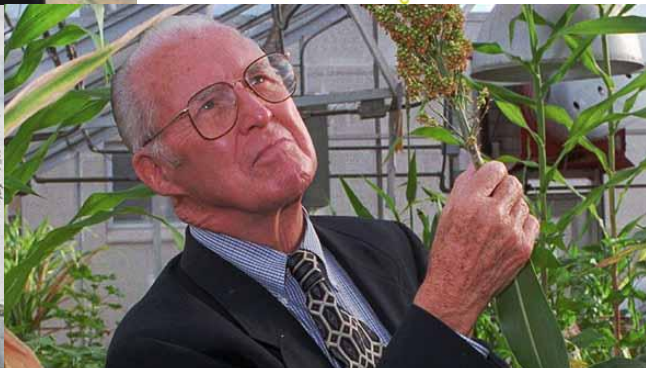
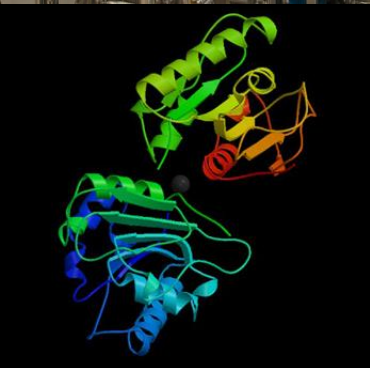
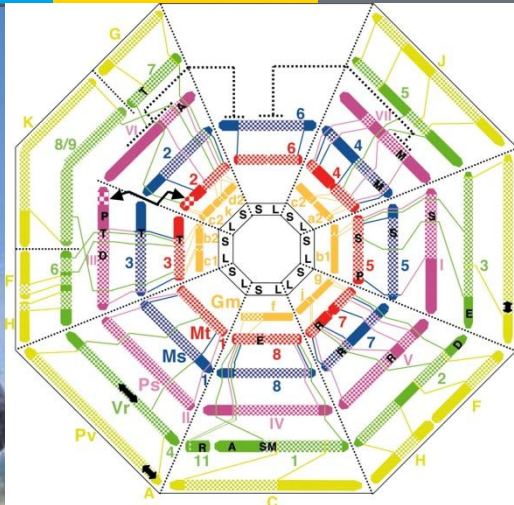


Update on Renewable Fuels & Chemicals



Florida Energy Systems
Consortium Workshop

Gainesville, Florida
May 12, 2014

Dr. Paul F. Bryan

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& Biological Engineering Dept.

Introduction / Background

- Thanks to Prof. Jennifer Sinclair Curtis & Conf. Organizers
- My Background
- Review the National Scene
 - Summary, Key Issues & Obstacles
 - Fuel Production Cost vs. Market Price
 - Promising New Technologies & Applications
- Comments re: Workshop Objective(s)
 - Help Florida Set R&D Objectives & Target Funding for FESC
 - Florida Resources, Needs & Issues
 - Match with Technical, Societal & Economic Drivers
 - Recommendations

