ |
| Scope 2 | 138.07 | 182.47 | 32% increase ↑ |
| Scope 3 | 2009.22 | 1780.05 | 15% decrease ↓[1] |

**Figure 2: EY2015 Emissions vs 2025 Projections**




Appendix B provides details regarding the EY2015 Base Year emissions vs 2025 Projections.

---

[1] The 2025 Scope 3 emissions projection, which demonstrates a decrease of emissions relative to 2015, includes aircraft emissions quantified by applying future operations estimates from the District's July 2015 Master Plan. These operations estimates appear relatively low when compared to recent actual aircraft operation data but were used in the projections as they represent the current best available estimates for 2025. Updates to these 2025 aircraft operations estimates could result in material changes to the District's 2025 Scope 3 emission projections.

# GHG Reduction Target

As a member of the community with accountability for its activities, the District recognizes its responsibility to minimize its impacts on the environment, especially from sources that are under its control. Though the District realizes that it must continue to grow and develop, it believes that it can do so in a manner that is clean, green, and respects the natural resources that surround it.

As a result, the District has considered a variety of opportunities for improving energy efficiency, sourcing cleaner energy, or otherwise mitigating its GHG emissions. Appendix C identifies the potential GHG reduction actions reviewed.

After considering these opportunities, the District asserts it can reasonably and effectively reduce 50 percent of its Scope 1 and 2 emissions by 2025, relative to its EY2015 base year emissions, by pursuing several GHG reduction projects.

The District believes that realizing even higher reductions could be possible by 2025 if it successfully implements all of the proposed reduction measures by that date.

# GHG Emission Reduction Projects

To achieve its GHG reduction target, the District proposes to implement the following 10 projects which are estimated to reduce GHG emissions as identified:

**Table 3: Projects Reduction Estimates**

| Reduction Project | Estimated GHG Reduction ($MTCO_2e$) |
|---|---|
| 1. Building Lighting Upgrades | 2.67 |
| 2. Runway Lighting Upgrades | 1.00 |
| 3. Building Insulation Improvements | 4.78 |
| 4. Generator Fuel Switch | 1.69 |
| 5. Smart Block Heater Systems | 43.33 |
| 6. Electric Ramp Vehicles | 0.01 |
| 7. Composting Program | 6.00 |
| 8. Recycling Program | 23.90 |
| 9. Solar Generation | Up to 414.48 MTCO2e |
| 10. Biosequestration | 975.92 MTCO2e *sequestered* |

Appendix D provides evaluations for each of the proposed actions including Project Definition and Scope, GHG Reduction Estimate, Implementation Costs, Implementation Steps and Timeframes, GHG Reduction Quantification Methodology, and Project Monitoring.

The following table presents these reductions relative to the Scope 1, 2, and 3 projections.

**Table 4: GHG Reduction "Balance Sheet"**

| | | SCOPE 1 TOTAL | | SCOPE 2 TOTAL | | SCOPE 3 TOTAL | |
|---|---|---|---|---|---|---|---|
| **2025** | **Emission Projections** | **260.74** | MT CO2e | **182.47** | MT CO2e | **1780.05** | MT CO2e |
| | | | | | | | |
| | **Reduction Actions** | | | | | | |
| | | | | | | | |
| 1 | Building Lighting Upgrades | | | 2.67 | MT CO2e | | |
| 2 | Runway Lighting Upgrades | | | 1.00 | MT CO2e | | |
| 3 | Building Insulation Improvements | 4.78 | MT CO2e | | | | |
| 4 | Generator Fuel Switch | 1.69 | MT CO2e | | | | |
| 5 | Smart Block Heater Systems | | | | | 43.33 | MT CO2e |
| 6 | Electric Ramp Vehicles | 0.01 | MT CO2e | | | | |
| 7 | Composting Program | | | | | 7.00 | MT CO2e |
| 8 | Recycling Program | | | | | 23.90 | MT CO2e |
| 9 | Solar Generation | | | 178.80 | MT CO2e | 88.98 | MT CO2e |
| 10 | Biosequestration | 254.26 | MT CO2e | | | 721.66 | MT CO2e |
| | | | | | | | |
| | | Scope 1 | | Scope 2 | | Scope 3 | |
| | **Net Emissions** | **0.00** | MT CO2e | **0.00** | MT CO2e | **895.18** | MT CO2e |
| | | | | | | | |

Though both the emission projections and the reduction project estimates are subject to uncertainty, the "balance sheet" demonstrates that meeting the District's target is reasonably achievable.

# Next Steps in GHG Management

In addition to the implementation of the proposed reduction projects, the following identifies suggested next steps in greenhouse gas management for the District.

### *Study Biosequestration Potential of TTAD Properties*

The District GHG reduction target is materially dependent upon the sequestration potential of its Waddle Ranch and the Jones properties. The sequestration estimate presented in this report was quantified using limited data available and default sequestration rates and as a result do not reflect the actual sequestration of these areas. To determine the actual sequestration potential of the properties, the District should pursue a technical study of the properties performed by qualified forestry experts.

### *Improve Aircraft Operation Emissions Projections*

GHG emissions from aircraft operations at the airport, though outside of the District's direct control, are the largest source of emissions associated with its activities. Projections of these aircraft emissions are limited by the future operations estimates presented in the current Master Plan. Since the last version of the Plan was prepared, the District has collected additional data on actual operations as well as expected usage trends. Refining such aircraft operations estimates and the associated emission projections will provide more relevant and reliable information on this significant Scope 3 emission source if the District seeks to pursue reduction efforts beyond Scopes 1 and 2.

### *Explore Voluntary GHG Offset programs for Scope 3 Emissions*

Reducing Scope 3 emissions, such as tenant activities and aircraft operations, will be challenging for the District due to factors such as operational control and current engine/fuel technology limitations. However, carbon offsetting, where GHG project reductions (e.g., landfill gas destruction) are verified, "credited" and then sold to mitigate GHG emissions from other activities, could be an efficient method to address Scope 3 emissions. A variety of carbon offset programs, projects, and providers exist and the District should explore these options to determine if it wants to pursue either investment in such offsets or offering a voluntary offset purchase option for tenants and other airport users.

### *Conduct a 2020 GHG Inventory Update*

The District is undergoing steady change as it grows and develops. Though the projections in this report provide an indication of how such changes affect its emissions, the District's GHG Inventory should periodically be updated to provide reliable actual emissions data. Performing an inventory update for EY2020 will provide the District a perspective of its progress toward its 2025 target and allow the re-assessment of its environmental impacts and management goals.

# Appendix A – TTAD Changes Included in the 2025 Projections

**2016**

- Warehouse Suite E Re-model
- Maintenance Building Lighting Retrofit

**2017**

- Clear Capital/Car Rental Office Construction
- Hanger 1 Insulation Improvement
- Maintenance Building Expansion
- Temporary Tower Addition
- Maintenance Building, Warehouse Garage and Hanger Lighting Retrofit

**2018**

- Tahoe City Heliport Construction

**2019**

- Executive Hanger Construction
- Hanger 1 Office Expansion
- Admin Building Expansion

