Energy Flow in Alaska

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Energy satisfies our “end-use” needs

- Warm rooms
- Cold freezer
- Transportation (snowmachines, barges)
- Light
- Mechanical Power (power tools....)
- Sound (speakers)
- Communication (internet, telephone,...)
Energy is converted from one form to another

- Electricity is an energy “currency,” not a primary energy source
- Hydrogen is an energy currency too!
- Example: Your Toaster
  
  Solar energy → plants → Natural Gas → Electricity → Heat →
  (toast + low-grade heat)
Evolution of Conversion Devices

Energy in World History

Source: Smil 1994
U.S. primary energy sources change over time

USGS 1991
Turning to Alaska--
The really big picture: overall disposition of energy (trillion btu)

<table>
<thead>
<tr>
<th></th>
<th>Coal</th>
<th>Natural Gas</th>
<th>Total petroleum</th>
<th>Hydroelectric</th>
<th>Wood, Ethanol, Wind, and Geothermal</th>
<th>Fossil Electricity</th>
<th>Total</th>
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<tbody>
<tr>
<td>Gross Extraction</td>
<td>22</td>
<td>2,651</td>
<td>2,166</td>
<td>5</td>
<td>2</td>
<td></td>
<td>4,845</td>
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<td>- Re Injected Gas</td>
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<td></td>
<td>2,288</td>
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<tr>
<td>- Other Use during Extraction</td>
<td>196</td>
<td>3</td>
<td></td>
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<td>199</td>
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<tr>
<td>= Net Extraction</td>
<td>22</td>
<td>167</td>
<td>2,163</td>
<td>5</td>
<td>2</td>
<td></td>
<td>2,358</td>
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<tr>
<td>- Raw Exports</td>
<td>11</td>
<td></td>
<td>1,868</td>
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<td></td>
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<td>1,879</td>
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<td>- Processing Use</td>
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<td>+ Refining conversion</td>
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<tr>
<td>= Alaska product disposition</td>
<td>11</td>
<td>156</td>
<td>272</td>
<td>5</td>
<td>2</td>
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<td>- Product Exports</td>
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<td>92</td>
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<td>261</td>
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<td>+ Imports</td>
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<td></td>
<td></td>
<td>59</td>
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<td>64</td>
<td>161</td>
<td>5</td>
<td>2</td>
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<td>243</td>
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<td>- Input to Electric Power</td>
<td>3</td>
<td>25</td>
<td>4</td>
<td>5</td>
<td>38</td>
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<td>+ electricity output</td>
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<td></td>
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<td>17</td>
<td>17</td>
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<td>= Final consumption</td>
<td>8</td>
<td>39</td>
<td>157</td>
<td>2</td>
<td>17</td>
<td></td>
<td>222</td>
</tr>
</tbody>
</table>
Overall Disposition of Energy

- **net consump**
- **elec losses**
- **product import**
- **product export**
- **crude export**
- **re-injected**
- **used for extraction**
- **gross extraction**
Oil & gas processing (462 trillion btu)

- Gasoline: 10%
- Distillate: 7%
- Jet fuel: 35%
- LNG: 16%
- Ammonia & urea: 11%
- Other product: 13%
- Used up: 8%

Total: 462 trillion btu
Exports (2,140 trillion btu)

- Liquid Natural Gas, Ammonia, and Urea: 4%
- Crude Oil: 89%
- Motor Gasoline: 1%
- Jet Fuel: 5%
- Coal: 1%

Exports: total 2,140
Electricity production (38 trillion btu)

Inputs and outputs:
- Electricity
- Hydro
- Diesel
- Natural gas
- Coal
- Losses

Trillion btu

- Inputs
- Outputs
Final consumption (222 trillion btu)

- Sector:
  - Industrial
  - Other
  - Residential
  - Commercial
  - Other transportation

- Fuel:
  - Diesel/gasoline
  - Jet fuel
  - Natural gas
  - Coal
  - Electricity
  - Other
The Natural Gas Network
PCE Communities
Everywhere else
Primary energy consumption per Alaskan barrels oil per person per year

Barrels of Oil per Year

- Alaska
- Gas Network
- PCE places
- Other

- Wood and all other
- Other petroleum
- Jet Fuel
- Gasoline
- Diesel
- Hydro
- Coal
- Natural Gas
Final energy consumption per Alaskan
barrels oil per person per year

Barrels of Oil per Year

Alaska | Gas Network | PCE places | Other

Jet air transportation | Other transportation | Industrial | Oil/propane/wood direct | Natural gas direct | Generation losses | Electricity

- 10
- 20
- 30
- 40
- 50
- 60
- 70
- 80
2001 Alaska Energy Flow (Trillion BTUs)

- Gross Extraction: 4,844
- Raw Exports: 1,878
- Gross Production: 436
- Product Exports: 261
- Net Alaska Consumption: 223
- Product Imports: 59

- Gas: 2,651
- Coal: 22
- Oil: 2,165
- Wood and other: 2,484
- Hydro: 5

- Residential/Commercial: 65
- Industrial/Military: 42
- Petroleum Product Imports: 59
- Transportation: 116

Arrows not to Exact Scale!
Alaska’s Three Energy Challenges (Steve Colt’s personal opinion)

- For the gas network, the era of cheap local gas is over
- For PCE places, the costs of liquid fuels delivered by barge are high and rising
- Alaskans have global responsibilities as energy consumers and carbon emitters
Full Report:
Alaska Electric Power Statistics with Energy Balance
www.iser.uaa.alaska.edu

• Other references: