GYA GHG Initiative:
Fleet Assessment & Analysis, Part I
February 11\textsuperscript{th}, 2010
INTRODUCTION

- GYCC and NREL
- About NREL
  - The DOE’s national laboratory dedicated to integrating energy efficiency and technologies
- About the presenter
  Kristin Day
  Kristin.Day@NREL.GOV
Today’s Webinar

1. Why Are We Interested?
2. Where Do We Fit In?
3. GYA Inventory and Action Plan
4. GYA Fleet Assessment and Analysis
5. Fleet Inventory Data
6. Next Time We Meet
7. Dates to Remember
8. Questions and Contact Information
Why Are We Interested?

- The past 150 years show an increase in greenhouse gases.
- Some GHGs occur naturally and some are human caused.
- About three-quarters of human caused (anthropogenic) emissions come from burning fossil fuels.

Source: http://tonto.eia.doe.gov/energyexplained/index.cfm?page=environment_how_ghg_affect_climate
Why Are We Interested?

- Carbon dioxide in the atmosphere is naturally regulated by the “carbon cycle”
- The movement, or flux, of carbon between the atmosphere and Earth’s land and ocean occurs by natural processes
- These natural processes can only absorb some of the anthropogenic carbon dioxide adding an estimated 4.1 billion metric tons to the atmosphere each year

Source: Intergovernmental Panel on Climate Change, Climate Change 2007: The Physical Science Basis, Figure 7.3 and Table 7.1. (U.K., 2007).

Source:
http://tonto.eia.doe.gov/energyexplained/index.cfm?page=environment_how_ghg_affect_climate
Why Are We Interested?

- The Greenhouse Effect
- Solar radiation passes through the atmosphere and most of it is absorbed by the Earth to warm it
- Greenhouse Gases (GHGs) absorb infrared radiation and trap heat in the atmosphere

Source: http://students.washington.edu/nofrills/phil.htm
So What Does This Really Mean?

- Studies show increasing greenhouse gas concentrations tend to warm the planet.
- Assessments by the Intergovernmental Panel on Climate Change (IPCC) suggest the Earth’s climate has warmed between 1.1° and 1.6°F over the past century.
- Rising temperatures could result in “climate change” affecting precipitation patterns, storm severity and sea level to name a few.

Greenhouse gases correlate directly to global warming, which impacts arctic sea ice. This image shows current arctic sea ice formation. The red outline depicts arctic sea ice boundaries in 1979.

Source:
http://www1.eere.energy.gov/femp/program/greenhousegases_basics.html
Where Do We Fit In?

- Approximately one third of the United States energy-related emissions come from transportation.
- Emissions from this sector increased by 29% from 1990 to 2007, representing an average annual increase of 1.7%.
- Nearly 60% of the emissions resulted from gasoline consumption for personal vehicle use.

Source: [http://tonto.eia.doe.gov/energy_in_brief/greenhouse_gas.cfm](http://tonto.eia.doe.gov/energy_in_brief/greenhouse_gas.cfm)
The Greater Yellowstone GHG Inventory and Action Plan

- 3 Federal Agencies
- 10 Agency Units
  - 6 Forests
  - 2 Parks
  - 2 Refuges

Source: “Greenhouse Gases 101: Understanding GHG Reduction and Climate Change,” Mike Fiebig, GYCC
Project Overview

- Fiscal Year 2007 baseline
- Inventory tools:
  - EPA Climate Leaders (USFS and USFWS)
  - Climate Leadership in Parks – CLIP (NPS)
- Anthropogenic emissions of 3 GHGs:
  - Carbon Dioxide (CO2)
  - Methane (CH4)
  - Nitrous Oxide (N2O)
- Inventory Completed in April 2009

Source: “Greenhouse Gases 101: Understanding GHG Reduction and Climate Change,” Mike Fiebig, GYCC
Project Overview

- Inventory data was collected for the following emissions sources:
  - Stationary combustion
  - Purchased electricity
  - Mobile ("Fleet")
  - Business travel (optional)
  - Employee commuting (optional)
- The data was then processed and summarized to illustrate the levels of GHG’s emitted by the GYA as a whole
Distribution of GHG Emissions from National Forest in GYA

- Stationary Sources: 54%
- Mobile Sources: 15%
- Purchased Electricity: 22%
- Business Air Travel: 8%
- Employee Commuting: 1%
Total GHG Emissions From Across the Ecosystem

- 6 National Forests
- Grand Teton National Park
- Yellowstone National Park
- 2 National Refuges

