Outline

• 5 minutes: overview and history
• 10 minutes: quick demo
• 5 minutes: ways to get involved
• Discussion and questions.
Energy Use in the United States

Total Energy Use = 98 quadrillion Btu
(in left chart, lighter shade is energy for electricity used in that sector)
Background

• Energy use is intrinsic to the whole economy
• We use a wide variety of different sources of energy for different services
• The media and other sources are inundated with pros and cons for many energy options
• Learning about and comparing the impact of various options is important, but with such a complex system, it is extremely challenging.
The Office of **Energy Efficiency** and **Renewable Energy** (EERE): Multiple Goals and a Diverse Portfolio

Electric Generation
- Geothermal
- Water
- Wind
- Solar

Transportation
- Vehicles
- Biofuels
- Hydrogen

Efficiency Research
- Industry
- Buildings

Deployment
- Federal Energy
- Weatherization

Blue dots are energy efficiency, green dots are renewable energy, and orange dots are deployment. Dot size proportional to program budget.
EERE Goals and Related Tools

• EERE has diverse goals (environmental, economic, energy security) and various programs on the supply and demand sides of energy

• Strategic Analysis developed tools to combine the impacts of technology development and deployment in all these EERE areas

• These tools were instructive for the team, so we developed a version for the web.
Four Sectors in BITES

- **Buildings**
  - Building Codes
  - Retrofits
  - Appliance Efficiency

- **Industry**
  - Industrial Efficiency
  - Fuel Switching

- **Transportation**
  - Light-duty Vehicle Efficiency
  - Heavy-duty Vehicle Efficiency
  - Renewable Fuels
  - Demand (Miles Driven)

- **Electricity**
  - Natural Gas
  - Renewables
  - Nuclear
  - Carbon Capture and Sequestration
Demonstration
Goals for Education

• Learn where we get energy and where we use energy in the U.S., as well as the associated emissions
• Experiment with options to change the energy future of the U.S.
• Explore the trade-offs between sectors and individual technologies
• Generate a realistic cross-sector scenario that meets or approaches energy and carbon emission targets
• Share learning by discussing, comparing, and justifying selected scenarios
Example Workshop

• Developed and piloted a draft curriculum

• Workshop timeline (approximately three class time hours, 10 minute break in the middle):
  – *Introduction (30 minutes)*: covers U.S. energy use, the prospects for clean energy, and societal context
  – *BITES demo (10 minutes)*: run through the features of the tool
  – *Sector exercises (45 minutes)*: student groups attempt to meet energy and emissions goals by implementing changes in one sector each (buildings, transportation, industry, electricity)
  – *Group exercises (45 minutes)*: redistribute students among different groups so each group has at least one representative from each sector to be an ‘expert’; focus on developing a combined scenario to meet goals
  – *Presentation, discussion of scenarios, and class consensus scenario (40 minutes)*: constructive discussion of the plausibility of scenario components.

• Optional: pre-lesson readings (45 minutes – 1 hour, suggested pages and links provided).
## Groups

### 1st groups: by sector

<table>
<thead>
<tr>
<th>Buildings</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td>Industry</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Transportation</td>
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<tr>
<td>Buildings</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
</tr>
</tbody>
</table>

### 2nd groups: whole system

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
How to Get Involved

• Join our ‘educators’ group
• Volunteer to run or host pilot workshops
• Use the tool in other ways, and let us know how
• Feedback on curriculum
  – Big or small changes?
  – Continue to develop one version, or split into different lengths and expertise levels?
• Feedback on overall site (usability, etc.).
Questions?

• Beta version: https://bites.nrel.gov/.

• Educational materials: https://bites.nrel.gov/education.php

• For more information: austin.brown@nrel.gov.
Appendix

(Some screenshots from the demo just in case)
Welcome to the BITES Tool - Beta

The Buildings Industry Transportation Electricity Scenarios (BITES) Tool is a scenario-based tool for analyzing how changes in energy demand and supply by economic sector can impact carbon dioxide emissions. BITES permits the rapid screening and exploration of energy options and technologies that can lead to major reductions in greenhouse gas emissions and reductions in oil dependence.
## Featured Scenarios

<table>
<thead>
<tr>
<th>Scenario Name</th>
<th>Description</th>
<th>Mode</th>
<th>Shared?</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEF Scenario</td>
<td>Based on the Transportation Energy Futures study as presented at the World Renewable ...</td>
<td>Advanced</td>
<td>Public</td>
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## My Scenarios

<table>
<thead>
<tr>
<th>Scenario Name</th>
<th>Description</th>
<th>Mode</th>
<th>Shared?</th>
</tr>
</thead>
<tbody>
<tr>
<td>scenario 1</td>
<td>[New Scenario Description]</td>
<td>Basic</td>
<td>Private</td>
</tr>
<tr>
<td>Intro Video</td>
<td>The scenario described in the BITES introduction video</td>
<td>Basic</td>
<td>Public</td>
</tr>
<tr>
<td>SCU Workshop</td>
<td>SCU Consensus</td>
<td>Basic</td>
<td>Private</td>
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</table>

