The ETCFC’s Focus – Smarter Transportation Fuels Use

November 13, 2008
Ms. Rehder’s Class – Farragut Middle School

Jonathan Overly, Executive Director
East Tennessee Clean Fuels Coalition
Today’s Agenda

1. Brief Alt Fuels Status Report
2. ETCFC – What, How, Who
3. Where East TN stands with public biofuel stations
4. The Basics - AF 101 & Carbon Scene
5. Current Energy, Oil & Oil Systems Picture
7. Biofuels Snapshot
8. Natural Gas Snapshot

The ETCFC’s 2008 Founding Partners:
At Fuels Status Report – *High Oil Prices Needed!*

- **Biofuels**: Ethanol & Biodiesel – continues to rise but changeover is dependent upon success of cellulosic ethanol, algae and federal fiscal support.

- **Electricity** – They are coming! Whether hybrid, plug-in hybrid, or pure electric, you will see more of these on the market in the coming years.

- **CNG** – Most used alt fuel in U.S. today. Fed. investment needed but not mandatory for continued growth.

- **LPG** – With much less infrastructure costs (than CNG), should grow considerably over the next few years.

What’s critical for fleets?

*Knowing where to get your questions answered getting accurate information!*
The Five Primary CC Areas of Focus are:

1. Alternative fuels and vehicles
2. Hybrid-electric vehicles
3. Idle reduction technologies
4. Fuel economy measures
5. Low-level fuel blends
Clean Cities Program PMCs

Project Management Centers (PMCs) help manage communication within each region, and act as liaisons to DOE for the coalitions in that area.
How did the ETCFC get started?

- In late 2001, learned of the DOE Clean Cities program
- Began researching what it is and how it works
- Found tremendous support from regional organizations in starting our own coalition; lack of SE coalitions further supported developing coalitions in Tennessee
- Received seed funding from State Energy Office
- Early drivers:
  - Air quality improvement locally, internationally
  - Expand vehicle fuel options for fleets and individuals
  - Develop regional networking & relationship building to share information and help one another with fuels
Who is the ETCFC?

- Designated member of U.S. DOE Clean Cities Program
- 6-yr old nonprofit in East TN
- Focused on transp. sector change: diversify away from petroleum alone and use less!
- Meetings; direct fleet & fuel supplier assistance; workshops; presentations to the commercial/industrial/gov’t community and to schools; multiple newsletters

West TN
Andrew Couch

Middle TN
David Pelton
Who is the ETCFC? - Examples

- Core staff out of Knoxville

- **Fuel suppliers:** Calloway, McNutt, Rogers, Benton, JAT, Appco, Pilot, Tri-Cities, Sweetwater Valley, Pioneer

- **Industrial fleets:** Eastman, ALCOA, Lodge, NFS, Blalock

- **City fleets:** Sevierville, Chattanooga, Gatlinburg, Knoxville, Maryville, Alcoa, Johnson City, Athens

- **Fuel producers:** Nu-Energie, Suns-Oil, Genera Energy

- **Others:** UTK, DOE-ORO, utilities, Friends of the Smokies, GM, Toyota, mass transit agencies, TDOT, Hwy Dept.s
Success Stories – Example #1: East Tennessee Biodiesel Use

- From humble beginnings in 2004, biodiesel use expanded fairly rapidly through 2007, with major peak in 2006 (pricing)
- In 2006, our total life-cycle CO2 emissions reductions in East TN from fleets using biodiesel blends was a minimum of 6,400 tons CO2
ET Cities & Towns – Leaders for Biodiesel
Cities with Populations >10,000
(and smaller that have started biodiesel projects)

2000 U.S. Census Populations Numbers
- 150,000 - 175,000
- 50,000 - 150,000
- 25,000 - 50,000
- 10,000 - 25,000
- 5,000 - 10,000

Level of Biodiesel Use
- Currently using a biodiesel blend
- Doing pilot project or have tried biodiesel
Current ET Public Biodiesel/E85 Stations

Biodiesel: 14 -- B99-1, B20-5, B5-8
E85: 11 (possible 12 more to open this year!)
**AF101 - What percentages of these alt fuels are domestically produced?**