- Stationary Combustion
- Purchased Electricity
- Mobile Combustion
- Total

Metric Tons of Carbon Equivalent (MTCE)
Mobile Source GHG Emissions From Across the Ecosystem
GYA Fleet Assessment and Analysis Objective

- Develop unit-specific mobile source GHG emissions reduction action plans
- Recommend fleet alternatives without compromising each unit’s needs to fulfill their individual mission
- Provide recommendations for ecosystem-wide fleet synergies
GYA Fleet Assessment and Analysis Approach

- Definition of baseline
  - Unit-specific analysis of the current fleet
- Identification of fleet GHG emissions reduction goals
  - How will the mobile source reduction fit in with eco-system-wide reduction goals?
  - Remain sensitive to the needs each particular unit
- Outline available options and emerging technology
  - Perform a unit-specific detailed analysis presenting the effects of integrating various vehicle technologies and GHG reduction methods into their fleets
- Provide fleet recommendations for each unit
Where We Are

- Mitigation and Avoidance actions organized by emissions source and timeline for each unit
- A commitment by each GYA unit to reduce their GHG emissions by a minimum of 20% before FY 2020
- Currently tracking at around a 40% reduction ecosystem-wide by 2020

<table>
<thead>
<tr>
<th>UNIT</th>
<th>YEAR</th>
<th>BY 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-D NF</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>B-T NF</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>C-T NF</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Custer NF</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Gallatin NF</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Grand Teton NP</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>National Elk WR</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>RRL NWR</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>Shoshone NF</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Yellowstone NP</td>
<td></td>
<td>43%</td>
</tr>
<tr>
<td>GYA-wide Total:</td>
<td></td>
<td>Approx. 40%</td>
</tr>
</tbody>
</table>

Source: “Greenhouse Gases 101: Understanding GHG Reduction and Climate Change,” Mike Fiebig, GYCC
Taking Advantage of Vehicle Efficiency Improvements

- A wide range of strategies are available to reduce GHG emissions from the transportation sector
- Fuels and vehicle technology
  - Changing emission rates through fuel or advanced technology or both
- Surface transportation planning
  - Travel Demand Management, transit investment, bicycle/pedestrian projects
- Transportation system operations
  - Reduce vehicle delay, improve traffic flow, and avoid unnecessary emissions
Typical Vehicle Efficiency and Energy Losses

- Engine Losses: 62.4%
- Driveline Losses: 18.2%
- Accessories: 2.2%
- Standby/Idle: 17.2%

Losses by Category:
- Aerodynamic Drag: 2.6%
- Rolling Resistance: 4.2%
- Inertia: ~
- Braking: 5.8%
Technology to Improve Vehicle Efficiency

- Fuel Cells
  - High efficiency & cost
- Diesels
  - High efficiency
  - High torque and towing
- Transmissions
  - Optimized shift points
  - Reduced losses
- Hybrids
  - High efficiency
  - Electric operation
Power & Efficiency Trends of the U.S. Light Duty Fleet

Data source: http://www.epa.gov/otaq/fetrends.htm
Taking Advantage of Vehicle Efficiency Improvements

Ford Escape Hybrid

Toyota Prius Hybrid

Chevy Tahoe Hybrid

Ford Fusion Hybrid

Chevy Silverado Hybrid

Hydrogen Electric Hybrid
## Initial Ecosystem-Wide Mobile Source Baseline

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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grand Teton</td>
<td>0</td>
<td>0</td>
<td>22,419</td>
<td>13,915</td>
<td>7,856</td>
<td>243</td>
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<td>4,873</td>
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<td>177</td>
<td>2,600</td>
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<td>23,049</td>
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<td>1,304</td>
<td>0</td>
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<td>0</td>
<td>0</td>
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<td>743</td>
<td>18,769</td>
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<tr>
<td>Caribou-Targhee</td>
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<td>0</td>
<td>28,327</td>
<td>17,083</td>
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<td>18,283</td>
<td>56,636</td>
<td>875</td>
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<td>4,900</td>
<td>8,755</td>
<td>134,885</td>
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<td>Bridger-Teton</td>
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<td>7,055</td>
<td>15,833</td>
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<td>8,655</td>
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<td>Beaverhead-Deerlodge</td>
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<td>22,306</td>
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<td>50</td>
<td>0</td>
<td>807</td>
<td></td>
<td>55,530</td>
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<tr>
<td><strong>Total Fuel Usage (gallons)</strong></td>
<td>96</td>
<td>677</td>
<td>75,458</td>
<td>81,646</td>
<td>7,858</td>
<td>5,496</td>
<td>254,748</td>
<td>8,009</td>
<td>1,020</td>
<td>800</td>
<td>0</td>
<td>252</td>
<td>38,739</td>
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<td>628,307</td>
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<tr>
<td><strong>Total CO₂ (kg)</strong></td>
<td>799</td>
<td>5,497</td>
<td>765,901</td>
<td>828,711</td>
<td>79,756</td>
<td>48,422</td>
<td>1,192,477</td>
<td>2,244,331</td>
<td>70,558</td>
<td>8,986</td>
<td>7,656</td>
<td>2,220</td>
<td>184,246</td>
<td>341,293</td>
<td>5,780,854</td>
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</tbody>
</table>
Initial Ecosystem-Wide Mobile Source Baseline