**2020**

- Hanger 2 Replacement Construction
- Generator Addition

**2021**

- Box Hanger Construction

**2023**

- Permanent Tower Construction

# Appendix B – 2025 GHG Projections Details

## B1 - GHG Emissions Projections - Scope 1 Detail

| | | | | |
|---|---|---|---|---|
| **2015** | **SCOPE 1 TOTAL** | **158.6016422** | **MT CO2e - SAR** | |
| | | | | |
| | Source Type | Source | MT CO2e - SAR | |
| | | | | |
| | Stationary Combustion | Natural Gas | 70.0865 | |
| | Stationary Combustion | Gasoline | 0.50409 | |
| | Stationary Combustion | Diesel | 2.45022 | |
| | Stationary Combustion | Acetylene | 0.0044 | |
| | Stationary Subtotal | | 73.0453 | |
| | | | | |
| | Mobile Combustion | Gasoline | 32.5451 | |
| | Mobile Combustion | Diesel | 41.3638 | |
| | Mobile Combustion | Propane | 0.86968 | |
| | Mobile Subtotal | | 74.7785 | |
| | | | | |
| | Fugitive | Chiller | 7.98095 | |
| | Fugitive | Domestic Refrigeration | 0.00232 | |
| | Fugitive | Stand Alone Commercial Application | 0.58224 | |
| | Fugitive | Mobile Air Conditioning | 2.21 | |
| | Fugitive | CO2 Fire Extinguishers | 0.00238 | |
| | Fugitive Subtotal | | 10.7779 | |
| | | | | |
| | | | | |
| **2025** | **SCOPE 1 TOTAL** | **260.7418771** | **MT CO2e - SAR** | |
| | | | | |
| | Source Type | Source | MT CO2e - SAR | |
| | | | | |
| | Stationary Combustion | Natural Gas | 168.574 | |
| | Stationary Combustion | Gasoline | 0.50409 | |
| | Stationary Combustion | Diesel | 4.04819 | |
| | Stationary Combustion | Acetylene | 0.0044 | |
| | Stationary Subtotal | | 173.131 | |
| | | | | |
| | Mobile Combustion | Gasoline | 32.5451 | |
| | Mobile Combustion | Diesel | 41.3638 | |
| | Mobile Combustion | Propane | 0.86968 | |
| | Mobile Subtotal | | 74.7785 | |
| | | | | |
| | Fugitive | Chiller | 9.03725 | |
| | Fugitive | Domestic Refrigeration | 0.00232 | |
| | Fugitive | Stand Alone Commercial Application | 1.58037 | |
| | Fugitive | Mobile Air Conditioning | 2.21 | |
| | Fugitive | CO2 Fire Extinguishers | 0.00238 | |
| | Fugitive Subtotal | | 12.8323 | |

## B2 - GHG Emissions Projections - Scope 2 Detail

| | | | | | |
|---|---|---|---|---|---|
| **2015** | | **SCOPE 2 TOTAL** | **138.0731917** | **MT CO2e - SAR** | |
| | | | | | |
| | | Source Type | Source | MT CO2e - SAR | |
| | | | | | |
| | | Purchased Energy | Electricity | 138.073 | |
| | | Purchased Energy Subtotal | | 138.073 | |
| | | | | | |
| | | | | | |
| **2025** | | **SCOPE 2 TOTAL** | **182.4701991** | **MT CO2e - SAR** | |
| | | | | | |
| | | Source Type | Source | MT CO2e - SAR | |
| | | | | | |
| | | Purchased Energy | Electricity | 182.47 | |
| | | Purchased Energy Subtotal | | 182.47 | |

# B3 - GHG Emissions Projections - Scope 3 Detail

| | | | | |
|---|---|---|---|---|
| **2015** | **SCOPE 3 TOTAL** | **2099.223422** | **MT CO2e - SAR** | |
| | | | | |
| | Source Type | Source | MT CO2e - SAR | |
| | | | | |
| | Stationary Combustion | Natural Gas | 15.9814 | |
| | Stationary Combustion | Gasoline | 0 | |
| | Stationary Combustion | Diesel | 0 | |
| | Stationary Subtotal | | 15.9814 | |
| | | | | |
| | Mobile | Gasoline | 32.9986 | |
| | Mobile | Diesel | 2.06051 | |
| | Mobile | LP | 0.69104 | |
| | Mobile Subtotal | | 35.7502 | |
| | | | | |
| | Fugitive | Domestic Refrigeration | 0.00487 | |
| | Fugitive | Commerical A/C | 6.49999 | |
| | Fugitive | Mixed MSW | 47.88 | |
| | Fugitive Subtotal | | 54.3849 | |
| | | | | |
| | Purchased Energy | Electricity | 119.85 | |
| | Purchased Energy Subtotal | | 119.85 | |
| | | | | |
| | Aircraft Fuel Sales | Avgas | 678.802 | |
| | Aircraft Fuel Sales | Jet A | 3133.81 | |
| | Aircraft Fuel Sales Subtotal | | 3812.61 | |
| | | | | |
| | Aircraft Operations | LTO - Pistons - 8020 | 376.303 | |
| | Aircraft Operations | LTO - Turboprop - 8020 | 517.068 | |
| | Aircraft Operations | LTO - Jets - 8020 | 850.852 | |
| | Aircraft Operations | Engine Startup | 29.9236 | |
| | Aircraft Operations | APU | 37.0664 | |
| | Aircraft Operations | Helicopter | 62.0443 | |
| | Aircraft Operations Subtotal | | 1873.26 | |

| | | | | |
|---|---|---|---|---|
| **2025** | **SCOPE 3 TOTAL** | | **1780.048259** | **MT CO2e - SAR** |
| | | | | |
| | Source Type | Source | MT CO2e - SAR | |
| | | | | |
| | Stationary Combustion | Natural Gas | 25.1832 | |
| | Stationary Combustion | Gasoline | 0 | |
| | Stationary Combustion | Diesel | 0 | |
| | Stationary Subtotal | | 25.1832 | |
| | | | | |
| | Mobile | Gasoline | 32.9986 | |
| | Mobile | Diesel | 2.06051 | |
| | Mobile | LP | 0.69104 | |
| | Mobile Subtotal | | 35.7502 | |
| | | | | |
| | Fugitive | Domestic Refrigeration | 0.00487 | |
| | Fugitive | Commerical A/C | 6.49999 | |
| | Fugitive | Mixed MSW | 47.88 | |
| | Fugitive Subtotal | | 54.3849 | |
| | | | | |
| | Purchased Energy | Electricity | 132.305 | |
| | Purchased Energy Subtotal | | 132.305 | |
| | | | | |
| | Aircraft Fuel Sales | Avgas | 947.949 | |
| | Aircraft Fuel Sales | Jet A | 2405.48 | |
| | Aircraft Fuel Sales Subtotal | | 3353.43 | |
| | | | | |
| | Aircraft Operations | LTO - Pistons - Representative | 523.464 | |
| | Aircraft Operations | LTO - Turboprop - Representative | 259.8 | |
| | Aircraft Operations | LTO - Jet - Representative | 593.697 | |
| | Aircraft Operations | Engine Startup | 22.072 | |
| | Aircraft Operations | APU | 26.8585 | |
| | Aircraft Operations | Helicopter | 106.533 | |
| | Aircraft Operations Subtotal | | 1532.42 | |