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Domestic Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodiesel</td>
<td>95%</td>
</tr>
<tr>
<td>Electricity</td>
<td>100%</td>
</tr>
<tr>
<td>Ethanol</td>
<td>95%</td>
</tr>
<tr>
<td>Natural gas</td>
<td>90%</td>
</tr>
<tr>
<td>Propane</td>
<td>95%</td>
</tr>
</tbody>
</table>

In 1945, we were 0% dependent on foreign countries for oil; now we are 60+% dependent. 
~60 years = 0→60% reliance on others for oil~
Cleaner burn equals reduced pollution, both up high+nearby

Reduce oil dependence

American fuels diversity

Reduce national security risks due to reducing our imports from not-so-friendly countries (e.g., Iran, Venezuela)

Promote renewable resource use

Helps create jobs in the USA!

*Using less oil and using ALL fuels more efficiently have got to be part of this picture!*
The Carbon Basics

- CO2 is the transportation sector’s primary global warming gas; thus, total GHG emissions will be slightly greater than the CO2 emissions totals.

- CO2 emissions are proportional to fuel consumption: 19.4 pounds CO2/gal gas; 22.2 pounds CO2/gal diesel.

- CO2 emissions are inversely proportional to fuel economy:
  - Each 1% decrease in fuel consumption results in a corresponding 1% decrease in CO2 emissions.

- Therefore, the #1 tool in your CO2-reducing toolkit is reducing your total petroleum consumption; find regular or innovative ways to do so!
# The Life-cycle Carbon Numbers: Petro-fuels and Alternatives

<table>
<thead>
<tr>
<th>Fuel</th>
<th>GHGs ((gms/mi))</th>
<th>Petroleum ((MJ/mi))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Emissions</td>
<td>% reduction</td>
</tr>
<tr>
<td>Gasoline (RFG)</td>
<td>473</td>
<td>---</td>
</tr>
<tr>
<td>E85-midwest corn</td>
<td>402</td>
<td>15%</td>
</tr>
<tr>
<td>E85-switchgrass</td>
<td>195</td>
<td>59%</td>
</tr>
<tr>
<td>E85-forest residue</td>
<td>132</td>
<td>72%</td>
</tr>
<tr>
<td>CNG</td>
<td>331</td>
<td>30%</td>
</tr>
<tr>
<td>LPG (from oil proc.)</td>
<td>389</td>
<td>18%</td>
</tr>
<tr>
<td>Electricity (NG)</td>
<td>124</td>
<td>74%</td>
</tr>
<tr>
<td>HEV</td>
<td>353</td>
<td>25%</td>
</tr>
<tr>
<td>Plug-in HEV</td>
<td>224</td>
<td>53%</td>
</tr>
<tr>
<td>Diesel</td>
<td>375</td>
<td>---</td>
</tr>
<tr>
<td>B20-midwest soy</td>
<td>331</td>
<td>12%</td>
</tr>
</tbody>
</table>

Long-term U.S. Energy Data - Production
Really Long-term U.S. Energy Data (Consumption)

What does this growth curve look like if add up all these different forms of energy we are consuming?
Over the long haul, we are going to have to learn to do things differently, or we will be forced to.
When Peaking? No one knows for certain

<table>
<thead>
<tr>
<th>Forecast</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>December 2005</td>
<td>Deffeyes (U.S.)</td>
</tr>
<tr>
<td>2006-2007</td>
<td>Bakhitari (Iran)</td>
</tr>
<tr>
<td>2007-2009</td>
<td>Simmons (U.S.)</td>
</tr>
<tr>
<td>After 2007</td>
<td>Skrebowski (U.K.)</td>
</tr>
<tr>
<td>2010</td>
<td>Campbell (Ireland)</td>
</tr>
<tr>
<td>Before 2010</td>
<td>Goodstein (U.S.)</td>
</tr>
<tr>
<td>After 2010</td>
<td>World Energy Council</td>
</tr>
<tr>
<td>2012</td>
<td>Weng (China)</td>
</tr>
<tr>
<td>2016</td>
<td>Doug-Westwood (U.K.)</td>
</tr>
<tr>
<td>After 2020</td>
<td>CERA (U.S.)</td>
</tr>
<tr>
<td>2030 or later</td>
<td>EIA (U.S) / Exxon Mobil</td>
</tr>
</tbody>
</table>

