

Why Does the Law & Policy Matter?

Industry pieces are in place but where are the results?

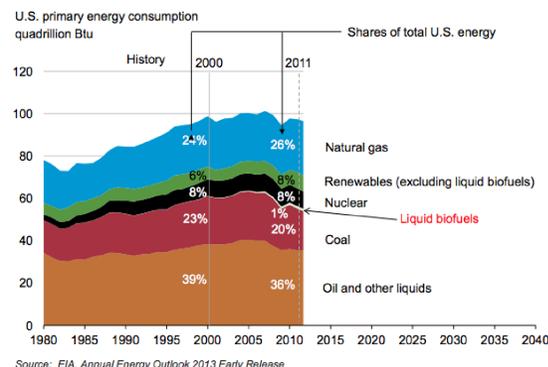
Are there opportunities in the aviation sector?

What is the likelihood of ...

- predictable industry development?
- taking the next step to commercialization?

How to address or draw upon issues related to ...

- decline of ground transportation sector motor gasoline consumption, which has occurred since 2007?
- decline of coal, oil and other liquids on decline?



Source: EIA, Annual Energy Outlook 2013 Early Release

Transportation vs. Aviation: Aviation is Different

Ground transport sector – reduced demand; aviation growth projected at 4-5%/yr. to 2050

Aviation customer pull (vs. technology push) due to:

- Concentration of customers – airports & military are embracing “sustainable alternative jet fuels” (SAJFs)
- No viable alternatives to liquid, high-density, “drop-in”
- Driven by desire to proactively reduce CO2 emissions
 - o Global aviation = 2% of all human-induced CO2 emissions and 12% of all transportation CO2 emissions (ATAG 2014).
 - o Int'l nature of aviation – Int'l emissions agreements (EU Emissions Trading Systems includes airlines)
 - o SAJF – up to 80% CO2 emissions reductions

Sustainable Alternative Jet Fuels (SAJF)

Benefits:

- Carbon emissions reductions
- Price stability
- Energy & national security
- Regional rural economic development

Government Policies:

- US military commitments to SAJF
- International nature of aviation
- International emissions agreements (EU Emissions Trading Systems – includes airlines)

1978-2004 Law & Policy Development/ Promotion of “First Generation” Biofuels

- Primarily food based feedstock: sugars, grains, starches
- Products: Ethanol, Biodiesel

Example law & policy supports

- 1973 Energy Crisis → 1978 Renewable Energy Act
- 1980 Energy Security Act targeted new sources of renewable energy, provided tax exemptions and insured loans, increased an earlier fuel blend credit from \$.40 to \$.60 / gallon.
- 1990 Omnibus Budget Reconciliation Act marked shift from goal of industry from energy security to regional economic development.

2005 to 2014: Law & Policy Development/ Promotion of “Second & Third Gen” Biofuels

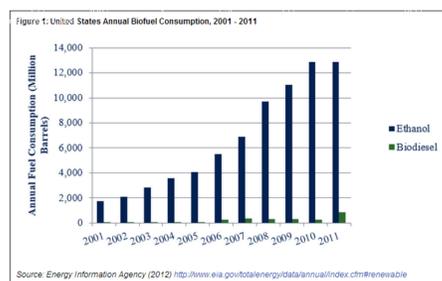
Second & Third Gen

- Non-food based stock: grasses, non-federal forest biomass, waste/residues, algae
- Products: Ethanol, biodiesel, drop in biofuels, biojet