# Appendix C – GHG Reduction Action Matrix

# GHG Reduction Action Matrix for Truckee Tahoe Airport District

| | | | Financial Considerations | | | Implementation Considerations | | | Potential Impacts | | | Other Considerations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Scope*** | ***Emission Category*** | ***Reduction Action*** | ***Capital Costs*** | ***O&M Costs*** | ***Payback Period*** | ***Control*** | ***Timeframe*** | ***Maturity*** | ***Quantifiable*** | ***Reduction Potential*** | ***Shifts*** | ***Locale*** |
| **Actions within the inventory boundary** | | | | | | | | | | | | |
| Scope 1 | Stationary Combustion | Energy Audits | Maybe | Maybe | Short/Medium | All | Immediate/Short | Proven | Indirectly | Variable | No | Local |
| | | Insulation improvements | Yes | No | Short | All | Short | Proven | Indirectly | Variable | No | Local |
| | | Thermostat upgrades | Yes | No | Short | All | Short | Proven | Indirectly | Variable | No | Local |
| | | Fuel switch - gasoline - E10/E15 | No/Maybe | No | N/A | All | Immediate | Proven | Yes | Low | No | Local |
| | | Fuel switch - diesel - B5/B20 | No/Maybe | No | N/A | All | Immediate | Proven | Yes | Low | No | Local |
| | | Fuel switch - biogas/LFG direct access | Yes | Yes | N/A | Shared | Medium | Proven | Yes | Variable | No | Local |
| | | Fuel switch - RNG transfer by displacement | No | No | N/A | Shared | Immediate | Innovative | Yes | Variable | No | Local |
| | | District heating | Yes | Yes | Long | All | Long | Proven | Indirectly | Variable | Maybe | Local |
| | | Cogeneration system | Yes | Yes | Long | All | Long | Proven | Indirectly | Variable | Maybe | Local |
| | | Geothermal heating | Yes | Yes | Long | All | Long | Innovative | Indirectly | Variable | Maybe | Local |
| | Mobile Combustion | Fuel switch - gasoline - E10/E15 | No/Maybe | No | N/A | All | Immediate | Proven | Yes | Low | No | Local |
| | | Fuel switch - diesel - B5/B20 | No/Maybe | No | N/A | All | Immediate | Proven | Yes | Low | No | Local |
| | | Vehicle upgrade - Increased MPG | Yes | No | Medium | All | Immediate | Proven | Indirectly | Low | No | Local |
| | | Vehicle upgrade - hybrid technology | Yes | No | Medium | All | Immediate | Proven | Indirectly | Low | No | Local |
| | | Vehicle upgrade - electric vehicle | Yes | No | Medium | All | Short | Proven | Indirectly | Low | Yes | Local |
| | | Vehicle upgrade/fuel switch - gasoline - E85 | Yes | No | Medium | All | Immediate | Proven | Yes | Low | No | Local |
| | | Vehicle upgrade/fuel switch - CNG | Maybe | No | Medium | All | Short | Proven | Yes | Low | Yes | Local |
| | Fugitive Emissions | Leak detection & reduction program | No | Yes | N/A | All | Short | Proven | No | Low | No | Local |
| | | Refrigerant switch - Lower GWP | Yes | No | N/A | All | Short | Proven | Indirectly | Low | No | Local |
| Scope 2 | Electricity | Energy Audits | Maybe | Maybe | Short/Medium | All | Immediate/Short | Proven | Indirectly | Variable | No | Local |
| | | Building lighting efficiency upgrades | Yes | No | Short | All | Short | Proven | Indirectly | Variable | No | Local |
| | | Runway lighting efficiency upgrades | Yes | No | Short | All | Short | Proven | Indirectly | Variable | No | Local |
| | | Other energy efficiency measures (e.g., pump upgrades, etc.) | Yes | Maybe | Short/Medium | All | Short | Proven | Indirectly | Variable | No | Local |
| | | Self generation - Solar | Yes | Yes | Long | All | Short/Medium | Proven | Yes | Variable | No | Local |
| | | Self generation - Wind | Yes | Yes | Long | All | Medium | Proven | Yes | Variable | No | Local |
| | | Self generation - Microturbine | Yes | Yes | Long | All | Medium | Proven | Yes | Variable | Yes | Local |
| | | Green Power PPA | No | No | N/A | All | Short | Proven | Yes | Variable | No | Other |
| Scope 3 | Tenant Activities | Tenant Policy Development | No | No | N/A | Shared/Influence | Short | Proven | Indirectly | Variable | No | Local |
| | | Tenant Sub-metering | Yes | Yes | N/A | Influence | Short | Proven | Indirectly | Variable | Maybe | Local |
| | Landfilled Waste | Recycling program | Yes | Yes | N/A | Shared/Influence | Short | Proven | Maybe | Low | No | Local |
| | | Composting program | Yes | Yes | N/A | Shared/Influence | Short | Proven | Maybe | Low | Maybe | Local |
| | | LF gas capture | Yes | Yes | N/A | Shared | Medium | Proven | Indirectly | Low | No | Local |
| | Aircraft LTO | Taxi policy and procedures | No | No | N/A | Shared/Influence | Short | Proven | Maybe | Low | No | Local |
| | | Alternative fuels for aircraft | Yes | Yes | N/A | Influence | Medium/Long | R&D | Maybe | Variable | No | Local |
| | | Push back/taxi tugs | Yes | Yes | N/A | Shared/Influence | Short | Proven | Maybe | Low | Yes | Local |
| | | Jet engine washing | Yes | Yes | N/A | Influence | Medium | Innovative | No | N/A | Yes | Local |
| | APU Emissions | APU usage policy and procedures | No | No | N/A | Shared/Influence | Short | Proven | Maybe | Low | No | Local |
| | | GPU services | Yes | Yes | N/A | Shared/Influence | Short | Proven | Yes | Low | Yes | Local |
| **"Balance Sheet" actions** | | | | | | | | | | | | |
| | | Offset purchases | No | No | N/A | All | Immediate | Proven | Yes | Variable | No | Other |
| | | REC purchases | No | No | N/A | All | Immediate | Proven | Yes | Variable | No | Other |
| | | RNG transfer by renewable attributes | No | No | N/A | All | Immediate | Innovative | Yes | Variable | No | Other |
| | | Carbon biosequestration | Yes | Yes | N/A | All | Medium/Long | Proven | Yes | Variable | No | Local |
| **Actions outside the inventory boundary** | | | | | | | | | | | | |
| | | Priority parking areas for low carbon vehicles | Maybe | Maybe | N/A | Influence | Short | Proven | No | N/A | No | Local |
| | | Public transit promotions | ? | ? | N/A | Influence | Short | Proven | No | N/A | No | Local |
| | | Alternative fuel rental cars | ? | ? | N/A | Influence | Short | Proven | No | N/A | No | Local |
| | | Alternative fuel limo and taxi | ? | ? | N/A | Influence | Short | Proven | No | N/A | No | Local |
| | | Construction policy development | ? | ? | N/A | Shared | Short | Proven | No | N/A | No | Local |
| **Other** | | | | | | | | | | | | |
| | | Climate Change Communications Program | No | Yes | N/A | All | Short | Proven | No | N/A | No | Local |
| | | Reporting or Accreditation Program Participation | No | Yes | N/A | All | Short | Proven | No | N/A | No | Local |

# C1. GHG Reduction Action Descriptions

## Scope 1 Reduction Actions

### Energy Efficiency Measures

***Insulation improvements*** – Install or replace building insulation to decrease natural gas usage for heating.

***Thermostat upgrades*** – Install or replace building thermostats to decrease natural gas usage for heating.

***Energy Audits*** – Perform inspections of District facilities including building envelope insulation, installed equipment and how equipment is operated to identify specific energy-saving actions (e.g., space heating equipment upgrades, etc.).

### Stationary Source Fuel Switch

***Fuel switch – gasoline - E10/E15*** - Use a gasoline blend that contains a percentage of ethanol (a "biogenic" fuel considered GHG-free) to decrease fossil fuel emissions.

***Fuel switch – diesel - B5/B20*** - Use a diesel blend that contains a percentage of biodiesel (a "biogenic" fuel considered GHG-free) to decrease fossil fuel emissions.

***Fuel switch - biogas/LFG direct access*** - Use either biogas or landfill gas (a "biogenic" fuel considered GHG-free) that is piped directly from a wastewater treatment facility, digester, or a landfill to replace fossil natural gas usage.

***Fuel switch - RNG transfer by displacement*** - Purchase renewable natural gas from a WWTF, digester, or a landfill that is not directly accessible. Biogas/landfill gas is fed into the NG transmission pipeline and displaces fossil natural gas usage.

### Heating system technology change

***District heating*** – Construct a central heat-only boiler station to provide heat to all District buildings. The higher efficiency of the boiler station results in decreased natural gas usage.

***Cogeneration system*** – Construct a combined heat and power system (aka cogeneration unit) to provide heat to all District buildings as well as generate electricity. The higher efficiency of the cogen unit results in decreased natural gas usage and the electricity generated decreases electricity demand from outside sources.

***Geothermal heating*** – Construct a ground-source heat pump system, which transfers heat to or from the ground, to provide heat and cooling to some/all District buildings. The energy efficiency of the system decreases natural gas usage.

### Mobile Source Fuel Switch

***Fuel switch - gasoline - E10/E1****5* - Use a gasoline blend that contains a percentage of ethanol (a "biogenic" fuel considered GHG-free) to decrease fossil fuel emissions.

***Fuel switch - diesel - B5/B20*** - Use a diesel blend that contains a percentage of biodiesel (a "biogenic" fuel considered GHG-free) to decrease fossil fuel emissions.

### Vehicle Technology Change

***Vehicle upgrade - Increased MPG*** – Replace an existing fleet vehicle with vehicle with higher fuel efficiency (i.e., increased MPG). The higher fuel efficiency decreases gasoline/diesel fuel usage.

***Vehicle upgrade - hybrid technology*** – Replace an existing fleet vehicle with petroleum-electric hybrid technology vehicle. The higher fuel efficiency decreases gasoline fuel usage.

***Vehicle upgrade - electric vehicle*** – Replace an existing fleet vehicle with an electric vehicle. Electricity consumption replaces fossil fuel combustion.

***Vehicle upgrade/fuel switch - gasoline - E85*** – Replace an existing fleet vehicle with vehicle with capable of combusting "E85" ethanol fuel to decrease fossil fuel emissions.

***Vehicle upgrade/fuel switch - CNG*** – Replace an existing fleet vehicle with a compressed natural gas vehicle. Natural gas consumption replaces gasoline/diesel usage and produces less GHG emissions.

### Fugitive Emissions Reduction

***Leak detection & reduction program*** – Perform refrigerant leak audits to identify refrigerant leak locations so those leaks can be sealed and emissions reduced.

***Refrigerant switch - Lower GWP –*** Either retrofit existing refrigerant-containing equipment so that it can use refrigerants with a lower global warming potential (i.e., less impact on climate) or replace equipment with equipment that uses refrigerants with a lower global warming.

