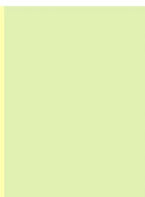
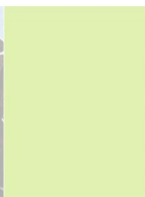




# Green Chemistry: An Interdisciplinary Approach to Sustainability

A perspective on technology  
commercialization at large companies

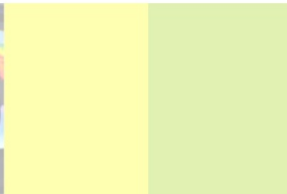
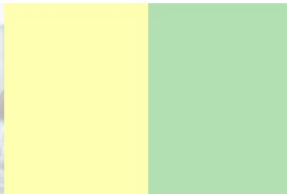
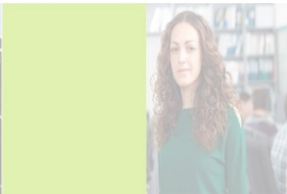
April 17, 2013



# My Bio



- Craig Vaughn
  - BSChE, Howard University
  - MSCEP and PhD ChE, MIT
- 25 years in the petrochemicals and refining business
  - Process Research
  - Manufacturing
  - Project Management
  - Research Management
  - Business Management
  - Business Development
  - Strategy
  - Intellectual Property Management
  - Group Technology (Energy Biosciences Institute)

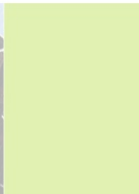


# About BP



BP is one of the world's largest energy companies, providing our customers with fuel for transportation, energy for heat and light, retail services and petrochemicals products for everyday items.

- Our business is the exploration, production, refining, marketing, trading and distribution of energy – this is what we do, and we do it on a massive global scale
- Our business is the exploration, production, refining, marketing, trading and distribution of energy – this is what we do  
We leverage world-class technology, the best people and





# BP by the numbers<sup>1,2</sup>

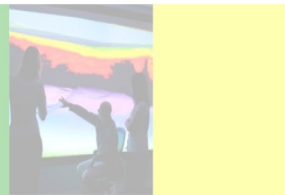
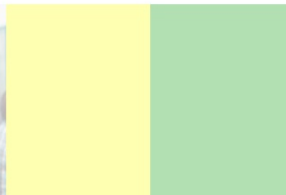
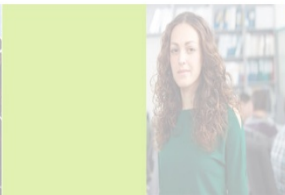
- Number of employees around the world: 85,700
- Service stations: 20,700
- Countries of operation: Over 80
- Refineries (wholly or partly owned): 16
- 2012 Production: 2.1 m barrels of oil per day every day
- 2012 capital expenditures: \$24 b (\$10.4 b in US)



# Biofuels as an opportunity



- Huge market
- Public and governmental support
- Theoretical feedstock availability
- Capital intensive (NREL estimated \$422m in 2007 for 68m gal/yr LC plant<sup>3</sup>)
- Sale price of final product is relatively low
- Potentially favorable but always volatile regulations



# Perceived Advantages of firm size <sup>bp</sup>

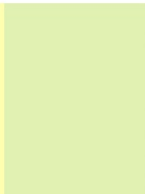


## Large company

- Access to capital
- Can easily acquire expertise
- Established process and procedures to deliver large capital projects
- Integration of new business into existing portfolio
- Really good at implementing incremental technology in existing businesses

## Start-ups

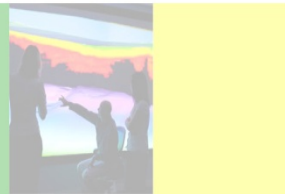
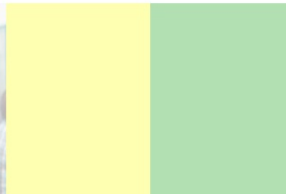
- Focus
- Can operate on small scale
- Can do some things faster
- Can more easily adjust organization based on needs
- High risk tolerance
- Want to be first



# Acquiring and developing capability



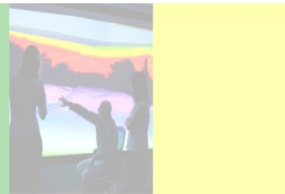
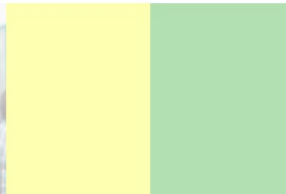
- Acquired 3 sugar mills in Brazil
- Acquired Verenium
  - Research center in San Diego
  - Scientists and capability to further develop technology
  - Demo unit in LA
- Partnered with DuPont
  - Butamax JV – biobutanol
- Partnered with DuPont and British Sugar
  - Vivergo JV – bioethanol
- Collaborated with DSM/Martek (sugar to diesel)
- Established EBI with UCB, UIUC and LBNL



# More on access to capital



- Expected returns lower than venture capital funds but...
  - “material” business is the goal (>\$1B)
  - Competition from existing businesses with lower risk higher return investments
  - Diversification vs growth in known businesses....trading one risk for another
  - Leaders of existing other businesses sit on capital allocation committees

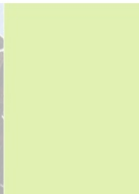




# Large firm organizational issues



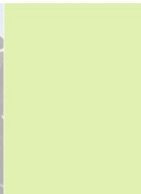
- Stockholders expect growth with risk consistent with the market sector
- Business Units concentrate on delivering short to mid term performance (may not have a 10 yr+ view)
- Sheer number of options can slow decision making
- New businesses compete with bigger profitable businesses for resources and attention
- Priorities can shift
- Once decisions are made, scale and resources can prove decisive



# Summary



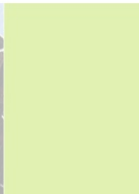
- Underlying market and regulatory uncertainties affect large and small alike
- Each firm size has its own challenges
- Compelling economics and technology are needed before capital will be put at risk
- Some technologies/business may only be successful when driven by organizations having large and diverse resources



# References



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2. Summary review 2012, Pg 31  
[http://www.bp.com/assets/bp\\_internet/globalbp/globalbp\\_uk\\_english/set\\_branch/STAGING/common\\_assets/bpin2012/downloads/BP\\_Summary\\_Review\\_2012.pdf](http://www.bp.com/assets/bp_internet/globalbp/globalbp_uk_english/set_branch/STAGING/common_assets/bpin2012/downloads/BP_Summary_Review_2012.pdf)
3. Humbird et al, Technical Report NREL/TP-5100-47764, May 2011



# Questions??

