Big Oil and Alternative Fuels

Framing the Challenge

Tom O'Connor

ICF International

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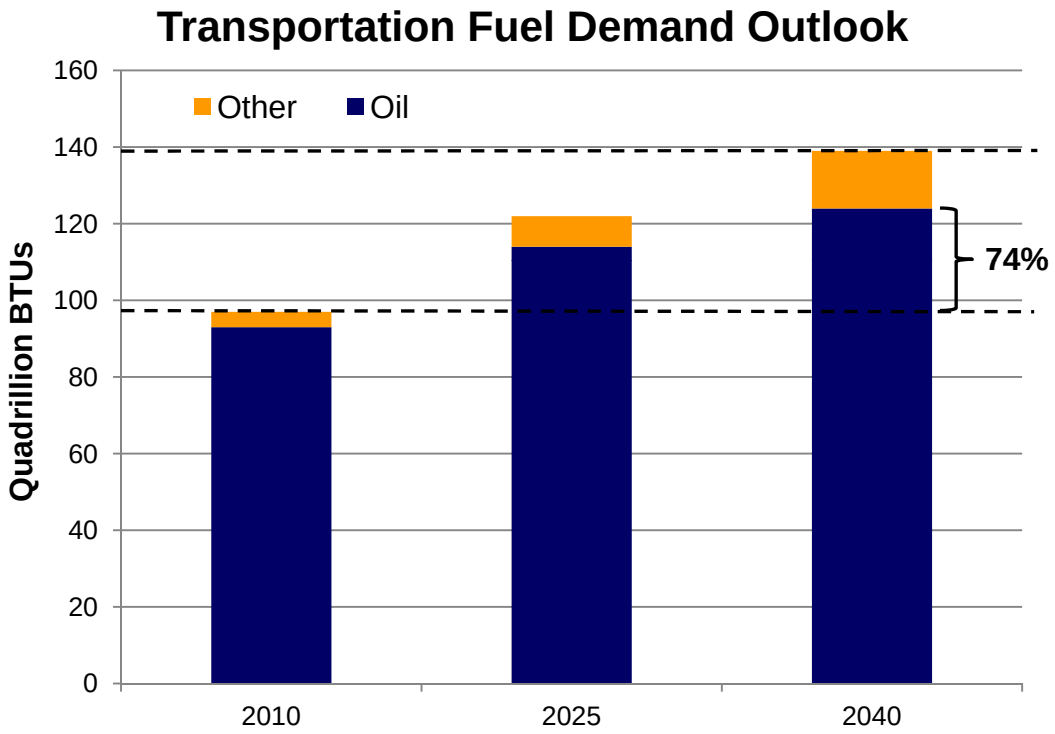
AGENDA

- Where we're headed: Global and US Outlook
- Implications for Big Oil and Alternatives
- Challenges for Developing Alternatives
- Final Thoughts
- Solutions? Next presentation!

Global Transportation Fuel Demand Will Grow from 2010 to 2040



- Growth of over 40% in BTU
- Oil growth 34%
- "Other" growth 240%
- Oil still 90% of demand by 2040