## Scope 2 Reduction Actions

### Energy Efficiency Measures

***Energy Audits*** - Perform inspections of District facilities including building lighting, electricity consuming equipment/appliances and how equipment/appliances are operated to identify specific energy-saving actions (e.g., use controls such as sensors, dimmers, or timers to reduce lighting use, etc.)

***Building lighting efficiency upgrades*** – Replace building incandescent/compact fluorescent light bulbs with compact fluorescent/LED light bulbs to reduce electricity consumption.

***Runway lighting efficiency upgrades*** – Replace airfield incandescent/compact fluorescent light bulbs with compact fluorescent/LED light bulbs to reduce electricity consumption.

***Other energy efficiency measures*** – Replace existing electric-consuming equipment (e.g., pumps)/appliances (e.g., refrigerators) with higher efficiency equipment/appliances to decrease electricity use.

### Electricity Generation

***Self-generation – Solar*** – Install solar photovoltaic panels or construct an on-site solar generation facility to generate GHG-free electricity and replace some or most of the District's grid electricity use.

***Self-generation – Wind*** - Install wind generation or construct an on-site wind generation facility to generate GHG-free electricity and replace some or most of the District's grid electricity use.

***Self-generation – Microturbine*** – Install a microturbine system to replace diesel-fueled generation sources (i.e., backup generators). Natural gas consumption replaces diesel usage and produces less GHG emissions.

***Green Power PPA –*** Contract to purchase electricity directly from a clean energy facility (e.g., a wind farm) to replace grid-source electricity.

## Scope 3 Reduction Actions

### Tenant Activities Reduction Actions

***Tenant Policy Development*** – Develop policies to influence tenant energy usage (e.g., require LED bulbs in hangars, etc.) to reduce fuel combustion and electricity consumption.

***Tenant Sub-metering*** - Install sub-metering in tenant facilities to measure, monitor, and motivate reduced fuel and electricity consumption, either indirectly by creating awareness of energy use, or directly by charging for the sub-metered consumption.

### Waste Emissions Reductions

**Recycling program** – Implement programs to encourage diversion of recyclable waste streams (e.g., aluminum, glass, etc.) from disposal in landfills to material recovery and reprocessing operations.

**Composting program** - Implement programs to encourage diversion of organic waste streams (e.g., food, waste, grass clippings, hedge trimmings, etc.) from disposal in landfills to composting operations.

***LF gas capture*** – Partner with landfill(s) receiving District waste to influence the facility to capture fugitive landfill gas, either for destruction or utilization, through electricity generation or pipeline supply.

### Aircraft LTO reduction actions

***Taxi policy and procedures*** - Develop policies and procedures to influence pilots' taxi performance to reduce aircraft operation emissions.

**Alternative fuels for aircraft** – Make aircraft biofuels available for purchase at the District to replace combustion of fossil fuels in aircraft operations.

***Push back/taxi tugs*** – Provide tug service to aircraft to reduce aircraft operations emissions during taxi.

***Jet engine washing*** – Provide jet engine washing services at the District to increase jet engine efficiency and reduce fuel consumption.

### APU emissions reduction actions

***APU usage policy and procedures*** - Develop policies and procedures to influence aircraft APU usage and reduce APU usage emissions.

***GPU services*** – Provide GPU services to reduce or replace APU usage. The GPU's higher efficiency results in reduced emissions.

## "Balance Sheet" Reduction Actions

***Offset purchases*** – Purchase credits from third-party emission reduction projects to offset District emissions.

***REC purchases*** – Purchase renewable energy credits from clean energy generation facilities to "green" District electricity purchases and "reduce" indirect emissions.

***RNG transfer by renewable attributes*** - Purchase renewable natural gas credits from biogas, digester, or landfill gas facilities to "green" District natural gas purchases and reduce natural gas emissions.

***Carbon biosequestration*** – Protect or enhance terrestrial carbon sinks (e.g., forests) to capture carbon dioxide from the atmosphere and create a credit against anthropogenic GHG emissions.

## Actions outside the inventory boundary

***Priority parking areas for low-carbon vehicles*** – Designate District parking areas as reserved for low-carbon vehicles (e.g., hybrids, electric, alternative fuels, etc.).

***Public transit promotions*** – Collaborate with public transit agencies to increase public transit usage.

***Alternative fuel rental cars*** – Collaborate with airport rental car companies to offer renters alternative fuel rental car options.

***Alternative fuel limo and taxi*** – Collaborate with local limo and taxi companies to encourage the use of alternative fuel vehicles.

***Construction policy development*** - Develop policies to influence construction company operations (e.g., require B5 fuel use in construction vehicles) to reduce fuel combustion and electricity consumption.

## Other Activities

***Climate Change Communications Program*** – Develop a program to inform and educate the public about the issue of climate change, including the District impacts on the climate and actions to mitigate those impacts.

***Reporting or Accreditation Program Participation*** – Join a GHG reporting or accreditation program (e.g., The Climate Registry, the Airport Carbon Accreditation program, etc.) to increase the profile and/or credibility of the airport's GHG mitigation actions.

## C2. Screening Criteria Descriptions

## Financial Considerations

**Capital Costs – Implementing reduction action includes material upfront costs to plan, design and/or construct.**

***Yes*** – Action will involve capital costs.

***Maybe*** – Action could involve capital costs depending on aspects of implementation.

***No*** – Action does not involve capital costs.

**Additional O&M Costs - Implementing reduction action includes material annual costs for continued operation.**

***Yes*** – Action will involve O&M costs.

***Maybe*** – Action could involve O&M costs depending on aspects of implementation.

***No*** – Action does not involve O&M costs.

**Payback Period – Reduction action provides a return on the investment and "repays" the capital and O&M costs.**

***Short*** – Expected payback period is <2 years.

***Medium*** – Expected payback period is 2-5 years.

***Long*** – Expected payback period is >5 years.

***N/A*** – Action would not payback.

## Implementation Considerations

**Control – Level of control that the District possesses over the reduction action.**

***All*** – District has complete control over the reduction action.

***Shared*** – District would share control of the reduction action with another party.

***Influence*** – District has no control over the reduction action, but influences the reduction actions of other parties.

**Timeframe – Time period needed to implement the reduction action and for emission reductions to begin occurring.**

***Immediate*** – Action could be implemented in <1 year.

***Short*** – Action could be implemented in 1-3 years.

***Medium*** – Action could be implemented in 3-5 years.

***Long*** – Could take >5 years to implement actions.

**Maturity – Developmental stage of the technology, operability, and effectiveness of the reduction action.**

***Proven*** – Action has a proven track record of implementation.

***Innovative*** – Action involves a technology or practice with limited instances of implementation.

*Emerging* – Action involves a leading edge technology or practice.

## Potential Impacts

**Quantifiable – Possibility to quantify the emission reductions resulting from the action implemented.**

***Yes*** – Current GHG inventory quantification approach will reflect emissions reductions from implementing the action.

***Maybe*** – Current GHG inventory quantification approach could reflect emissions reductions from implementing the action, depending on aspects of implementation.

***No*** – Current GHG inventory quantification approach would not reflect emissions reductions from implementing the action.

***Indirectly*** - Emissions reductions from implementing the action would indirectly be reflected in the GHG inventory (e.g., less fuel use would result in less emissions).

**Reduction Potential – Magnitude of the emission reductions as a result of the action.**

***Low*** – Reduction of emissions due to action will be relatively low.

***Variable*** – Reduction of emissions due to action varies depending on aspects of implementation (e.g., number of electric vehicles, size of cogen, etc.)

**Emission Shifts – Reduction action will shift emission between the GHG Inventory Scopes (i.e., from Scope 1 to Scope 2) as a result of changing control of the emission source, or replacing an emission source in one scope with an emission source in another scope.**

***Yes*** – Action results in a shift of emissions one scope to another scope.

***No*** – Action does not result in a shift of emissions one scope to another scope.

## Other Considerations

**Locale – Does the action result in emission reductions locally?**

***Local*** – Action results in local emission reductions.

***Other*** – Action results in emission reductions in other locations.

# Appendix D – Reduction Project Evaluations

## D1. GHG Reduction Candidate Action: Building Lighting System Upgrades

### A. Project Definition and Scope

Switching to energy-efficient lighting, such as halogens, compact fluorescent lamps (CFLs), and light-emitting diodes (LEDs), produces the same amount of light using less electricity when compared to older technologies such as incandescent, high pressure sodium (HPS), or metal halide (MH).

