Challenges in financing of new sustainable biofuels technology projects

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Agenda

• DONG Energy / Inbicon straw-based bioethanol
• From laboratory to demonstration
• Funding history
• Challenges for commercialisation
• Proposals for incentivising commercialisation
• Conclusion and recommendation
DONG Energy / Inbicon Bio-refinery

**The Inbicon process**
- Cellulosic biomass (agricultural residues)

**Inbicon**
- Ethanol
- C5 molasses
- Lignin biofuel

**Demonstration plant in Kalundborg**

- **Input:**
  - 30,000 t wheat straw
  - € 64 mill., incl. € 10 mill. support from DK government

- **Output:**
  - 5.4 mio. l ethanol
  - 13,100 t lignin pellets
  - 11,250 t C5-molasses

- **Investment:**
  - € 9.1 mill. support from EU 7th FP

**2G ethanol on the market**
- October 2010 Statoil introduced 2G E5 on 98 petrol stations in Denmark

In operation since November 2009
Straw Ethanol – Inbicon Demo-Plant Results

Technology
- High ethanol yield
- Continuous operating process
- High dry solids
- Enzymatic liquid fraction
- Integrated contamination control
- Water & energy consumption: 2011

Overall Concept
- Ethanol according to EN standard: Proven
- Lignin pellets in high quality: Proven
- Molasses for biogas: Proven
- Molasses for feed: 2011

Capacity and Availability
- The capacity is tested and proven in key areas
- Availability is calculated and tested by sections

Scope of demo plant
- The demo plant is a complete Inbicon Biomass Refinery, showing all steps in sequence
- The demo plant produces 3 end-products
- The demo plant purpose is to show continuous operation, fully automated and with limited staff (3)
DONG Energy / Inbicon Bio-refinery
Technology ready for commercial deployment

Commercialisation Phase
1st of kind commercial
• 98 million liter bioethanol
• + lignin solid biofuel
• + C5 molasses
• Possible sites identified in Denmark
• Feedstock collection in place
• €320M investment
• Debt, equity + possibly grant funding
• Solid market incentives required
• Potential for many plants across the EU by 2020
Investment and operating cost increase dramatically with scale

Initial technology project: "Co-production biofuels", budget €13.5m, EU FP5 support: €6.5m

Demonstration plant: Investment €64m, DK gov't support €10m
Demonstration support: EU FP7 € 9m

1st. commercial plant: Investment €320m, Operation: Regulatory incentives required

Demonstration plant: Investment €64m, DK gov't support €10m
Commercial scale plants are needed to get down the experience curve

The curve assumes plants being built!

Source: ePURE working group on cellulosic ethanol
Barriers and needs from the perspective of a cellulosic ethanol producer

**Barriers - Risks:**
- Uncertain policy environment: RED implementation, targets, FQD
- Unclear incentives / policy signals to invest big scale in advanced biofuels
- Results in no or unclear premium for cellulosic biofuels to value superior sustainability

**Needs:**
- Specific mandatory target for advanced/cellulosic ethanol
- Production support, fixed premium for first 1 billion liters per plant (wind mill model)
- Other support measures (e.g. grants, loan guarantees) for production plants
- Incentives for creation of value chain also for by-products and collection of residues

Reluctance to invest in cellulosic biofuels
No capacity build up

Source: EBTP Financing Workshop, June 2011
Willingness to pay for sustainable renewable energy – but not within fuels

- Renewable energy usually cannot stand alone without subsidies
- Financial stability is needed to ensure build-up of capacity
- Windpower enjoy support resulting in prices 2X to 3X the price of the fossil alternatives, such as coal-based power
- Biomass power and heat also enjoy incentives resulting in prices considerably above the price of the fossil alternative
- Why are cellulosic biofuels expected to be able to compete with mature, optimised first-generation bioethanol?

**PROPOSAL:**
Support of XX €cent per liter for the first 1 billion liter per individual plant
Conclusion

- R&D funding programmes are very useful for R&D activities
- Deployment and commercialisation need support of another magnitude, i.e. solid regulatory incentives
- New, sustainable technologies are rarely competitive with the fossil technologies they replace, for example windpower, biopower etc.
- Financing of sustainable biofuels projects is a challenge, but not impossible. Financing can deal with technological risk and market risk
- Financing can not deal with an economically unsustainable business case
- There is a need for strong regulatory incentives, that can be put into the investment calculation

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Success story in EU funding of projects

10 X multiplication effect of original EU investment:

- **Initial technology project:** "Co-production biofuels", budget €13.5m, EU contribution (FP5): €6.5m
- **Demonstration plant:** Budget €40m, Danish gov't support €10m
- **Total project expenditure till end of 2009:** +/- €65m

New projects based on the initial project:

- **HYPE**
  - Develop consolidated and more cost-effective bioprocessing, budget €5.4m, EU contribution €3.6m

- **Renescience**
  - Pre-treatment of waste with enzymes for introduction in pressurised gasifiers, budget €7.3 million, contribution from Danish sources approx. €3.8m

- **2nd generation biofuel for cars of the future**
  - Comparison of pretreatment technologies, budget €5.6m, DK gov't contribution approx. €2.8m

- **Biomass for biofuel and bioethanol on pilot scale**
  - Optimisation, budget €1m, contribution from Danish sources approx. €0.8m

- **Kacelle**
  - Demonstration and optimisation of the Kalundborg demonstration plant
  - FP7 contribution: €9 m