Source: ExxonMobil 2012 Outlook

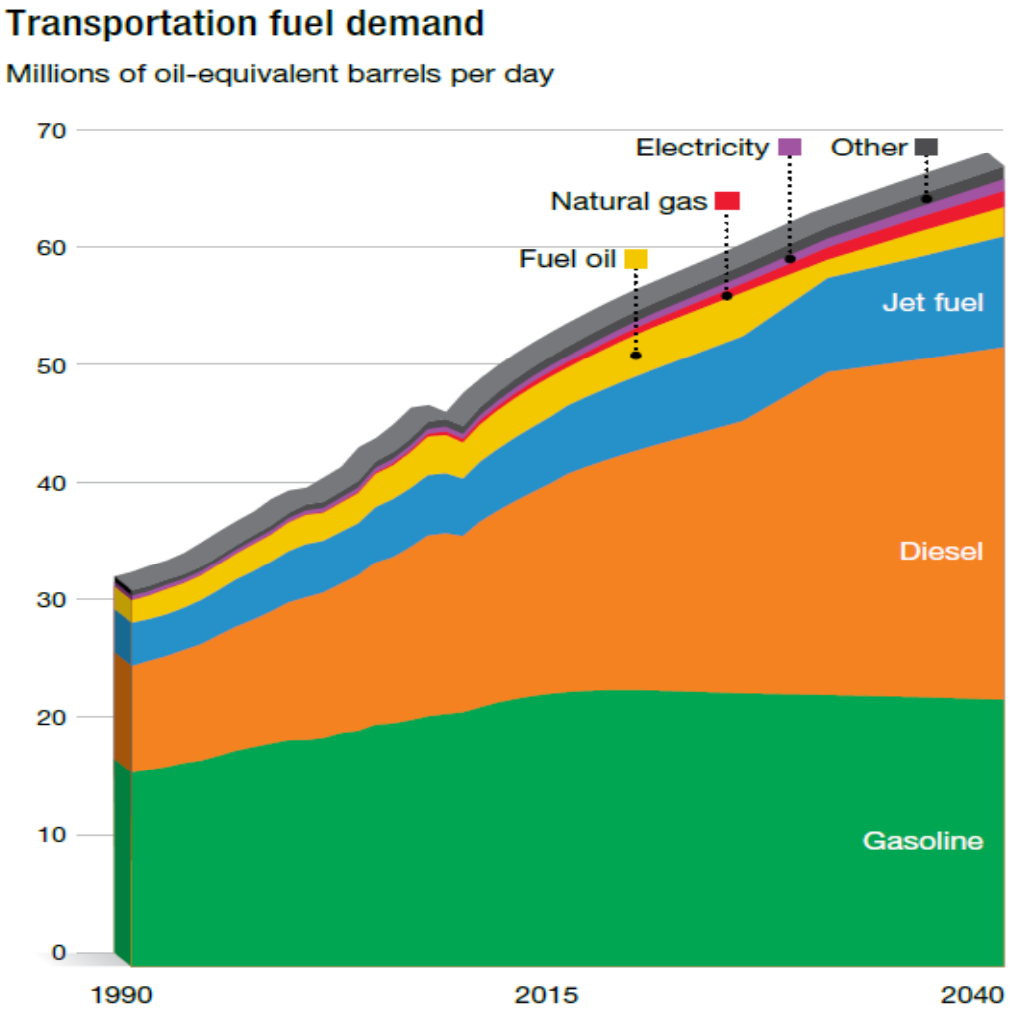
Transportation Fuel Growth Distribution

Quad BTU	Quadrillion BTU			% Growth	% Total Growth
	2010	2025	2040		
Africa	4	6	9	125%	12%
Asia Pacific	25	40	51	104%	62%
Europe	19	19	19	0%	0%
Latin America	7	10	13	86%	14%
Middle East	6	9	11	83%	12%
North America	32	33	31	-3%	-2%
Russia/Caspian	4	5	5	25%	2%
Total	**97**	**122**	**139**	**43%**	**100%**

Source: ExxonMobil 2012 Outlook

- **Demand in Asia, Africa, Middle East & Latin America all double from 2010 to 2040**
- **All global demand growth is outside the US and Europe**
- **North America and Europe share of global demand drops from over 50% in 2010 to 36% by 2040 - US CAFÉ standards, other efficiencies and slower economic growth**

Transportation Fuel Mix: Diesel Focus



Source: ExxonMobil 2012 Outlook

- Global Gasoline peaks about 2015 then declines
- Diesel demand increases at a sustained pace to support global economic growth
- Diesel growth is aligned with overall transportation growth

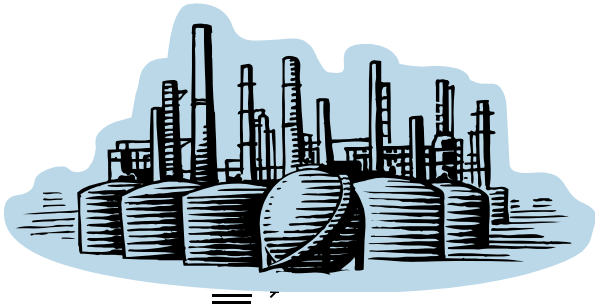
U.S. Transportation Demand Shows Less Growth, More Biofuel Supply (AEO)

	Quadrillion BTU			% Growth	% Total Growth
	2010	2025	2035		
Petroleum	25.74	24.64	23.97	(7)%	(148)%
Biofuel	1.14	2.28	3.93	245%	233%
Electric	0.02	0.04	0.08	300%	5%
CNG	0.04	0.11	0.16	300%	10%
Total	**26.94**	**27.07**	**28.14**	**4%**	**100%**

Source: EIA Annual Energy Outlook 2012

Slight growth in transportation fuel demand is concentrated in biofuels offset by a 7% decline in petroleum based demand.

Who Exactly is "Big Oil"??