In addition, electric lighting controls can be incorporated to achieve a more energy efficient lighting system. Controls such as timers and photocells save electricity by turning lights off when not in use. Dimmers save electricity when used to lower light levels. Exterior motion detectors and interior occupancy sensors can be used to turn lights on only when people are present.

The following District buildings possess opportunities for lighting system upgrades:

- Hanger A – currently incandescent and HPS lighting
- Hanger H – currently HPS lighting
- Hanger L – currently HPS lighting
- Hanger M – currently HPS lighting

Upgrading lighting systems for these facilities could decrease electricity consumption needed to illuminate these buildings interiors.

Reduction project implementation could decrease:

- Indirect Emissions: Electricity Consumption

### B. GHG Reduction Estimate

The replacement of these hangers' existing lighting, consistent with the following assumptions, could produce the following energy use reductions:

| Location | Existing Lighting - each hanger | Replacement Lighting - each hanger | Energy Savings – all hangers (assuming 8 hours weekly usage) |
|---|---|---|---|
| A-Row | 2 x 250w incandescent | 2 x 30w LED | 3478 kWh |
| H-Row | 4 x 300w HPS | 4 x 150w LED | 2496 kWh |
| L-Row | 4 x 300w HPS | 4 x 150w LED | 1498 kWh |
| M-Row | 2 x 300w HPS | 2 x 150w LED | 2246 kWh |

Implementation of all the above replacements could annually save approximately 9,718 kWh of electricity consumption.

An annual reduction of 9,718 kWh results in an emission reduction of approximately ***2.67 metric tonnes $CO_2$e***.

### C. Implementation Costs

Capital: Assuming a time and materials cost of $500 per fixture, estimated costs for the lighting system upgrades in A, H, L, and M row hangers would be approximately $70,000.

O&M Costs: N/A

### D. Implementation Steps and Timeframes

I. Perform energy audit or other assessments as needed to identify opportunities for lighting system upgrades.
II. Select facilities for lighting system upgrades and design improvement measures.
III. Determine whether project will be performed by District staff or outsourced, and bid, select and contract services as needed.
IV. Identify lighting system upgrades materials.
V. Order lighting system upgrades materials.
VI. Install lighting system upgrades materials.

Completion of project implementation could be expected **within six months** of decision to proceed.

### E. GHG Reduction Quantification Methodology

***Indirect Emissions: Purchased Electricity***

"Market-based electricity emissions" are calculated by multiplying the megawatt hours of total consumption in project buildings by the following electricity emission factors for $CO_2$, $CH_4$ and $N_2O$ sourced from the Truckee Donner PUD 2012 GHG Re-Inventory:

| | lb $CO_2$ per MWh | lb $CH_4$ per GWh | lb $N_2O$ per GWh |
|---|---|---|---|
| Electricity - TDPUD | 606.8 | 9.55 | 7.02 |

The results of these calculations are pounds of $CO_2$, $CH_4$, and $N_2O$ emissions that are converted to metric tonnes of $CO_2$, $CH_4$, and $N_2O$ emissions, and then multiplied by IPCC SAR GWPs to identify total emissions in units of metric tonnes $CO_2$e.

Assuming consistent operations and conditions, comparison of project building emissions after lighting system upgrades with project building EY2015 base year emissions will identify project reduction.

### F. Project Monitoring

***Indirect Emissions: Purchased Electricity***

- Annual electricity consumption in kilowatt hours in project buildings, compiled from Truckee Donner Public Utility District invoices.

# D2. GHG Reduction Candidate Action: Runway Light Upgrades

## A. Project Definition and Scope

Switching runway lights from incandescent to energy-efficient light-emitting diodes (LEDs) could provide the same runway illumination services using less electricity.

The District's runway lights currently include approximately 200 incandescent light fixtures which represent opportunities for LED replacements.

Replacing this runway lighting could decrease electricity consumption while continuing to ensure clear runway conditions during bad weather or night settings.

Reduction project implementation could decrease:

- Indirect Emissions: Electricity Consumption

## B. GHG Reduction Estimate

The replacement of these runway lights, consistent with the following assumptions, could produce the following energy use reductions:

| Location | Existing Light | Replacement Light | Energy Savings – each fixture (assuming 2 hour daily usage) |
|---|---|---|---|
| Runway - 200 fixtures | 45w incandescent | 20w LED (without heater) | 18.25 kWh |

Implementation of all 200 fixture replacements could annually save approximately 3,650 kWh of electricity consumption.

An annual reduction of 3,650 kWh results in an emission reduction of approximately: ***1.00 metric tonne $CO_2$e***.

## C. Implementation Costs

Capital: Assuming a time and materials cost of $350 per fixture[2], estimated costs for runway incandescent light replacement with LEDs for would be approximately $70,000.

O&M Costs: N/A

## D. Implementation Steps and Timeframes

I. Perform assessments as needed to identify opportunities for runway lighting replacements.
II. Select lighting replacement measures.
III. Determine whether project will be performed by District staff or outsourced, and bid, select and contract services as needed.
IV. Identify lighting replacement materials.
V. Order lighting replacement materials.
VI. Install lighting replacement materials.

[2] Cost estimate informed by "FAA Standards for LED Lighting and Energy Efficiencies, https://pdfs.semanticscholar.org/presentation/3ff5/bbcdfe724147516f2543db25ddc0cf900ced.pdf

Completion of project implementation could be expected **within 12-18 months** of decision to proceed.

### GHG Reduction Quantification Methodology

#### *Indirect Emissions: Purchased Electricity*

"Market-based electricity emissions" are calculated by multiplying the megawatt hours of total consumption by the following electricity emission factors for $CO_2$, $CH_4$ and $N_2O$ sourced from the Truckee Donner PUD 2012 GHG Re-Inventory:

| | lb $CO_2$ per MWh | lb $CH_4$ per GWh | lb $N_2O$ per GWh |
|---|---|---|---|
| Electricity - TDPUD | 606.8 | 9.55 | 7.02 |

The results of these calculations are pounds of $CO_2$, $CH_4$, and $N_2O$ emissions that are converted to metric tonnes of $CO_2$, $CH_4$, and $N_2O$ emissions, and then multiplied by IPCC SAR GWPs to identify total emissions in units of metric tonnes $CO_2e$.

Assuming consistent operations and conditions, comparison of project electricity account emissions after light replacement with project electricity account EY2015 base year emissions will identify project reduction.

## E. Project Monitoring

#### *Indirect Emissions: Purchased Electricity*

- Annual electricity consumption in kilowatt hours in project electricity accounts, compiled from Truckee Donner Public Utility District invoices.

# D3. GHG Reduction Candidate Action: Building Insulation Improvements

## A. Project Definition and Scope

Building insulation reduces heat gain or loss, which leads to less of a demand for energy to maintain the temperature of the building with heating, air conditioning, and ventilation (HVAC) systems.

However, most District buildings are adequately insulated or additional insulation would not result in material energy use reductions. As a result, opportunities for insulation improvement are limited to:

- Warehouse Unit D2
- Warehouse Units “E”

Insulation of these facilities could decrease natural gas and electricity use needed to heat, or cool, the building during periods of occupancy.

Reduction project implementation could decrease:

- Direct Emissions: Stationary Combustion: Natural Gas

## B. GHG Reduction Estimate

Natural gas usage for Warehouse Unit D2 & E was modeled using Department of Energy insulation energy saving worksheets[3]. These DOE models suggested that improving the existing R-13 batt insulation to an R-25 level for these units could produce a 60% reduction of energy use and annually reduce approximately 900 therms of natural gas use.

An annual reduction of 900 therms of natural gas results in an emission reduction of approximately: ***4.78 metric tonnes $CO_2e$***.

## C. Implementation Costs

Capital: Assuming a conservative time & materials cost of $2.00/square foot[4], estimated costs for insulation improvements to Warehouse Units D2 and E would be approximately $20,000.

O&M Costs: N/A

## D. Implementation Steps and Timeframes

I. Perform energy audit or other assessments as needed to identify opportunities for insulation improvements.
II. Select facilities for insulation improvements and design improvement measures.
III. Determine whether project will be performed by District staff or outsourced, and bid, select and contract services as needed.
IV. Identify insulation improvement materials.
V. Order insulation improvement materials.

---

3 https://www.energy.gov/sites/prod/files/2014/01/f7/energy_savings_insulation_worksheet.xls

4 Cost estimate informed by https://www.homewyse.com/services/cost_to_install_batt_wall_insulation.html and https://www.remodelingexpense.com/costs/cost-metal-building-insulation/

VI. Install insulation improvement materials.

Completion of project implementation could be expected **within 12-36 months** of decision to proceed.

