Alternate Boiler Fuels & Their Uses

Presented by Marty Toth
ECS Consulting
& the Boisco Training Group
The Big Three

Coal
Fuel Oil
Natural Gas
Coal

- Time
- Pressure
- Heat

Peat
- Lignite
- Sub-bituminous
- Bituminous
- Anthracite
Coal Is King?

- Over 1/3 Global Electricity Generation
- 38 MMTJ (36 Quadrillion BTU)
- US Largest Surplus Reserves
- Largest Single Source of CO2 Emission
Fuel Oil
Fuel Oil Fazing

- Reduced Usage
- Maintaining Costs
- Highly Pollutant
- Thank Goodness For Coal!
Natural Gas
The Growth Of Natural Gas

- Nearly 1/4 Global Electricity Generation
- Nearly 80% Of Industrial Boiler Units & 85% Commercial
- Over 50% Of Industrial Boiler Capacity & 87% Commercial
- Far Less Emissions (30% < CO2 than Oil & 45% < than Coal)
- Non-Renewable Resource
Common Alternative Fuels

- Biomass
- Wood
- Municipal Solid Waste
- Landfill Gas
- Digester Gas
U.S. primary energy consumption by energy source, 2021

- **Total**: 97.33 quadrillion British thermal units (Btu)
- **Renewable Energy**: 12%
  - Nuclear electric power: 8%
  - Coal: 11%
  - Natural gas: 32%
  - Petroleum: 36%

- **Other Sources**:
  - Geothermal: 2%
  - Solar: 12%
  - Hydroelectric: 19%
  - Wind: 27%
  - Biomass waste: 4%
  - Biofuels: 19%
  - Wood: 17%

**Total**: 12.16 quadrillion Btu
Reason For Alternative Fuels

Renewability
Environmentally
Economically
Reason For Alternative Fuels

Renewability

- Solar energy
- Wind energy
- Hydro energy
- Tidal energy
- Geothermal energy
- Biomass energy
Reason For Alternative Fuels

Environmentally

• Sustainable
• Spillage & Leaks
• Reducing GHG
  
  CO2 & Methane
Reason For Alternative Fuels

Economically

• Waste Boilers
• Direct Usage on Farms
• Sustained Indefinitely
BioMethane

The Renewable Natural Gas
Anaerobic Digestion Process

- Creates Methane & CO2
- Creates Digestate for Ag Purposes
- BioGas is Cleaned into BioMethane
HYDROGEN

Chasing The Rainbow
Hydrogen Rainbow

• Black (Brown) Hydrogen: Gasifying Coal
• Grey Hydrogen: Steam Reformation CO2 Release
• Pink Hydrogen: Nuclear Energy
• Blue Hydrogen: Steam Reformation CO2 Capture
• Green Hydrogen: Electrolysis
Hydrogen

- Most Abundant Element In The Universe
- Lightest Element In The Universe
- Colorless, Odorless, & Tasteless
- Extremely Flammable
- 1/3 Heating Value Per Unit of Volume Than Natural Gas
- 3x Heating Value Per Unit of Mass Over Natural Gas
Upside Downside
Alternate Fuels Uncertainty

- Costs
- Transmission
- Market Entry
- Continuing GHG
Hydrogen Myth?

• Extremely Expensive
• Still Can Emit GHG
• Storage & Transportation Issues
• Cannot Sustain Demand
• Continuing GHG
<table>
<thead>
<tr>
<th>Methane/Hydrogen Mix</th>
<th>Energy Content (LHV)</th>
<th>Energy Content relative to pure methane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>Hydrogen</td>
<td>BTU/cuft</td>
</tr>
<tr>
<td>100%</td>
<td>0%</td>
<td>911</td>
</tr>
<tr>
<td>90%</td>
<td>10%</td>
<td>847</td>
</tr>
<tr>
<td>80%</td>
<td>20%</td>
<td>784</td>
</tr>
<tr>
<td>70%</td>
<td>30%</td>
<td>720</td>
</tr>
<tr>
<td>60%</td>
<td>40%</td>
<td>656</td>
</tr>
<tr>
<td>50%</td>
<td>50%</td>
<td>593</td>
</tr>
<tr>
<td>40%</td>
<td>60%</td>
<td>529</td>
</tr>
<tr>
<td>30%</td>
<td>70%</td>
<td>466</td>
</tr>
<tr>
<td>20%</td>
<td>80%</td>
<td>402</td>
</tr>
<tr>
<td>10%</td>
<td>90%</td>
<td>339</td>
</tr>
<tr>
<td>0%</td>
<td>100%</td>
<td>275</td>
</tr>
</tbody>
</table>
Hoping For Blue Skies

**HYDROGEN**
- Renewable
- Exhausts H2O, Not CO2
- Potential Zero GHG
- Reduce Fossil Fuel Dependency

**BioMethane**
- Renewable Natural Gas
- Easily Blended With NG Supplies & Infrastructure
- Potential Reduction of Methane & CO2 Emissions
- Reduce Fossil Fuel Dependency
- Natural Fertilizer
LOOKING FORWARD...

- Current State
- Government Regulation Changes
- Manufacturer Innovations
- System Infostructure
- Cost Reductions
Thank You!

Marty Toth
ECS Consulting &
the Boisco Training Group
615.504.9064
mtoth@boiscotraininggroup.com
BoiscoTrainingGroup.com