UPSTREAM	REFINING	MARKETING
		
■ Drills	■ Buys Crude	■ Buys Wholesale
■ Sells Crude	■ Sells Products	■ Sells Retail
NOCs **Anadarko** **Apache**	**Independents** **Valero, Sunoco** **Tesoro, Flint Hills**	**Sheetz** **Pilot** **Getty**

Integrated Majors

BP, Chevron, ConocoPhillips, ExxonMobil, Marathon, Shell, etc

UPSTREAM

- Drills
- Sells Crude

REFINING

- Buys Crude
- Sells Products

MARKETING

- Buys Wholesale
- Sells Retail

FARMING

- Grows Crops
- Sells Bio-mass

BIO-REFINING

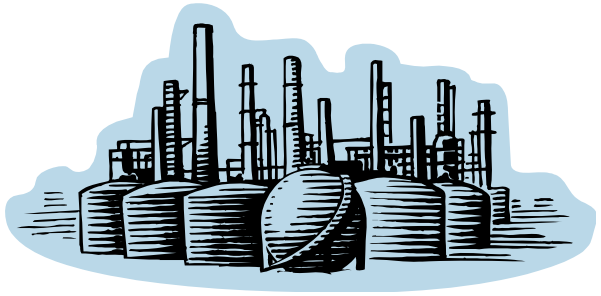
- Buys Bio-mass
- Sells Products

Implications of the Outlook for Big Oil

BIG OIL: Upstream (Production)

- Strong demand growth worldwide
- More global dependence on OPEC
  - Working with NOC's
- Develop Oil Sands/Shale Oil
- Alternative fuels: No Big Issue

❑ ***Message: Opportunity!***



BIG OIL: Downstream (US Refining)

- Focus capacity investment outside US
- Close less efficient US refineries?
  - Reg costs (LCFS, RFS, etc)
  - Gasoline substitute growth
  - More efficient capacity starting up
- Marginal profit expectations (US)

❑ ***Message: Threats!***

Implications of the Outlook on U.S. Alternative Fuels

- Strong growth for fossil fuel worldwide is likely to keep petroleum prices high (new oil must be found and much of it will be unconventional) → *good for alternatives*
- Sustained dependence on OPEC will keep geo-political premiums in the market) → *good for alternatives*
- Global financial markets and high petroleum prices could lead to global recessions and price collapses → *bad for alternatives*
- Focus on gasoline substitutes (ethanol, EV, CNG) is important, but may be short-sighted. Heavy fuel substitution (Diesel and Jet fuel) are the global growth products. → *unclear for alternatives*
- *Success of alternatives and petroleum price are directly linked!*

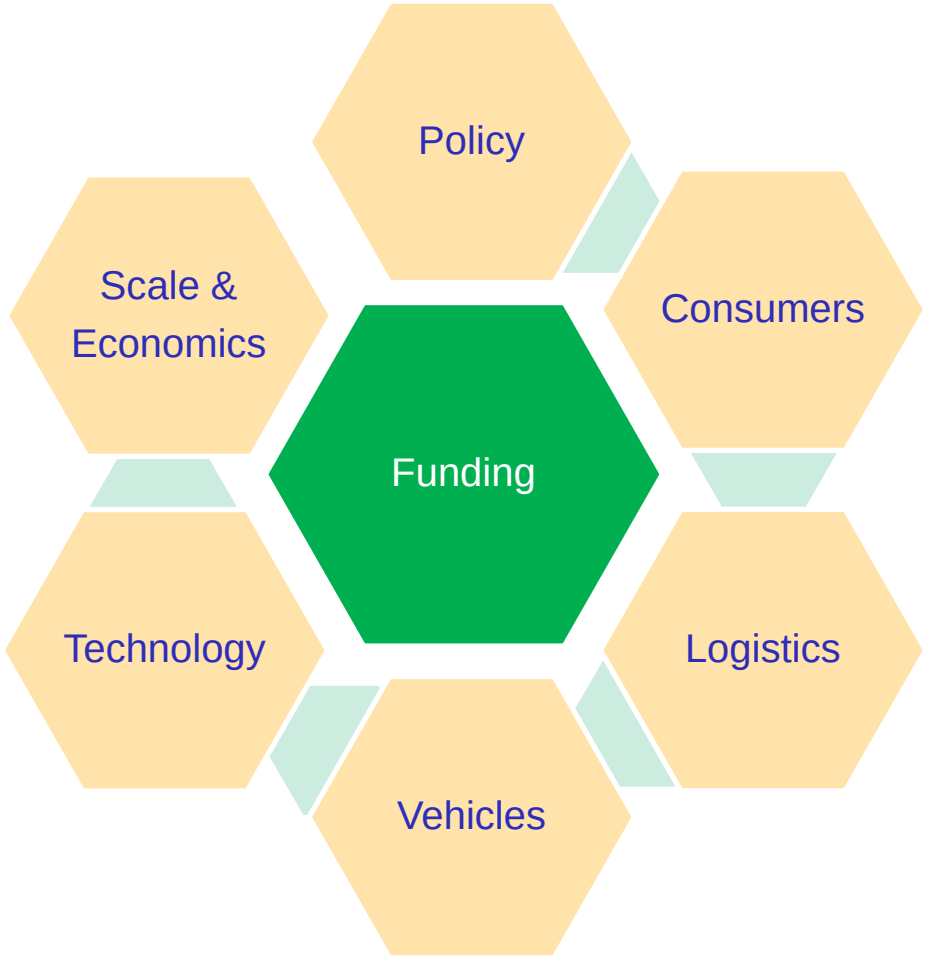
Alternative Fuels for Transportation: Opportunity and Logic