## E. GHG Reduction Quantification Methodology

***Direct Emissions: Stationary Combustion: Natural Gas***

Emissions are calculated by multiplying the mmBtu heat content of the total natural gas usage in project buildings by the following natural gas emission factors for $CO_2$, $CH_4$, and $N_2O$ sourced from the US EPA emission factors for GHG inventories:

| | kg $CO_2$ per mmBtu | g $CH_4$ per mmBtu | g $N_2O$ per mmBtu |
|---|---|---|---|
| Natural Gas | 53.06 | 1.00 | 0.10 |

The results of these calculations are converted to pounds of $CO_2$, $CH_4$, and $N_2O$ emissions that are converted to metric tonnes of $CO_2$, $CH_4$, and $N_2O$ emissions, and then multiplied by IPCC SAR GWPs to identify total emissions in units of metric tonnes $CO_2e$.

Assuming consistent operations and conditions, comparison of project building emissions after insulation improvements with project building EY2015 base year emissions will identify project reduction.

## F. Project Monitoring

***Direct Emissions: Stationary Combustion: Natural Gas***

- Annual natural gas usage in therms in project buildings compiled from Southwest Gas Corporation invoices.

# D4. GHG Reduction Candidate Action: Generator Fuel Switch

## A. Project Definition and Scope

Fuel switching to fuels with a lower carbon intensity will reduce GHG emissions.

TTAD has two diesel-fueled emergency generators on site. Natural gas is a less carbon-intensive fuel than diesel per MMBtu; therefore switching to natural gas-fired generators would reduce GHG emissions.

Reduction project implementation could decrease:

- Direct Emissions: Stationary Combustion

## B. GHG Reduction Estimate

Annual GHG emissions from the existing diesel generators are estimated to be 23.78 $MTCO_2e$. Emissions quantification was based on assumed runtime of 30 minutes each week by each generator.

GHG emissions from two comparable natural gas generators (e.g., Caterpillar G3412C engine) running 30 minutes each week are estimated to be 22.1 $MTCO_2e$.

This results in an annual emission reduction of ***1.69 metric tonnes CO2e***.

This reduction is based solely use of the engine/generator for weekly testing. Prolonged use of a natural gas generator set during power outages would result in reductions of 1 $MTCO_2e$ for every 31 hours of use relative to the existing diesel-fired equipment.

## C. Implementation Costs

Capital: The estimated cost for a 500 kW natural gas engine/generator is $150,000.

O&M Costs: Annual costs include fuel to test the generator and any required maintenance. Maintenance cost are anticipated to be less than those associated with the existing generator because a replacement would represent newer equipment relative to the existing 1991 model year diesel generator with fewer age-related issues.

## D. Implementation Steps and Timeframes

I. Source and procure new generator
II. Install and commission generators
III. Update air permit for generators

Completion of project implementation could be expected **within 12 to 18 months** of decision to proceed.

## E. GHG Reduction Quantification Methodology

***Direct Emissions: Stationary Combustion: Natural Gas***

Emissions are calculated by multiplying the quantity of natural gas consumed by the natural gas-fired generators by natural gas emission factors for $CO_2$, $CH_4$, and $N_2O$ sourced from the US EPA emission factors for GHG inventories:

| Fuel | kg $CO_2$ per MMBtu | g $CH_4$ per MMBtu | g $N_2O$ per MMBtu |
|---|---|---|---|
| Natural Gas | 53.06 | 1 | 0.1 |

The results of these calculations are converted to metric tonnes of $CO_2$, $CH_4$, and $N_2O$ emissions and then multiplied by IPCC SAR GWPs to identify total emissions in units of metric tonnes $CO_2$e.

***Direct Emissions: Stationary Combustion: Diesel***

Each hour of natural gas generator runtime represents 25 gallons of diesel fuel that would have been burned in the replaced diesel generator.

Emissions are calculated by multiplying the quantity of total diesel that would have been combusted by the replaced backup generator by diesel emission factors for $CO_2$, $CH_4$, and $N_2O$ sourced from the US EPA emission factors for GHG inventories:

| Fuel | kg $CO_2$ per gallon | g $CH_4$ per gallon | g $N_2O$ per gallon |
|---|---|---|---|
| Diesel | 10.21 | 0.41 | 0.08 |

The results of these calculations are converted to metric tonnes of $CO_2$, $CH_4$, and $N_2O$ emissions and then multiplied by IPCC SAR GWPs to identify total emissions in units of metric tonnes $CO_2$e.

GHG emission reductions are quantified as the difference between emissions associated with diesel fuel combustion by the existing generators and emissions associated with natural gas combustion in the replacement natural gas engines.

## F. Project Monitoring

***Direct Emissions: Stationary Combustion***

- Annual generator run-time in hours
- Annual generator natural gas fuel consumption

# D5. GHG Reduction Candidate Action: Smart Aircraft Engine Block Pre-heaters Systems

## A. Project Definition and Scope

To ensure safe engine operation as well as realize long-term maintenance benefits, it is recommended that an aircraft engine block be pre-heated before operation when temperatures approach freezing. Several companies provide electrical engine pre-heaters which perform this function.

Under most circumstances, engine pre-heating can be accomplished in a few hours before aircraft use. However, to ensure the engine is pre-heated before arrival at the hanger, it is not uncommon for owners to keep engine heaters continuously operating (and therefore consuming electricity) regardless of when or how often aircraft use occurs.

A "smart aircraft engine pre-heater system" could reduce excessive heater operation by allowing an owner to initiate engine pre-heater operation several hours (or even overnight) before expected aircraft use. Such a system consists of an internet connected device that supplies power to the engine pre-heater that can be activated using a phone, tablet or computer, either using an app or via text message.

Implementing smart engine block pre-heater technology at the District could decrease:

- Indirect Emissions: Electricity Consumption

## B. GHG Reduction Estimate

Implementation of smart aircraft engine pre-heater systems, consistent with the following assumptions, could produce the following energy use reductions:

| Hangers with heaters | Hourly pre-heater energy use | Pre-project annual heater operation (24hr x 7d x 24w) - Each hanger | Pre-project annual energy use – Each hanger | Post-project annual heater operation (4hr x 1d x 24w) - Each hanger | Post-project annual energy use – Each hanger |
|---|---|---|---|---|---|
| 50 | 800 watts[5] | 4032 hours | 3226 kWh | 96 hours | 77 kWh |

Installing a smart system at the 50 hangers which use engine pre-heaters could annually save approximately 157,400 kWh.

An annual reduction of 157,400 kWh results in an emission reduction of approximately ***43.33 metric tonnes $CO_2$e***.

## C. Implementation Costs

Capital: Assuming a time and materials cost of $400 per smart system[6] (power connection device, not the actual heater), estimated costs for implementation of the project at the 50 hangers would be approximately $20,000.

O&M Costs: Unless it is already available at all hangers, the smart systems would need internet access either via Wi-Fi networks, or alternatively via cellular connections, for an estimated annual cost of $1,000.

[5] http://www.reiffpreheat.com/product.htm, assuming 6 cylinder engine.
[6] Cost estimate informed by http://switchboxcontrol.com/

## D. Implementation Steps and Timeframes

I. Perform assessments (surveys, etc.) as needed to identify engine pre-heater hangers.
II. Identify project's smart power connection technology.
III. Order power connection units.
IV. If needed, install supporting Wi-Fi networks.
V. Install and activate engine pre-heater smart power connection units.
VI. Completion of project implementation could be expected **within 12 months** of decision to proceed.

## E. GHG Reduction Quantification Methodology

***Indirect Emissions: Purchased Electricity***

"Market-based electricity emissions" are calculated by multiplying the megawatt hours of total consumption in project hanger buildings by the following electricity emission factors for $CO_2$, $CH_4$ and $N_2O$ sourced from the Truckee Donner PUD 2012 GHG Re-Inventory:

| | lb $CO_2$ per MWh | lb $CH_4$ per GWh | lb $N_2O$ per GWh |
|---|---|---|---|
| Electricity - TDPUD | 606.8 | 9.55 | 7.02 |

The results of these calculations are pounds of $CO_2$, $CH_4$, and $N_2O$ emissions that are converted to metric tonnes of $CO_2$, $CH_4$, and $N_2O$ emissions, and then multiplied by IPCC SAR GWPs to identify total emissions in units of metric tonnes $CO_2e$.

