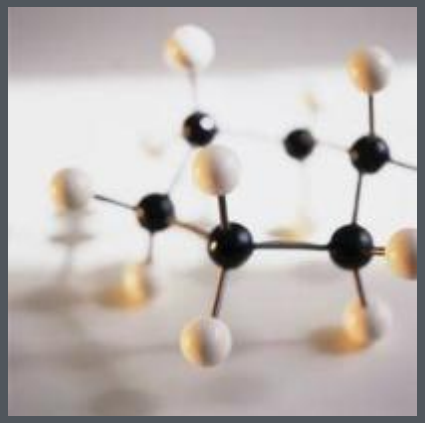
Biomass Program Highlights

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy



BR&D TAC Meeting
March 2, 2011

Paul F. Bryan,
Program Manager
DOE Biomass Program

Replacing the Whole Barrel –
Ethanol, "Drop-ins," and Market Balance

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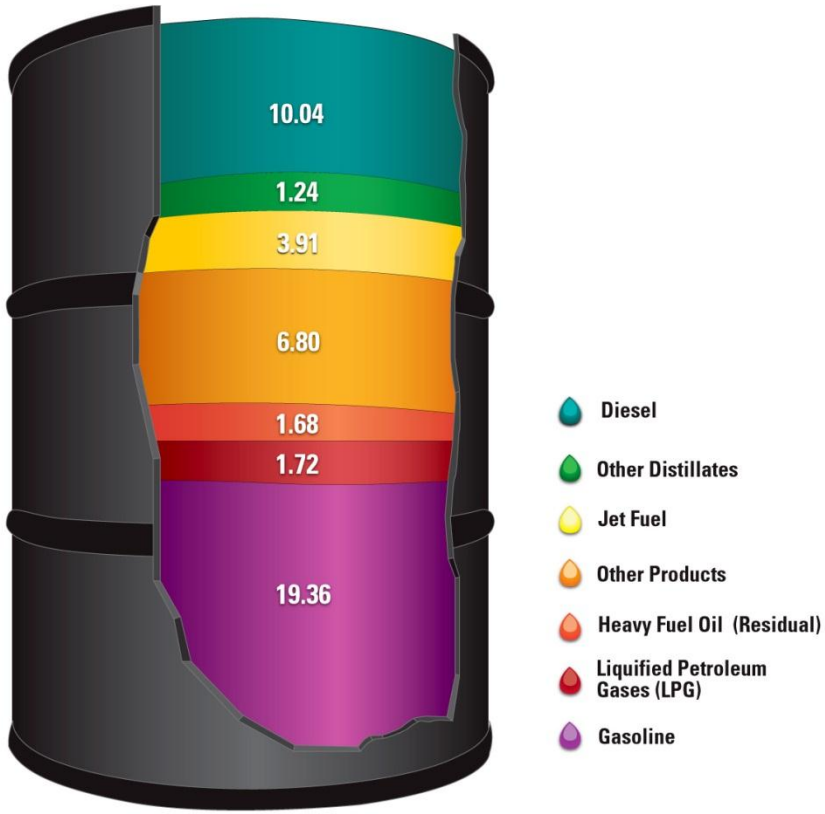
Products Made from a Barrel of Crude Oil (Gallons)
(2009)



Source: Energy Information Administration, "Oil: Crude Oil and Petroleum Products Explained" and AEO2009, Updated February 2010, Reference Case.

- **Below E10, refiners can adapt**
- **Somewhere above E10, problems arise:**
  - Refiners shift gasoline to lower-value products
  - Reduced crude runs reduce diesel / jet supply
  - Refinery balance can be disrupted (aromatics, H2, light / heavy, heat / process integration, etc.)
- **Foreseeable capacity ~100% ethanol:**
  - Conv. RF will be ethanol (mostly corn)
  - Adv. NCRF will be ethanol (mostly cane)
  - Adv. CRF will initially be ethanol (cellulosic)
  - Limited biodiesel & renewable diesel from veg oils and waste fats & oil
- **No single hydrocarbon is a panacea:**
  - Paraffin vs. aromatic
  - Single component (volatility)
  - Acceptability as "contaminant" in other fuels
  - Combustion behavior
  - Refinery adaptability

