

From Roadmaps to Implementation

IEA Workshop, 2-3 November 2009

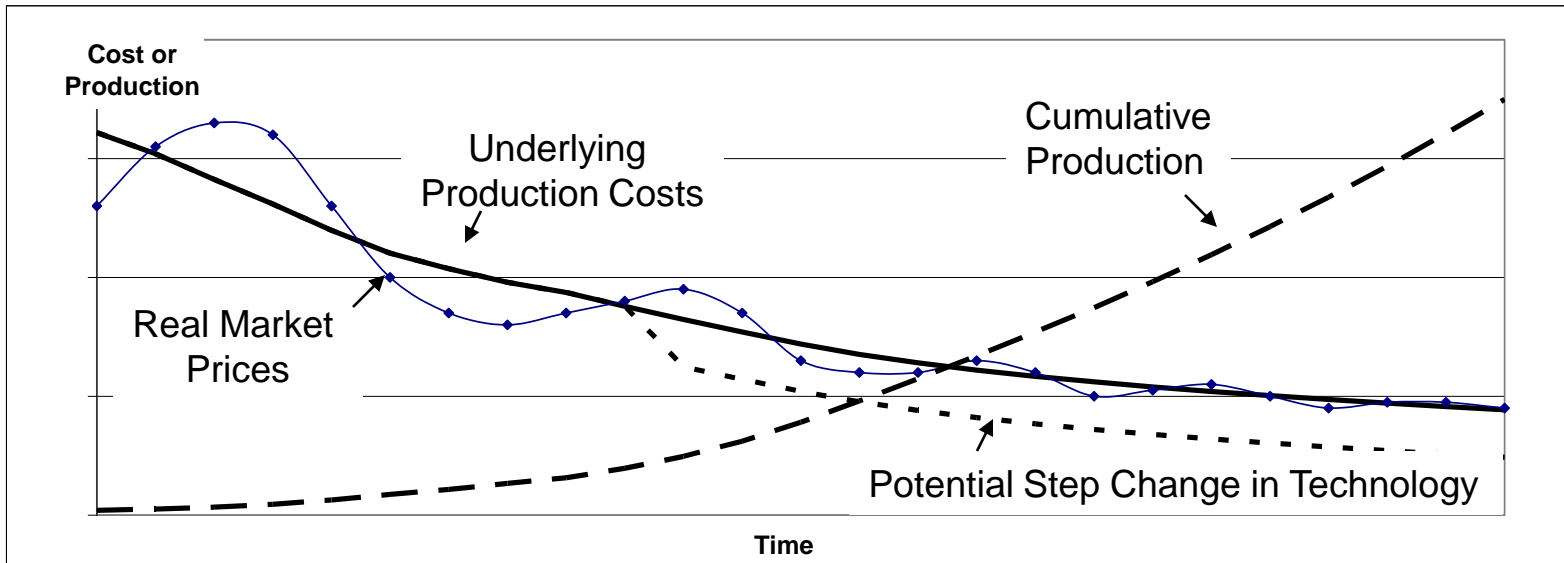
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BP Alternative Energy



- 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



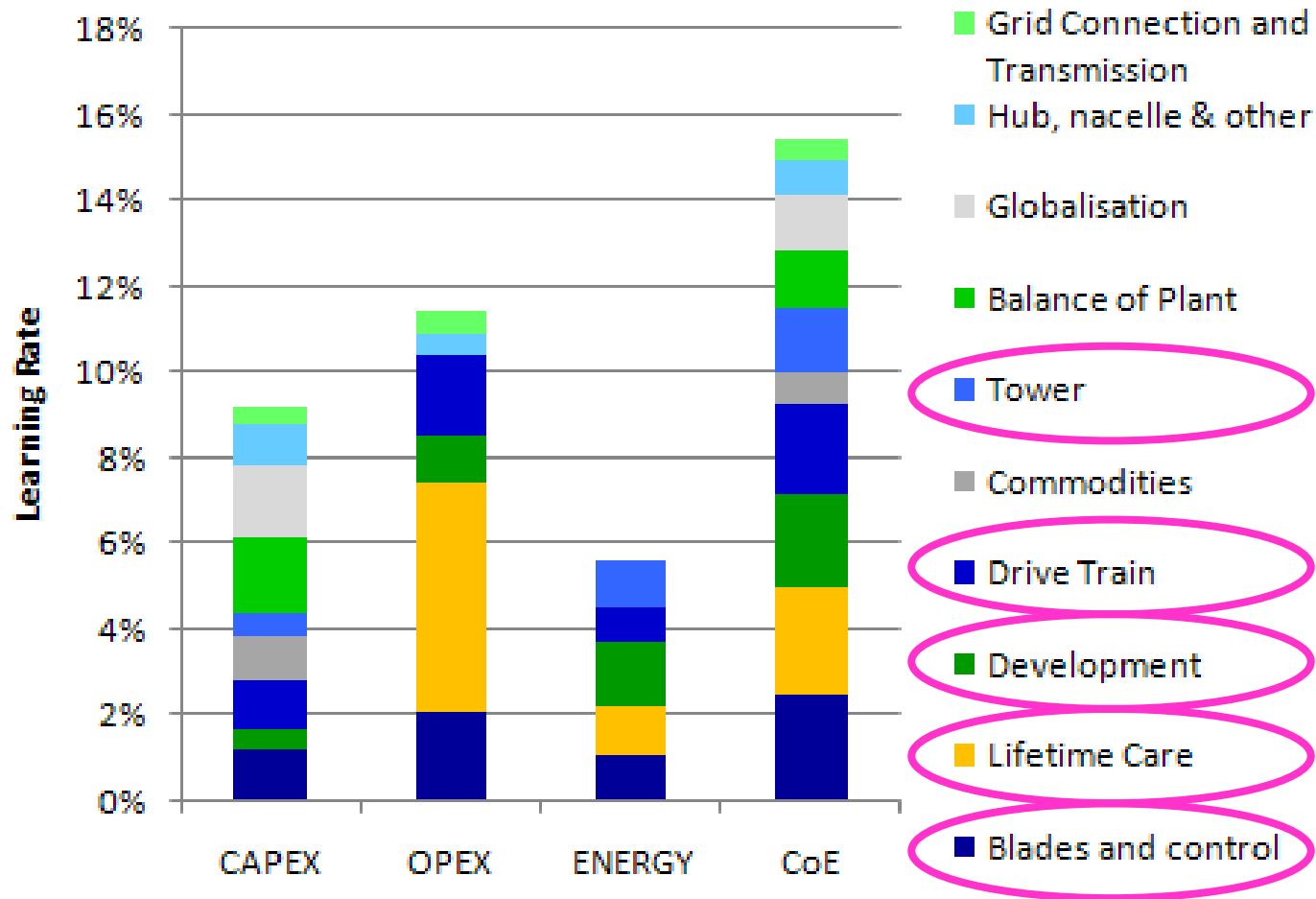
- Develop view on market deployment
- Review history of learning rates and technology development
- Review future technology developments and potential market impacts
- Combine future developments into learning rates
- Iterative loop between roadmaps and implementation

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