Assuming consistent operations and conditions, comparison of project hanger emissions after smart engine pre-heater system implementation with project hanger EY2015 base year emissions will identify project reduction.

## F. Project Monitoring

***Indirect Emissions: Purchased Electricity***

- Annual electricity consumption in kilowatt hours in project hangers, compiled from Truckee Donner Public Utility District invoices.

# D6. GHG Reduction Candidate Action: Electric Ramp Vehicles

### A. Project Definition and Scope

Using ramp vehicles with electric motors in place of equipment with fossil fuel-powered engines has the potential to reduce GHG and other air pollutant emissions.

On a per energy unit basis, power generated from electricity emits less GHGs than the same energy produced from internal combustion engines in ramp equipment. Use of electric-powered ramp vehicles such as utility task vehicles (UTVs, i.e., “mules”), tugs, and jet refuelers would reduce TTAD’s overall GHG emissions.

Reduction project implementation could decrease:

- Direct Emissions: Mobile Combustion

Reduction project implementation *would increase*:

- Indirect Emissions: Electricity Consumption

However, the net change is anticipated to be a reduction overall and will also result in local air quality improvements through reduced fuel combustion on site.

### B. GHG Reduction Estimate

Estimated emissions from purchased electricity are subtracted from UTV vehicle emissions from gasoline combustion to determine emission reductions attributable to switching to electric ramp vehicles.

Emission reductions attributable to switching from a gasoline-powered UTV to an electric vehicle for ramp operations would result in annual emission reductions of less than ***0.01 metric tonnes $CO_2$e***.

The low impact of the switch is attributable to the limited usage of the gasoline-power UTV (25 gallons per year). Reduced fuel consumption by District pickup trucks due to increased electric vehicle use was not quantified.

### C. Implementation Costs

<u>Capital</u>: Estimated costs for an electric UTV are $15,000.

<u>O&M Costs</u>: Electricity costs will increase slightly with the implementation of the project. Increases are anticipated to be slightly offset by decreases in spending on gasoline purchases.

Maintenance costs for an electric-powered UTV are anticipated to be lower than a gasoline-powered UTV because the engine and other assemblies have fewer moving parts.

### D. Implementation Steps and Timeframes

I. Select candidate ramp equipment for replacement
II. Identify electric-powered replacement vehicles
III. Administer procurement of replacement vehicles

Completion of project implementation could be expected **<u>within six months</u>** of decision to proceed.

## E. GHG Reduction Quantification Methodology

### *Indirect Emissions: Purchased Electricity*

"Market-based electricity emissions" are calculated by multiplying the megawatt hours of total consumption in ramp vehicles by the following electricity emission factors for $CO_2$, $CH_4$ and $N_2O$ sourced from the Truckee Donner PUD 2012 GHG Re-Inventory:

| | lbs. $CO_2$ per MWh | lbs. $CH_4$ per GWh | lbs. $N_2O$ per GWh |
|---|---|---|---|
| Electricity - TDPUD | 606.8 | 9.55 | 7.02 |

The results of these calculations are pounds of $CO_2$, $CH_4$, and $N_2O$ emissions that are converted to metric tonnes of $CO_2$, $CH_4$, and $N_2O$ emissions, and then multiplied by IPCC SAR GWPs to identify total emissions in units of metric tonnes $CO_2e$.

### *Direct Emissions: Mobile Combustion: Gasoline & Diesel*

Each hour of electric UTV runtime represents 0.5 gallons of gasoline fuel that would have been burned in the replaced gasoline UTV.

Emissions are calculated by multiplying the quantity of total gasoline or diesel used by ramp vehicles by the following gasoline and diesel emission factors for $CO_2$, $CH_4$, and $N_2O$ sourced from the US EPA emission factors for GHG inventories:

| Fuel | kg $CO_2$ per gallon | g $CH_4$ per gallon | g $N_2O$ per gallon |
|---|---|---|---|
| Gasoline | 8.78 | 0.5 | 0.22 |
| Diesel | 10.21 | 0.57 | 0.26 |

The results of these calculations are converted to metric tonnes of $CO_2$, $CH_4$, and $N_2O$ emissions and then multiplied by IPCC SAR GWPs to identify total emissions in units of metric tonnes $CO_2e$.

GHG emission reductions are quantified as the difference in emissions associated with fuel combustion by pre-project vehicles and emissions associated with electricity generation for electric vehicles that replace them.

## F. Project Monitoring

### *Indirect Emissions: Purchased Electricity*

- Annual run-hours by new ramp vehicles

# D7. GHG Reduction Candidate Action: Composting Program

## A. Project Definition and Scope

Diversion of organic waste from landfills to alternative methods of waste treatment potentially reduces methane ($CH_4$) emissions at solid waste disposal sites. Composting of organic material in waste streams primarily creates only $CO_2$ emissions, compared to $CH_4$ and $CO_2$ during anaerobic decomposition at landfills.

TTAD would implement programs to encourage diversion of organic waste streams (e.g., food waste) from disposal in landfills to composting operations.

The scope of this project could include both on- and off-site composting of organics.

Project implementation would decrease TTAD's scope 3 GHG emissions associated with waste disposal because the global warming potential of the $CO_2$ emitted during the composting process is lower than that of the $CH_4$ emitted during waste decay at landfills.

Reduction project implementation could decrease:

- Fugitive Emissions: Waste

## B. GHG Reduction Estimate

For every 14 short tons of waste diverted to composting, TTAD can expect to achieve approximately 1 metric ton $CO_2$e of emission reductions compared to landfilling of the same waste.

Based on feedback from TTAD, green waste (i.e., grass clippings, hedge trimmings, etc.) is not currently sent to landfills therefore this waste stream was not considered in the quantification of GHG emission reductions.

The EY2015 GHG Inventory reported 163.8 short tons of waste sent to landfills. By diverting 50% of its food waste to composting, TTAD could achieve annual Scope 3 GHG reductions of approximately **6 *metric tonnes $CO_2$e***.

## C. Implementation Costs

Capital:

*On-site composting* – Required equipment and supplies (composting system, shovels, etc.) could be purchased off-the-shelf. Based on the quantity of waste generated and anticipated to be composted, TTAD should conservatively budget $15,000-$25,000 for the cost of a composting system capable of meeting its needs.

O&M Costs:

*On-site composting* – On-site composting activities would require periodic monitoring by TTAD staff but otherwise do not entail any O&M costs.

*Off-site composting* – TTAD would not incur any O&M costs associated with off-site composting by third parties.

## D. Implementation Steps and Timeframes

*On-site Composting* –

I. Identify on-site location for composting activity

II. Purchase and install equipment (composting bins, shovels, etc.)
III. Implement food waste collection program for composting

*Off-site Composting –*

I. Contract with waste hauling service for separate pickup of organics for composting
II. Install and utilize separate collection of organic waste streams for composting by third party

Both on-site and off-site composting projects can be implemented **within six months** of a decision to proceed.

## E. GHG Reduction Quantification Methodology

***Other Indirect Emissions: Waste***

Emission reductions are quantified using the US EPA Warm Model, consistent with the methodology used to quantify Scope 3 emissions from landfilled waste in TTAD's EY2015 GHG Inventory.

The US EPA WARM model is used to calculate $CO_2$e emissions from landfilling waste diverted to composting and $CO_2$e emissions from composting the same quantity. The results are compared to one another to estimate total emission reductions from waste diversion to composting.

## F. Project Monitoring

- Quantity (i.e., weight) of waste diverted from landfill disposal to composting
  - Maybe be easier to track if disposal is off site and an invoice is generated
  - Weighing of waste at on-site operations would be tricky

# D8. GHG Reduction Candidate Action: Recycling Program

## A. Project Definition and Scope

Recovery of recyclable materials from waste streams reduces GHG emissions at solid waste disposal sites (and also avoids emissions associated with their production from virgin raw materials).

TTAD would implement a program to collect recyclable materials from waste generated that otherwise would be disposed of in the dumpster and sent to landfills. Such materials could include:

- Aluminum cans
- Steel cans
- Glass
- Plastics
- Corrugated cardboard
- Magazines/mail
- Newspaper
- Office paper

Project implementation would decrease TTAD's scope 3 GHG emissions associated with waste disposal at landfills by avoiding the production of methane ($CH_4$) from the decay of organic material.

