What future should we count on?

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Introduction

- Socio-economic analysis is becoming an increasingly important appraisal tool in relation to large scale infrastructural investments in Denmark

- Are socio-economic analysis supportive of societal transitions?
Socio-economic calculations are simple in theory …

(a) Calculate costs and benefits over the lifetime of the investments

(b) Discount future cost and benefit to present value
Socio-economic calculations are much more complex in practice

- because the value of a component in a societal system dependent on the overall architecture of the system.

- In order to calculate the future value of one system component the future development of the entire system need to be known

- The choice of ‘system future’ is critical
## Case: Socio-economic analysis of wind turbines

<table>
<thead>
<tr>
<th>Virkemiddel</th>
<th>Reduktion, ton CO₂-ækv. 2020</th>
<th>Skyggepris, inkl. sideeffekter</th>
<th>Kr./ton CO₂-ækv.</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 MW kystnær havmøllepark</td>
<td>500.000</td>
<td>489</td>
<td></td>
</tr>
<tr>
<td>200 MW landmøller</td>
<td>450.000</td>
<td>55</td>
<td></td>
</tr>
</tbody>
</table>
The energy system future of the Energy Agency’s

The baseline scenario

- Uses external input from IEAs “new policy scenario”
- Based on ‘frozen policy’ assumption
Electricity prices in the baseline scenario

The electricity price in the baseline scenario

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Figur 2.7. Nordpool spotpris beregnet i BF2014, herunder ved forskellige kvotepriser og følsomheder
A relevant energy system future?

Supply and demand in the baseline scenario

**Electrification of transport**
- 6000 eclectic vehicles in 2030

**Electrification of heating**
- 3 pct district heating produced by heat pumps in 2030

**Gas/Electrofuels**
??
A relevant energy system future?

Global temperature rise in the IEA's "new policy scenario"

“Energy-related CO2 emissions rise from an estimated 31.2 Gt in 2011 to 37.0 Gt in 2035, pointing to a long-term average temperature increase of 3.6 °C. A lower rate of global economic growth in the short term would make only a marginal difference to longer-term energy and climate trends (IEA, Factsheet, 2012) ”.
A relevant energy system future?

The baseline scenario is a catastrophic energy system future

- The Danish low carbon transition stalls after 2020
- The increase in global emissions produce a temperature rise of 3.6 degrees
- Political goals (national, international) are not fulfilled

Yet, the baseline scenario continues to be used as a relevant energy system future in socio-economic calculations
Are there no better energy system futures around?

Transition pathways developed by the Energy Agency
- Biomass
- Windpower
- Hydrogen (windpower)

<table>
<thead>
<tr>
<th>Scenarie</th>
<th>Vind</th>
<th>Biomasse</th>
<th>Bio+</th>
<th>Brint</th>
<th>Fossil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomasse</td>
<td>171</td>
<td>308</td>
<td>393(*)</td>
<td>108(*)</td>
<td>31</td>
</tr>
<tr>
<td>Imp. biobrændstof</td>
<td>0</td>
<td>50(*)</td>
<td>231(*)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Biogas</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>17</td>
</tr>
<tr>
<td>Affald</td>
<td>42</td>
<td>43</td>
<td>43</td>
<td>41</td>
<td>44</td>
</tr>
<tr>
<td>Fossile brændsler</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>391(*)</td>
</tr>
<tr>
<td>Vindkraft</td>
<td>246</td>
<td>113</td>
<td>76</td>
<td>295</td>
<td>113</td>
</tr>
</tbody>
</table>

(*) Estimated
Are there no better energy system futures around?

The energy system concept of the Danish TSO

• Build more wind windturbies
• Increasing demand for electricity (transport, heating, gas/eletrofuels)
• Strategic adaption of grid infrastructure
Are there no better energy system futures around

Price effects of different “wind power integration measures” on wind power generated electricity

<table>
<thead>
<tr>
<th>Tiltag</th>
<th>Ændret indtægt fra elsalg ift. referencing (mio.kr./år)</th>
<th>Ændret indtægt fra elsalg ift. referencing (% af årlig indtægt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>700 MW kabel til Holland (COBRA)</td>
<td>157</td>
<td>3.7%</td>
</tr>
<tr>
<td>Øget fleksibilitet på kraftværker (500 MW el patroner på store kraftværker)</td>
<td>84</td>
<td>2.0%</td>
</tr>
<tr>
<td>500 MW varmepumper i Vest Danmark (eksisterende tariffer og afgifter)</td>
<td>50</td>
<td>1.2%</td>
</tr>
<tr>
<td>500 MW varmepumper i Vest Danmark (uden tariffer og afgifter)</td>
<td>264</td>
<td>6.2%</td>
</tr>
<tr>
<td>Fleksibelt elforbrug ved lave priser (eksisterende tariffer og afgifter)</td>
<td>9</td>
<td>0.2%</td>
</tr>
<tr>
<td>Fleksibelt elforbrug ved lave priser</td>
<td>13</td>
<td>0.3%</td>
</tr>
</tbody>
</table>
Conclusions

We should not base socio-economic calculation on system futures we don’t want to realise!
Conclusions

• Socio-economic analysis of system component (e.g. wind turbines) relies on in-built system futures.

• Periods of transition is often characterised by the co-existence of multiple system futures

• The choice of system future can have significant implications for the outcome of the analysis
Conclusions

• Socio-economic calculation should be based on several energy system futures to open up democratic debate