Department of Energy, Biomass Program
Integrated Biorefinery Capacity Timeline

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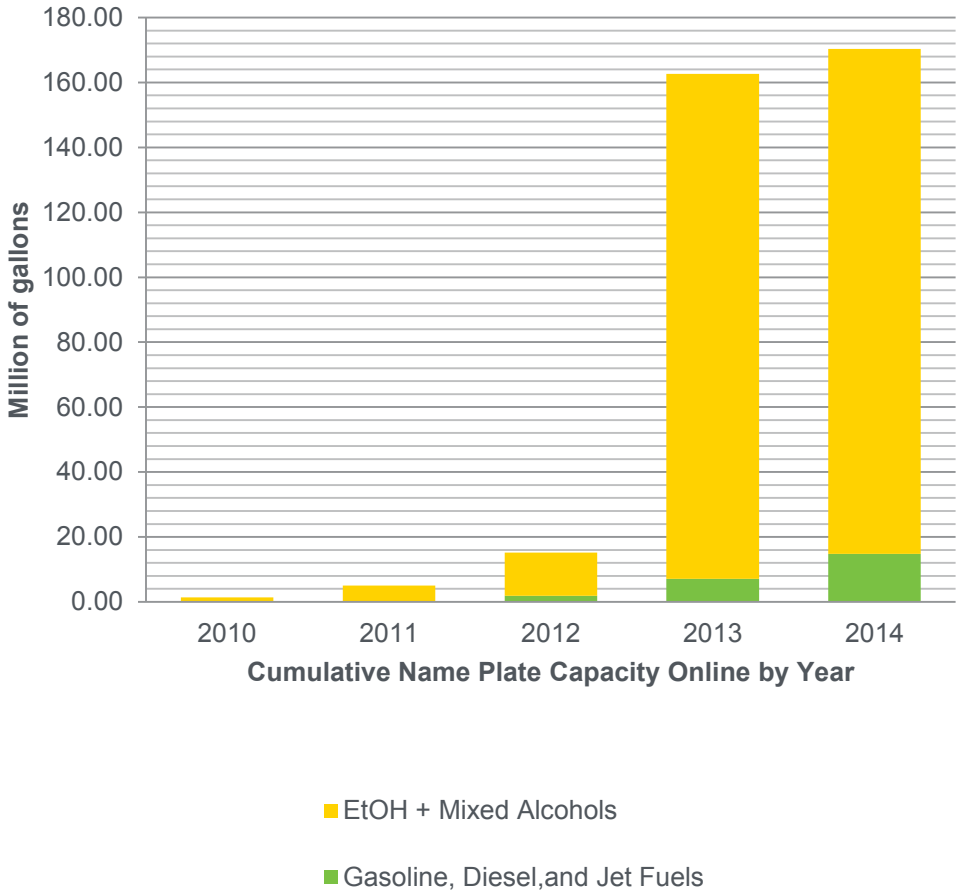

DOE OBP has 26 IBR projects producing biofuels at various scales:

- **12 at pilot scale** (min 1 dry tonne per day feedstock)*
- **8 at demonstration scale** (min 50-70 dry tonnes per day feedstock)
- **6 at commercial scale** (min 700 dry tonnes per day feedstock)

* Note, pilot projects would not sell biofuel in commercial markets. This scale is for techno-economic validation.

DOE OBP IBR –
Volumetric Projections by Project

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Project (State)	Fuel Type	Scale	2010	2011	2012	2013	2014
Bluefire (MS)	Cellulosic Ethanol	commercial				18.900	18.900
Abengoa (KS)	Cellulosic Ethanol	commercial				25.000	25.000
Poet (IA)	Cellulosic Ethanol	commercial				25.000	25.000
Mascoma (MI)	Cellulosic Ethanol	commercial				40.000	40.000
Flambeau (WI)	FT diesel and waxes	commercial					7.700
RangeFuels (GA)	Mixed alcohol	commercial		2.500	2.500	20.000	20.000
RSA (ME)	Biobutanol	demonstration				1.300	1.300
NewPage (WI)	FT diesel and waxes	demonstration				4.600	4.600
Pacific Biogasol (OR)	Cellulosic Ethanol	demonstration				2.700	2.700
Lignol (OR)	Cellulosic Ethanol	demonstration				1.800	1.800
Verenium (LA)	Cellulosic Ethanol	demonstration	1.400	1.400	1.400	1.400	1.400
INEOS (FL)	Cellulosic Ethanol	demonstration			8.000	8.000	8.000
Enerkem (MS)	Cellulosic Ethanol	demonstration				10.000	10.000
Sapphire (NM)	Jet fuel and diesel	demonstration			1.000	1.000	1.000
Solazymes (PA)	Biodiesel and renewable diesel	pilot				0.300	0.300
Alpena (MI)	Cellulosic Ethanol	pilot		0.760	0.760	0.760	0.760
ICM (MO)	Cellulosic Ethanol	pilot		0.260	0.260	0.260	0.260
Logos/EdenIQ (CA)	Cellulosic Ethanol	pilot			0.050	0.050	0.050
ADM (IL)	Cellulosic Ethanol	pilot			0.026	0.026	0.026
Zeachem (OR)	Cellulosic Ethanol	pilot			0.250	0.250	0.250
Algenol (FL)	Cellulosic Ethanol	pilot			0.100	0.100	0.100
REII (OH)	Diesel	pilot			0.625	0.625	0.625
Amyris (CA)	Diesel	pilot		0.001	0.001	0.001	0.001
UOP (HI)	Diesel, gas, jet fuel	pilot			0.060	0.060	0.060
Clearfuels (CO)	FT diesel and jet fuel	pilot		0.151	0.151	0.151	0.151
Haldor Topsoe (IL)	Green gasoline	pilot				0.345	0.345
	Cumulative Capacity in Million Gals / Year		**1.400**	**5.072**	**15.183**	**162.628**	**170.328**