Total GYA-Wide* Mobile Source Fuel Usage and CO₂ Emissions by Vehicle Type

* Excludes Yellowstone
I need your help!

Confirm with each unit the baseline data being used is the latest and greatest

Provide any additional information regarding fleet changes since the inventory data was recorded
Unit-Specific Data Collection

Fleet Data Collection Sheet

<table>
<thead>
<tr>
<th>SITE INFORMATION</th>
<th>Name of Unit</th>
<th>Name of Contact</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Contact Email</td>
<td>Phone Number</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FLEET CHANGES</th>
<th>What changes has your unit already implemented to help reduce your fleet's GHG emissions?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>What changes do you currently have planned that haven’t yet been implemented?</td>
</tr>
<tr>
<td></td>
<td>Referencing the unit-specific data provided, please describe in detail how the mobile sources in each of the top three emitters are used on a day-to-day basis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yes/No/Uncertain</th>
<th>If yes, please provide make, model and year for each vehicle added or subtracted</th>
<th>If yes, please describe why each vehicle was added or subtracted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have any vehicles been retired?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have any new vehicles been added?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional information or comments:
Unit-Specific Data Collection

Grand Teton National Park
Mobile Source Fuel Usage and CO₂ Emissions by Vehicle Type

- Grand Teton CO₂ (kg)
- Grand Teton Fuel Usage (gallons)
Unit-Specific Data Collection

- E-mail follow-up from me following today's webinar
- Directions to complete the Fleet Data Collection Sheet
- Obtain contact information for baseline data verification
- Completed form returned me by March 12, 2010
- My contact information
  - E-mail: Kristin.Day@nrel.gov
  - Phone: 303-275-4491
Next Step Time We Meet

- In-depth review of mobile source data
- Review current and up-coming vehicle technologies
- Review GHG reduction strategies of other fleets
- Review actions to be taken prior to April’s workshop
The GYA Climate Action Plan

- The metrics aren’t perfect, but we need to act
- Iterative process
- Tiered goals: Unit-level and GYA-wide
- Coordinated implementation
- New territory... and a great opportunity

Source: “Greenhouse Gases 101: Understanding GHG Reduction and Climate Change,” Mike Fiebig, GYCC
GYCC Definition of Success

1. Setting and meeting a collective, realistic and credible ecosystem-wide GHG reduction goal
2. Ensuring the capacity and leadership intent to meet the goal
3. Developing/documenting a methodology for GHG accounting and reduction that serves as a model for other footprint areas, other agencies, and the public

Source: “Greenhouse Gases 101: Understanding GHG Reduction and Climate Change,” Mike Fiebig, GYCC
Further Resources:

- http://www.nrel.gov
- http://www.eia.doe.gov
- http://www.epa.gov
- http://www.globalchange.gov
- http://www.ipcc.ch
- http://www1.eere.energy.gov/femp/program/greenhousegases_basics.html
Some Dates to Remember

- **GYA Fleet Webinars - Kristin Day, NREL:**
  - March 30, 2-3 PM (Workshop preparation and new technology)

- **GYA Facilities Webinars - Eliza Hotchkiss, NREL:**
  - February 25th, 10-11 AM (Basics, energy intensity, outliers, priorities)
  - March 25th, 10-11 AM (Data preparation, calculations and Q&A)

- **GYA Scope 3 Emissions Webinars - John Nangle, NREL:**
  - February 18th, 10-11 AM (Overview and opportunities)
  - March 19th, 10-11 AM (Data preparation, calculations and Q&A)

- **Greater Yellowstone Interagency Climate Action Plan Working Session:**
  - April 19th-22nd, Bozeman, MT
Questions and Follow-Up

Kristin Day
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