- Lower oil dependency
- Energy security
- Reduce greenhouse gases
- Support farmers
- Renewable fuel

Many Challenges…..and all Big Ones

- Cost effective & proven technology
- Scale issues
- Policy uncertainties: Carbon value??
- Raw material availability, logistics & commoditization (biofuels)
- Biofuel distribution limitations: mode, cost and integration
- Electric, CNG and E-85 Distribution Infrastructure: MIA?
- Vehicle Gaps: (Flex, EV, CNG) MIA?
- Vehicle Cost and Consumer Issues

Resolving these Challenges is Essential to Unlocking Funding from Investors



All Components of the Supply Chain are Critical

Comparison of Four Developing Cellulosic Ethanol Plants

	BP/Vercipia Florida	Mascoma Michigan	POET Iowa	Abengoa Kansas
Feedstock	Cane/grasses	Wood	Stover	Stover/grass
Cost, MM$	$299	$232	$250	$350
Completion	2013-4	2013	2013	2013
Capacity, mmg/y	36	20	25	23
Tons/day feed	1000	NA	770	1000
Jobs	200	NA	230	65
Inv.Cost/mmg/y	$8.31	$11.60	$10.00	$15.20

Scale is a huge factor in investment cost per gallon of production

- Product value less raw material cost and fixed & variable costs must pay back investment and generate an adequate ROI
- Small scale and high investment cost per gallon means higher margins needed for economic investment
- RFS2 16 bgy cellulosic will require 640 POET-sized biorefineries

Difficult to Compete with Petroleum Refining Investments

	BP/Vercipia Florida	Mascoma Michigan	POET Iowa	Abengoa Kansas	Motiva Texas
Feedstock	Cane/grasses	Wood	Stover	Stover/grass	Crude
Cost, MM$	$299	$232	$250	$350	$7,500
Completion	2013-4	2013	2013	2013	2012
Capacity, mmg/y	36	20	25	23	4,000
Tons/day feed	1000	NA	770	1000	50,000
Jobs	200	NA	230	65	300+
Inv. Cost/mmg/y	$8.31	$11.60	$10.00	$15.20	$1.90

- Major US refinery expansion (Shell/Motiva) initiated in 2006 has much lower investment cost per gallon of production
- Project will be put online in 2012 and may be one reason less efficient refineries are closing
- Project has almost 200 times the annual production capacity of advanced biofuel refineries >>>> means lower cost of operation, too

Commoditization & Logistics Challenges for Advanced Biofuels

Advanced Biofuels Refineries

- Must develop local feedstock
- Acreage may limit capacity
- Feedstock transport labor intensive
- No feedstock market alternatives
- Limited and costly distribution infrastructure
- No market centers

Petroleum Refineries

- Wide access to global crude oil supply
- Acreage limited to Refinery
- Pipeline & marine transport efficiencies
- Multiple crude oil alternatives
- Established, efficient distribution infrastructure
- Well-defined market centers

Some Advantages:
Petroleum terminal infrastructure and service stations can be utilized for delivery (E-85 conversion costs will impact service station dealers)

Electric and CNG Challenges are More in the Delivery, Vehicle and Consumer Areas

Electric Vehicles

- Develop infrastructure for charging
- Develop batteries with more capacity
- Reduce vehicle cost
- Reduce operating cost/mile
- Resolve consumer hurdles

CNG and LNG Vehicles

- Develop infrastructure for fuel distribution
- Develop longer range vehicles
- Reduce vehicle cost
- Address home safety
- Reduce operating cost/mile
- Resolve consumer hurdles

Advantage:
U.S. natural gas abundance should enable meeting the higher demand for power and CNG/LNG

The Path Ahead: Conflicts & Trade-offs

- Meeting forecast alternative fuel goals will require high energy prices and/or substantial taxation on fossil fuels to stimulate alternative fuel investment
  - Who will say this? Who will propose this as something we need to do?
  - Are lower carbon goals sufficient incentive for consumers to radically change their lifestyle and pocketbook?
- Can we develop policies that support alternative growth without undermining the existing refining and distribution industry?
- Is success in biofuels inevitably linked to more and more rail and truck traffic and infrastructure cost?
- Natural Gas supply is a resource that must be part of the solution through either greater EV or CNG development. Can it happen? Who will drive it?