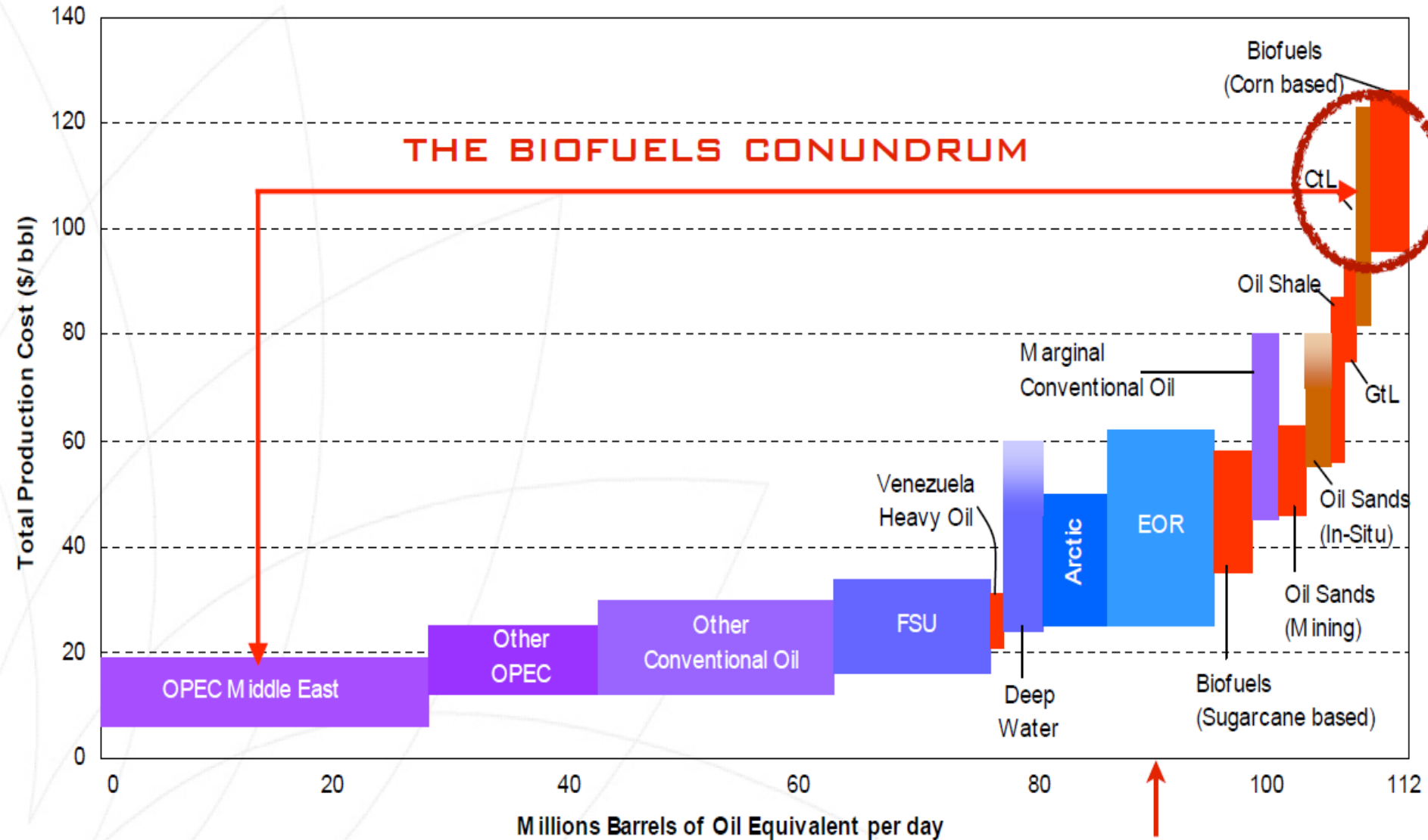
What a Long Strange Trip It's Been

- Chem. Eng. BS / PhD
- Academia – 8 years (UC-Berkeley, MIT, Colorado School of Mines)
- Industry – 18 years
 - Dow (Union Carbide) – 3 years
 - Chevron – 15 years
 - Biofuels Monitoring & Advising 1999 – 2006
 - VP Biofuels Technology 2006 – 2010
- Government – 2 years
 - DOE Biomass Program Manager 2010 – 2012
- Industry Consulting
 - Renewable / Conventional Fuels & Chemicals – 2 years – 2012 – Present

National Scene

- RDD&D (Res., Dev., Demo. & Deployment):
 - Rapid progress at the Bench Scale
 - Much slower at Pilot / Demo Scale; Stagnant at Full Scale
- Policy:
 - Anemic, Unreliable, and under constant Political Threat
- Economics:
 - Conventional BF are nearly **price**-competitive with Mandate / Subsidy
 - Advanced BF are nearly **price**-competitive with Mandate / Subsidy
 - In some cases, BF may be **price**-competitive without Mandate / Subsidy
 - In **no** case will **any** BF be **cost**-competitive for several decades at least

Liquid Fuels Supply Curve Projection – 2020



Source: Booz Allen Hamilton Analysis (ca. 2005)

Promising BF Technologies & Applications

- Advanced (e.g., lignocellulosic) Sugars:
 - Incremental progress in conventional hydrolysis
 - Several promising new concepts & crops
- Bio-Conversion:
 - Explosion of new tools and technologies for R&D
 - Likely to prove economic for chemical rather than fuels
- Biomass Liquefaction:
 - Most likely to prove economical for liquid fuels production (rural)
- Biomass Gasification:
 - Best bet for combined fuel / chemical + electricity co-prod'n (urban)
- Algae (from Sunlight, CO₂ & Water)
 - Enormous potential, but also numerous obstacles

“Planet Earth, Neat” (i.e., without ice)



Source: National Geographic Magazine (2013)

Shedding some light on the Sunshine State

- Among States most vulnerable to Climate Change
 - Sea-level rise, hurricane storm surge, beach erosion, salt-water infiltration, etc.
- Multiple Major Metropolitan Areas (5.6, 2.8, 2.1, 1.3, 0.7 million)
 - Many cars / drivers; regional & international travel hub
- Tourism is #1 Industry
 - Agreeable climate; popular beaches; scenic interior; historical, technological, and amusement attractions
- Agriculture is #2 Industry – sun, water, land, transportation
 - Existing biomass potential with prospect for expansion
 - Water-use and other impacts are issues
 - Sugarcane has great potential for both contributions to a biomass-based industry and to environmental impacts
- Large land area, but limited vacant or “underutilized” land

Recommendations

- To extent appropriate, establish 1 State Plan, not 67 County Plans
- Identify / focus on significant feedstock potential (urban waste, ag waste, cane, algae) and optimal zones (climate, competing land use, environment, infrastructure, etc.)
- Support R&D, pilot studies, and “pioneer” commercial demos
- Partner with industry and Federal agencies (DOE, USDA, DoD, etc.)
- Leverage “brownfield” sites and vacant or underutilized land and infrastructure
- Where possible, develop “multi-user” facilities (e.g., for feedstock supply & preprocessing; fuel upgrading, testing & distribution; etc.)
- Recognize high-value products as a stepping stone to fuels
- Exploit Florida’s importance in the Presidential Election process, as Iowa has done with its Caucus to promote corn / ethanol

Thank You!