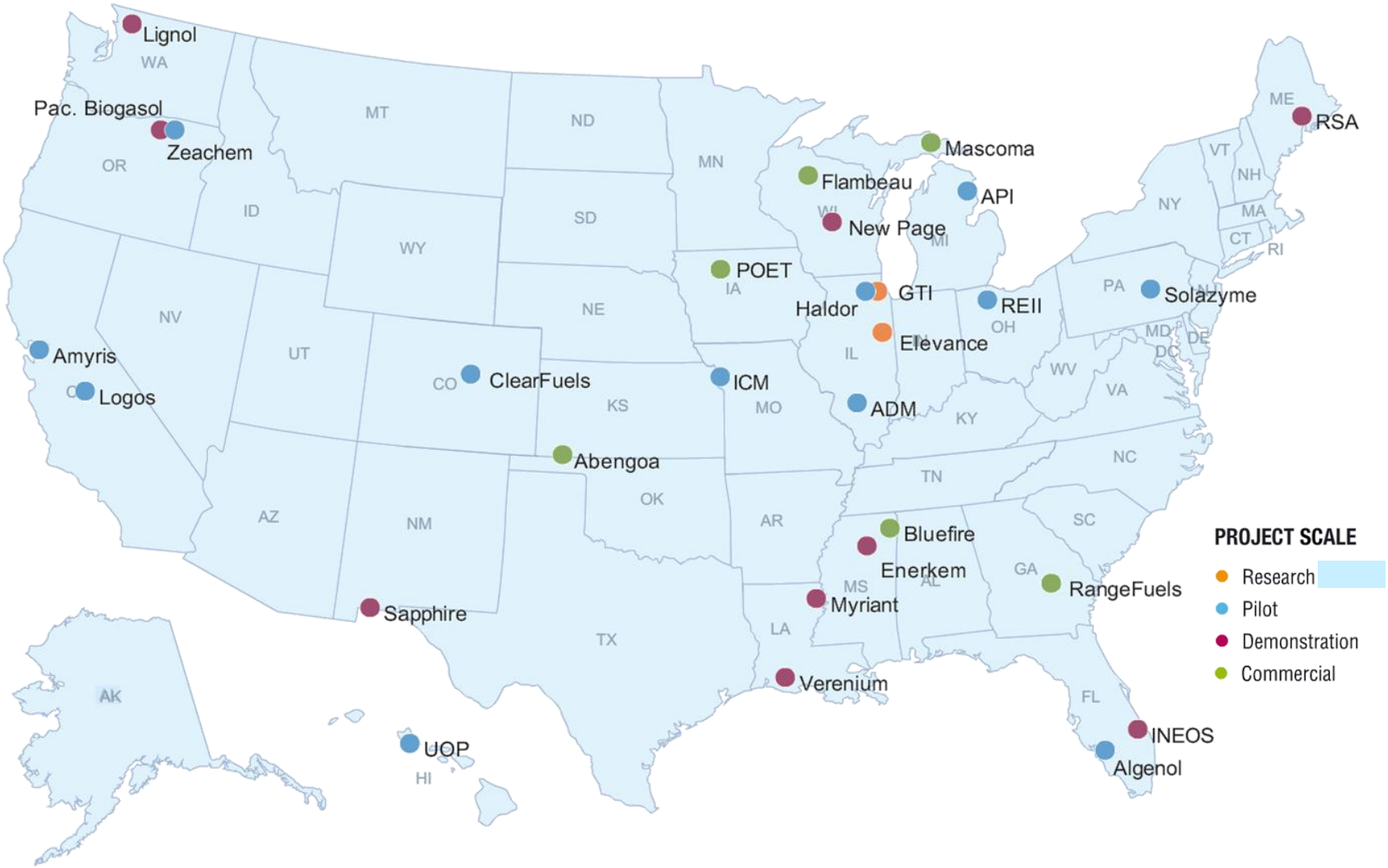
Projects in **GREEN** funded through the American Reinvestment and Recovery Act.

Projected volumes and dates for capacity coming online are based on information presented by IBR projects at the Peer Review conducted on Feb 1-3, 2011 and the project fact sheets located on the Program's IBR website, found at:

http://www1.eere.energy.gov/biomass/integrated_biorefineries.html

http://obpreview2011.govtools.us/IBR/

DOE OBP - Integrated Biorefinery Map



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