Example law & policy supports

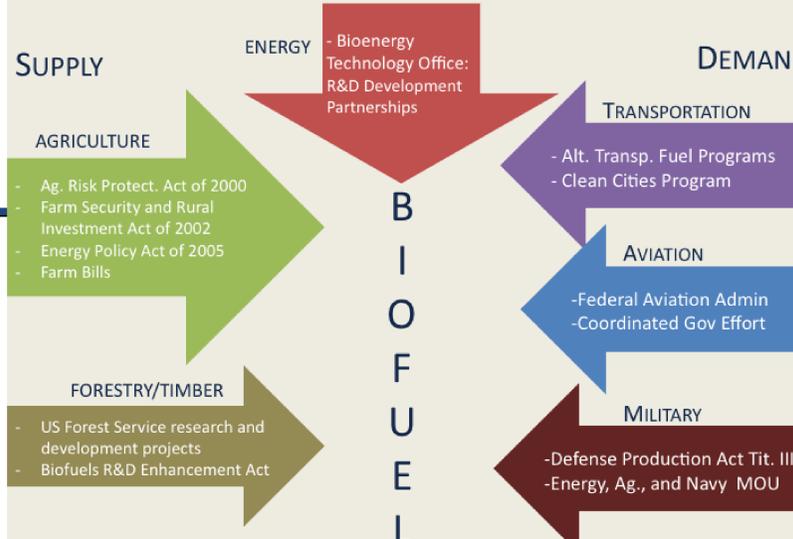
- 2005 Energy Policy Act (“RFS1”) aimed to spark growth of biofuel industry and address number of challenges
 - RFS1 “promotes dependable, affordable, and environmentally sound production and distribution of energy for America’s future.” (George W. Bush)
- 2007 Energy Independent & Security Act (“RFS2”) expanded RFS1
 - Mandated “obligated parties” to blend certain percentages of biofuels into the U.S. transportation fuel supply



Source: Energy Information Agency (2012) <http://www.eia.gov/totalenergy/data/annual/index.cfm#renewable>



Current Focuses

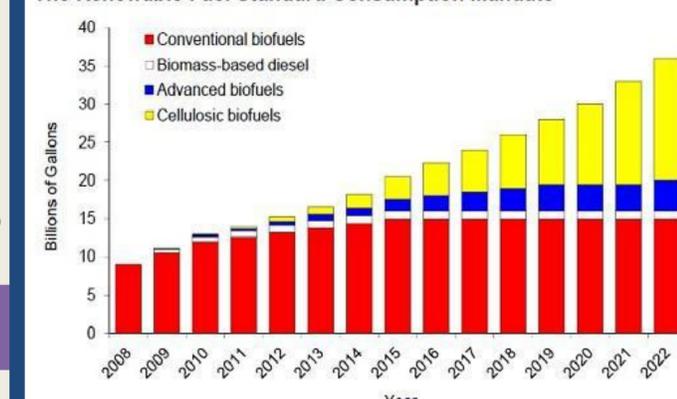


Renewable Fuel Standard by the numbers

Year	Cellulosic biofuel anticipated requirement	EPA mandate	Biomass-based diesel anticipated requirement	EPA mandate	Total adv. biofuel anticipated requirement	EPA mandate	Total renewable fuel anticipated requirement	EPA mandate
2011	0.25	0.0066	0.8	1	1.35	1.35	13.95	13.95
2012	0.5	0.00865	1	1	2	1.3-1.5	15.2	14.5-14.7
2013	1	0.006	-	1.28	2.75	2.75	16.55	16.55
2014	1.75	0.017	-	1.28	3.75	2.2	18.15	15.21

in billions of gallons

The Renewable Fuel Standard Consumption Mandate



Source: National Academy of Sciences

Looking Beyond the U.S. European Commission Biofuel Law & Policy

Shift in 2009: Exemption → obligation focus

- Directives to member states:
- Reduce overall carbon footprint
 - Meet 10% renewable fuel target by 2020 in transport sector
 - Establish emissions trading scheme
 - Require long term-policy goals

Similar challenges as the United States:

- “Initiatives to support alternative transport fuels exist at both European Union and national level but a coherent and stable overarching strategy with an investment friendly regulatory framework needs to be put in place.”

Directives in areas like aviation = direct effect on U.S.

What's Next with U.S. Policy?

- Assessment is needed of the short-term and long-term policy impacts.
- Is the RFS successful? Where do we go from here?
 - First, second, third, fourth... generation biofuels...
- International aspect of aviation sector requires multinational cooperation; what does this look like?
- What are the results of local, state, and other regional approaches?
- How can policy address 2nd and 3rd generation impediments – price, supply chain, investment?

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Resources

DOE: Bioenergy Legislative Library https://bioenergykdf.net/legislative_library

DOE: Alternative Fuels Data Center <http://www.afdc.energy.gov/laws>

Congressional Research Center <http://www.loc.gov/>

Energy Information Administration <http://www.eia.gov/biofuels/issuestrends/>