BP Alternative Energy

- Biofuels
  - Focus on Europe and US
  - Manufacturing JV in Brazil
  - Investing $500m in R&D over next 10 years at the Energy Biosciences Institute (UC Berkeley, Lawrence Berkeley Lab and U of Illinois)
- Wind – one of the largest wind developers in the US
- Solar – global business
- CCS – two major projects (California and Abu Dhabi)
Project Approach to Technology Roadmaps – Learning Rates

- Develop view on market deployment
- Review history of learning rates and technology development
- Review future technology developments and potential market impacts
- Combine future developments into learning rates
- Iterative loop between roadmaps and implementation
Some Observations

- Significant technology stretch in the wind sector – offshore in particular
- OEMs and project developers need to work together to drive innovation in the sector
- Some of the key areas for future cost reduction are:
  - Condition Monitoring
  - New Meteorology Technology
  - Variable Rotor Geometry Design
  - Permanent Magnets
- Large scale energy storage will be critical for load balancing
Bottom up Technology Review
Value added by Oil & Gas Companies

- Oil and Gas companies have deep “know-how” (different from technology and IP)
  - Project development and cost management for large scale and complex offshore projects
  - Ability to manage and diversify risks
  - Experience with permitting, environmental impact assessment etc.
  - Operating in hostile offshore environment
  - Safe operating practices
Lessons from the Frontline

• Do not generalise – learning rates can vary significantly (high capital requirements lead to slow learning rates)

• Consider innovation in other technologies

• Supply chain buy-in is essential to turn roadmaps into reality

• Engagement from regulators can determine pace

• R&D – both input and output metrics are needed

• Need to understand interaction with other primary energy sources, e.g., wind and gas
Some Challenges

• Educating public about costs and benefits is critical for success - there is opposition to every renewable technology

• Who pays for transmission? Where does grid operator take over the responsibility?

• Protecting IP vs. accelerating implementation

• How to link climate/energy policies with domestic industrial policies?

• Impact on other resources – water, land, biodiversity, ecosystem

• Project financing