1) General comments to the work structure of the project.

From my point of view the general structure of the work is excellent, and I very much like the comprehensive approach. There is only one thing which - according to my current understanding of the project - might be under-represented in the project set-up: there are various feedback loops, in the way that e.g. composition of future electric power systems have an influence on the LCA of individual technologies. I'm wondering whether this is sufficiently addressed.

2) Comments on Scenario Framework

I have two major problems in fully understanding the basic approach:
(1) I have to appologise for my ignorance, but from the documents you sent me I was finally not able to clearly see whether the EnergyPLAN model is an optimisation model (economic optimisation on the energy system level), or a model simulating energy flows (and emissions/costs). Basically I had the impression that the model does not do economic optimisation on the system level, but there were some sentences on economic optimisation on the plant level. I'm not sure on how this goes together, and of course this has implications on the definition of scenarios.

(2) I do not fully understand why you go for the two 'extreme' scenarios (biomass vs. wind). If you go for an economic optimisation, you will get something in between. Do you want to demonstrate that both of the two scenarios are viable? I'm missing a bit the reasoning for this approach.

In my work, I understand a scenario as a development pathway over time. From the documents you sent, I have the impression that you basically focus on a specific configuration of the supply system at a given point in time - is that right? Are the time dynamics in the system which govern a transition process sufficiently addressed?

You have a very strong focus on fuel cells and hydrogen. Although I'm working in an institute which is developing fuel cell technology, I would be more prudent in assumptions on future fuel cell developments. There are very interesting competitors, both for mobile and stationary applications. I'm afraid that the focus on fuel cells in the end might hamper the credibility of your results. The same applies from my point of view to hydrogen as an energy storage system: the electricity-hydrogen-electricity conversion is related to significant losses. There are other innovative storage systems (e.g. adiabatic compressed air storage) which are probably more economic than hydrogen for energy storage. I think it is worthwhile to at least include these technologies in your analysis.

3) Specific comments

- I have some problems to see how much exactly the work in WP1 relies on the scenario work described in the paper 'Energy System Analysis of 100 Per cent Renewable Energy Systems'. The WP1 paper aims at a 100% RES system in 20-30 years from now, while the other paper has the target of 50% RES in 2030 and 100% RES in 2050, so there seem to be similarities, but assumptions seem not to be the same. This might cause some confusion (at least it did at my side).

- In the 'Energy System Analysis of 100 Per cent Renewable Energy Systems', bottom of page 4 it says that the insulation of houses is not feasible if solar thermal is applied. I do not understand this.

- In the 'Energy System Analysis of 100 Per cent Renewable Energy Systems', bottom of page 6 it is suggested that an SOFC is a good technology to provide balancing capacity. I have some strong

doubts on this, as the SOFC because of its high temperature level is sensitive on load transitions. Why not a gas turbine? Fuel cells seem to be considered as the only promising CHP technology.

- The assessment of export potentials ('Energy System Analysis of 100 Per cent Renewable Energy Systems'; page 8) needs to be based on global energy scenarios. I do not see how the export potentials are derived based on scenarios for Denmark.

WP1 paper, page 6, Figure 1: I do not understand the definition of the demand sectors (electricity, heat, industry, transport): industry requires e.g. both electricity and heat input.

WP1 paper, LCA screening: to which extent does the LCA of future technologies take into account technical progress? We just learn from the EU NEEDS project (Kim Winther from Dong Energy is part of NEEDS) that technical development significantly reduces the environmental impact of future technology configurations. Please do not use LCA of current non-competitive systems to evaluate the performance of far-future systems.

I got the impression that you focus on liquid biofuels only. Several studies indicate that gaseous biofuels (Bio-SNG) result in higher yields per hectar, and lead to more efficient CO2 reductions than liquid biofuels.

Mail from Wolfram Krewitt, 10.09.2007