From Robert Hirsch’s presentation “Peaking of World Oil Production” at the National Clean Cities Congress & Expo ~ May 8, 2006
Forget the oil peak for a minute: who do you want to give your money to today?
Who are we giving our fuel money to?  
2007 Net Imports by Country & Totals

Units are Thousand Barrels per Day
From the U.S. Energy Information Administration -- Petroleum Navigator / Imports/Exports & Movements
http://tonto.eia.doe.gov/dnav/pet/pet_move_neti_a_ep00_IMN_mbbldpd_a.htm

<table>
<thead>
<tr>
<th>Country</th>
<th>2007</th>
<th>%</th>
<th>Running %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Canada</td>
<td>2,243</td>
<td>19%</td>
<td>*</td>
</tr>
<tr>
<td>2. Saudi Arabia</td>
<td>1,487</td>
<td>12%</td>
<td>31%</td>
</tr>
<tr>
<td>3. Venezuela</td>
<td>1,336</td>
<td>11%</td>
<td>42%</td>
</tr>
<tr>
<td>4. Mexico</td>
<td>1,258</td>
<td>10%</td>
<td>53%</td>
</tr>
<tr>
<td>5. Nigeria</td>
<td>1,131</td>
<td>9%</td>
<td>62%</td>
</tr>
<tr>
<td>6. Algeria</td>
<td>663</td>
<td>6%</td>
<td>67%</td>
</tr>
<tr>
<td>7. Angola</td>
<td>507</td>
<td>4%</td>
<td>72%</td>
</tr>
<tr>
<td>8. Iraq</td>
<td>485</td>
<td>4%</td>
<td>76%</td>
</tr>
<tr>
<td>9. Russia</td>
<td>412</td>
<td>3%</td>
<td>79%</td>
</tr>
<tr>
<td>10. Virgin Islands</td>
<td>345</td>
<td>3%</td>
<td>82%</td>
</tr>
</tbody>
</table>

TOTAL NET IMPORTS 12,253

<table>
<thead>
<tr>
<th>Worldwide region</th>
<th>2007</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total All Countries</td>
<td>12040</td>
<td></td>
</tr>
<tr>
<td>Persian Gulf Countries</td>
<td>2166</td>
<td>18%</td>
</tr>
<tr>
<td>OPEC Countries</td>
<td>5946</td>
<td>49%</td>
</tr>
<tr>
<td>Non-OPEC Countries</td>
<td>6094</td>
<td>51%</td>
</tr>
</tbody>
</table>
Oil Systems #1 = Inefficient

This is why improving fuel economy and using hybrids is important!
Oil Systems #2 = Not diversified

Fuel Use Within Sectors

- Residential
- Commercial
- Industrial
- Transportation

Fuel Sources:
- Electricity
- Renewable
- Coal
- Natural Gas
- Petroleum

Quads

Oil Systems #2 = Not diversified
One Way to Look at Life-cycle Fossil Energy Efficiency

Image from the U.S. DOE & Michael Wang of Argonne Nat’l Lab and his GREET Model.
Fossil Energy In vs. Energy Out as Fuel: Basis

What you get as output for every 1 unit of fossil energy input:

Circle graphs courtesy of nationalgeographic.com
Fossil Energy In vs. Energy Out as Fuel: Add → Gasoline & Diesel

What you get as output for every 1 unit of fossil energy input:
Fossil Energy In vs. Energy Out as Fuel: Add → Corn-based Ethanol

What you get as output for every 1 unit of fossil energy input:
Fossil Energy In vs. Energy Out as Fuel: Add → Today’s Biodiesel (3.2-3.5)

What you get as output for every 1 unit of fossil energy input:
Fossil Energy In vs. Energy Out as Fuel: Add → Sugar-based Ethanol

What you get as output for every 1 unit of fossil energy input:
Fossil Energy In vs. Energy Out as Fuel: Add → Cellulosic Ethanol

What you get as output for every 1 unit of fossil energy input:

- Between 2 and 36, depending on production method
The Conundrum: *Alternative Fuels Cannot Do It Alone!*

They must be teamed with significantly improving vehicle fuel efficiency and energy conservation to really achieve the ultimate goal of foreign oil—or oil period—Independence.