Reduction project implementation could decrease:

- Fugitive Emissions: Waste

## B. GHG Reduction Estimate

The EY2015 GHG Inventory reported 163.8 short tons of waste sent to landfills. Achieving an airport-wide recycling rate of 50% of waste generated would result in annual Scope 3 GHG reductions of **23.9 *metric tonnes $CO_2e$***.

## C. Implementation Costs

Capital: Minimal capital costs are associated with implementation of a recycling program. Purchase of new receptacles for recyclable materials is estimated to be approximately $500.

O&M Costs: The recycling program would require time from TTAD staff to educate facility users and monitor compliance.

Separate waste collection bags would need to be purchased to collect source-separated recyclables. This is estimated to cost approximately $500 annually.

## D. Implementation Steps and Timeframes

I. Contract with waste hauling service for separate pickup of recyclables
II. Purchase and place new recycling bins
III. Educate facility staff and users on recycling program

A recycling program could be implemented **within six months** of a decision to proceed.

## E. GHG Reduction Quantification Methodology

### *Other Indirect Emissions: Waste*

Emission reductions are quantified using the US EPA Warm Model[7], consistent with the methodology used to quantify Scope 3 emissions from landfilled waste in TTAD's EY2015 GHG Inventory.

The US EPA WARM model is used to calculate $CO_2$e emissions from landfilling waste diverted to recycling and $CO_2$e emissions from recycling the same quantity. The waste category "Mixed Recyclables" is selected in the WARM model because it is most representative of the waste stream expected at TTAD. The results are compared to one another to estimate total emission reductions from waste diversion to recycling.

## F. Project Monitoring

- Quantity (i.e., weight) of recyclable material recovered and sent off site
    - May be possible to obtain from waste disposal service invoices

[7] https://www.epa.gov/warm

# D9. GHG Reduction Candidate Action: Solar Generation

## A. Project Definition and Scope

The generation of electricity using solar photovoltaic devices, or solar cells, which does not produce GHGs, can displace the purchase of electricity from utility grid sources which produce GHG emissions.

The District is considering development of a 1 megawatt solar photovoltaic electricity generation system.

Reduction project implementation could decrease:

- Indirect Emissions: Purchased Electricity

## B. GHG Reduction Estimate

The National Renewable Energy Lab's PVWatts® Calculator estimates that a 1 MW solar photovoltaic electricity generation system sited at the District's location would annually generate approximately 1,500,000 kWh of electricity.

The District's total electricity consumption in EY2015 was approximately 933,429 kWh, so the 1MW system, operated under a net metering arrangement, could be expected to meet all the airport's electricity needs, including expected growth through 2025.

Using electricity provided by this zero emission generation source could potentially reduce all District emissions from electricity consumption up to ***414.48 metric tonnes CO2e*** each year.

## C. Implementation Costs

Capital: Assuming an installed price of $\$3/W_{AC}$, the estimated costs for a 1MW system would be approximately $3,000,000.

O&M Costs: Assuming a factor of $\$30/kW_{AC}$-year, the annual operating costs of the system are estimated at approximately $30,000.

Both cost factors were informed by:

Bolinger, Mark, and Joachim Seel. Utility-Scale Solar: Empirical Trends in Project Technology, Cost, Performance, and PPA Pricing in the United States – 2018 Edition. 2018. (https://emp.lbl.gov/utility-scale-solar/)

## D. Implementation Steps and Timeframes

I. Identify solar system site.
II. Request bids and select solar generation system designer
III. Design solar generation system
IV. Negotiate Interconnection Agreement with Utility
V. Permit solar generation system
VI. Permit transmission system
VII. Request bids and select solar generation system builder
VIII. Construct plant and transmission system
IX. Connect to utility transmission

Utility scale PV projects typically require **5-7 years** to complete.

## E. GHG Reduction Quantification Methodology

***Indirect Emissions: Purchased Electricity***

It is assumed that that the District's solar system interconnection with Truckee Donner PUD will be subject to a net meeting arrangement which will credit the District for electricity not consumed and consequently added to the grid. As a result, the District' TDPUD bills will reflect net electricity consumption from grid sources.

"Market-based electricity emissions" are calculated by multiplying the megawatt hours of total consumption from Airport accounts by the following electricity emission factors for $CO_2$, $CH_4$ and $N_2O$ sourced from the Truckee Donner PUD 2012 GHG Re-Inventory:

| | lb $CO_2$ per MWh | lb $CH_4$ per GWh | lb $N_2O$ per GWh |
|---|---|---|---|
| Electricity - TDPUD | 606.8 | 9.55 | 7.02 |

The results of these calculations are pounds of $CO_2$, $CH_4$, and $N_2O$ emissions that are converted to metric tonnes of $CO_2$, $CH_4$, and $N_2O$ emissions, and then multiplied by IPCC SAR GWPs to identify total emissions in units of metric tonnes $CO_2e$.

Assuming consistent operations and conditions, comparison of District electricity emissions after implementation of the PV solar system with District EY2015 base year emissions from electricity will identify the project emissions reduction.

## F. Project Monitoring

***Indirect Emissions: Purchased Electricity***

- Annual **net** electricity consumption in kilowatt hours for District facilities, compiled from Truckee Donner Public Utility District invoices.

# D10. GHG Reduction Candidate Action: Biosequestration

## A. Project Definition and Scope

Carbon biosequestration is the process by which atmospheric carbon dioxide is taken up by trees, grasses, and other plants through photosynthesis and stored as carbon in biomass (trunks, branches, foliage, and roots) and soils. The sink of carbon sequestration in forests helps to offset sources of carbon dioxide to the atmosphere.

The District's property holdings include:

- Waddle Ranch - 1,481 acres
- The Jones Property – 141 acres

By protecting or enhancing terrestrial carbon sinks (e.g., forests), the District is facilitating the capture carbon dioxide from the atmosphere and creating a credit against its anthropogenic GHG emissions.

## B. GHG Reduction Estimate

Carbon sequestration calculations are difficult to perform due to data requirements, complexity of estimation methodologies and inherent uncertainties. Many factors, including geographic location, temperature, humidity, and species dominance, will affect the rate of carbon sequestered by forested land in a given area.

Though data is not available to provide a reliable estimate of the GHG sequestration potential for the specific District properties above, the Carbon Online Estimator (COLE)[8] by NCASI and the USDA Forest Service was queried to identify the carbon stocks of forest plots within 50km of the airport property. COLE data for local Jeffrey Pine forests, which is a predominant species in Waddle Ranch, suggests an average sequestration rate of 0.51 tonnes carbon/hectare per year[9]. This value converts to 0.7521 metric tonnes carbon dioxide sequestered per acre per year.

Assuming that 80% of Waddle Ranch and the Jones Property are forested, these District lands could sequester approximately ***975.92 metric tonnes $CO_2$e*** each year.

## C. Implementation Costs

Capital: N/A under the assumption that the District has already acquired the Waddle Ranch and the Jones property.

O&M Costs: Credible quantification of sequestered carbon dioxide would require periodic monitoring/quantification/documentation services estimated at $25,000 per event[10].

No other O&M costs are expected, for the "carbon project" beyond those already incurred to manage the property.

## D. Implementation Steps and Timeframes

I. Perform initial inventory of existing carbon stocks of TTAD properties.
II. Conduct periodic monitoring of stocks to determine sequestration.

---

[8] https://www.fs.usda.gov/ccrc/tools/cole

[9] This sequestration rate is an average of the difference in the forest carbon stocks over a 100 year period; the rate sequestration during this period (i.e. in a specific year of forest growth) varies.

[10] Cost estimates informed by "Transaction cost and forest management carbon offset potential" (Working Paper) Climate Change Policy Partnership, Duke University, July 2009. https://nicholasinstitute.duke.edu/sites/default/files/publications/transaction-costs-and-forest-management-carbon-offset-potential-paper.pdf

## E. GHG Reduction Quantification Methodology

In situations of forest preservation, a carbon sequestration rate is typically determined by comparison of existing carbon stocks over time. The difference between a forest's carbon stock at an earlier date versus a later date is attributed to carbon dioxide sequestered by the forest during the period between the two measurements.

## F. Project Monitoring

Forest carbon stocks should be measured by qualified forestry professionals consistent with recognized standards. Stocks can be estimated using satellite/remote sensing methods, or more directly measured at the plot scale in forests. USDA's General Technical Report NRS-18 "Measurement guidelines for the sequestration of forest carbon"[11] represents a methodology for quantifying forest sequestration for the purposes for public reports. However, other procedures or best practice approaches could also provide acceptable carbon removal estimates.

[11] https://www.nrs.fs.fed.us/pubs/3292