## Shared Scenarios

<table>
<thead>
<tr>
<th>Scenario Name</th>
<th>Description</th>
<th>Mode</th>
<th>Shared?</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEO 2010 Base Case</td>
<td>Advanced mode inputs using 2010 AEO reference data</td>
<td>Advanced</td>
<td>Reference</td>
</tr>
</tbody>
</table>
Create New Scenario

Name: Quick Demo

Input Mode:
- Basic
- Advanced

Base Data:
- AEO 2011

Description:
[New Scenario Description]

[Create] [Cancel]
### Quick Demo (AEO 2011 Base Case)

#### Buildings
- **Improvements to New Buildings in 2030**: 30% (30 to 75)
- **Percent of Existing Buildings Retrofitted by 2050**: 0% (0 to 100)
- **Percent Efficiency Improvement of Building Retrofits in 2050**: 15% (0 to 39)
- **Heating, Cooling and Appliance Efficiency Improvement in 2050**: 0% (0 to 35)
- **Fuel Switching in 2050**: 0% (0 to 100)

#### Industry

#### Transportation

#### Electricity
Quick Demo (AEO 2011 Base Case)

- **Light Duty Vehicle Fleet Miles Per Gallon in 2050**: 38 mpg (38 to 75)
- **Non-Light Duty Vehicle Efficiency in 2050**: 0% (covering all non-LDVs (0 to 60))
- **Gallons of Biofuels by 2050 (in billions)**: 34 billion gallons (34 to 65)
- **Vehicle Miles Traveled per Light Duty Vehicle in 2050**: 13500 (10000 to 15000)
Quick Demo (AEO 2011 Base Case)

- Light Duty Vehicle Fleet Miles Per Gallon in 2050: 60 mpg (38 to 75)
- Non-Light Duty Vehicle Efficiency in 2050: 20% (covering all non-LDVs (0 to 60))
- Gallons of Biofuels by 2050 (in billions): 34 billion gallons (34 to 65)
- Vehicle Miles Traveled per Light Duty Vehicle in 2050: 13500 (10000 to 15000)
**Quick Demo (AEO 2011 Base Case)**

Electricity Generation Mix in 2050

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Source</th>
<th>Percentage</th>
<th>Source</th>
<th>Percentage</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>Coal (0 to 68)</td>
<td>24%</td>
<td>Natural Gas (2 to 70)</td>
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<td></td>
</tr>
<tr>
<td>16%</td>
<td>Nuclear (16 to 84)</td>
<td>50%</td>
<td>Renewables (14 to 82)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Percent Fossil Fuel Carbon Capture and Sequestration in 2050

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Source</th>
<th>Percentage</th>
<th>Source</th>
<th>Percentage</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>2%</td>
<td></td>
<td>10%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Click on the link below to post a comment to this scenario.

Post A Comment
### Quick Demo (AEO 2011 Base Case)

<table>
<thead>
<tr>
<th>Metric</th>
<th>Reduction by 2050</th>
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</thead>
<tbody>
<tr>
<td>Emissions</td>
<td>39.5%</td>
</tr>
<tr>
<td>Energy Use</td>
<td>9.2%</td>
</tr>
<tr>
<td>Oil Use</td>
<td>28.9%</td>
</tr>
</tbody>
</table>

**Summary Info**

- **Name:** Quick Demo
- **Description:** [New Scenario Description]
- **Input Mode:** Basic
- **Base Case:** AEO 2011 Base Case
- **Author:** abrown
- **Created:** Mon Nov 19 2012
- **Last Update:** Mon Nov 19 2012

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**Summary Info**

- Total Emissions by End Use Sector
- Total Emissions by Sector
- Delivered Energy
- Primary Energy
- Primary Energy by Source
- Oil Consumption
- Biomass Consumption
- Electric Demand

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**Quick Demo**

- **Emission Reduction by 2050:** 39.5%
- **Energy Use Reduction by 2050:** 9.2%
- **Oil Use Reduction by 2050:** 28.9%
Quick Demo (AEO 2011 Base Case)
Total Emissions by End Use Sector - Electricity Generation is Distributed

- Buildings
- Industry
- Transportation

Year
2010 2015 2020 2025 2030 2035 2040 2045 2050

mmt CO2
0k 1k 2k 3k 4k 5k 6k
Quick Demo (AEO 2011 Base Case)
Total Emissions

- AEO 2010 Base Case
- AEO 2011 Base Case
- Quick Demo

Total Emissions
Transportation Emissions
Buildings Emissions
Industry Emissions
Electricity Emissions
Energy Consumption
Petroleum Consumption
Biomass Consumption
Electric Demand

View Data Table  Export  Print  Close