Who is ready for the reality of reducing *their* petroleum consumption by 50% or more?
Ethanol – Summary

13 public E85 stations open now; ~10 more on their way!

About 60-90% of all public stations in ET now have E10

Tennessee Ethanol Plants

- 1 open today = Tate & Lyle – Loudon County (75 MGY)
- Open very soon = EGP – Obion County (100 MGY)
- Opening in 2009 = Genera Energy – Monroe County (1 MGY)

Pros

- E10 can run in ANY gasoline vehicle (E20, E30, E40?)
- E85 in flex-fuel vehicles, which can switch back and forth

Cons

- For E85, more power (octane rating of 105), but reduced fuel economy of around 20-25% (just need fuel to cost about 20% less)
Billion Ton Vision
Basis & Assumptions

- Goal was set: By 2030, biomass will supply 5% of the nation’s power, 20% of its transportation fuels and 25% of its chemicals
- That is equivalent to 30% of our current petroleum use, and will require 1 billion dry tons of biomass feedstock per year
- Largest single source of biomass is forestlands (no parks, roads)
- What assumptions?
  - Yields of corn, wheat and other small grains increased by 50%
  - Residue-to-grain ratio for soybeans increased to 2:1
  - Harvest recovery capable of recovering 75% of annual crop residues
  - All cropland managed with no-till methods
  - 55M acres of cropland, idle cropland and cropland pasture dedicated to production of perennial bioenergy crops
  - All manure used for biofuel (excluding that applied on-farm for soil improvement)
  - All other available residues utilized
An annual biomass supply of more than 1.3 billion dry tons can be accomplished with relatively modest changes in land use and agricultural and forestry practices.
Biodiesel – Summary

25 public stations; about 80-90 fleets using biodiesel today

5 Plants in Tennessee now – 3 Plants Being Built in East TN
- Nu-Energie, LLC – Phipps Bend (open!)
- Suns-Oil, LCC – southeastern TN

Pros
- Is the only alt fuel that can yield increased economy and power
- No new vehicles or infra. Required; Fill-n-go option at ≤ B20
- Renewable; less smoke & smell; biodegradable & nontoxic
- Helps equipment last longer; less wear and tear

Cons
- Possible fuel filter changes; all biodiesel gels faster than diesel
Biodiesel Emissions Reductions

difference in emissions from
B100 and B20 to conventional diesel

Who? - Regional Biodiesel Fleets
Compressed Natural Gas – Summary

- Most widely used alt fuel in U.S. today
- Some of the cleanest vehicles in the U.S. || Civic GX – AT-PZEV
- Can be co-fired with diesel or hydrogen

<table>
<thead>
<tr>
<th>Category</th>
<th>Honda Civic</th>
<th>Honda Civic GX</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle</td>
<td>$20-22,000</td>
<td>$25,000</td>
<td>$4k fed. tax credit</td>
</tr>
<tr>
<td>Fuel</td>
<td>$3.00</td>
<td>$2.30</td>
<td>$0.50/gal tax credit</td>
</tr>
<tr>
<td>Home refueling</td>
<td>Can’t!</td>
<td>~$4,000</td>
<td>-$1k + -$2k = -$3k**</td>
</tr>
<tr>
<td>Petroleum cons.*</td>
<td>11.8</td>
<td>0.1</td>
<td>barrels/year</td>
</tr>
<tr>
<td>Carbon footprint*</td>
<td>6.3</td>
<td>5.4</td>
<td>tons CO2/yr</td>
</tr>
<tr>
<td>EPA air poll. score*</td>
<td>6</td>
<td>9</td>
<td>1-10; 10 is best</td>
</tr>
</tbody>
</table>

* From www.fueleconomy.gov
** Federal tax credit of $1k, and Fuelmaker+Honda rebate of $2k
“Do not follow where the path may lead. Go, instead, where there is no path and leave a trail.”
- Ralph Waldo Emerson

Your Link to Alt Fuels Info in East TN:

ETCleanFuels.org

(865) 974-3625

Questions?