Evaluation of the Samsø RE-energy project

RE-island conference
10-years status
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Samsø, Denmark

http://www.inforse.org/europe/seminar07_samso.htm

Important award criteria for the master plan for the Danish Energy Agency in 1997

- A realistic and realizable plan
- Use of local resources
- Focus on energy savings in all sectors
- Great local participation
- Use of well-known technology
- New ways of organizing, financing and ownership
- Display window for Danish RE technology
- No extraordinary subsidies

Energy balance for Samsø, TJ/Year
1997 – Starting point 2005

<table>
<thead>
<tr>
<th></th>
<th>1997</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity import</td>
<td>99</td>
<td>-286</td>
</tr>
<tr>
<td>LPG and petroleum</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Oil</td>
<td>133</td>
<td>74</td>
</tr>
<tr>
<td>Diesel</td>
<td>155</td>
<td>163</td>
</tr>
<tr>
<td>Patent</td>
<td>42</td>
<td>49</td>
</tr>
<tr>
<td>Straw</td>
<td>52</td>
<td>79</td>
</tr>
<tr>
<td>Wood</td>
<td>7</td>
<td>41</td>
</tr>
<tr>
<td>Biogas</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Solar heat</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Wind turbines</td>
<td>6</td>
<td>388</td>
</tr>
<tr>
<td>In all</td>
<td>497</td>
<td>513</td>
</tr>
</tbody>
</table>

Evaluation of the Samsø RE-energy project

1. RE-supply and use of local resources

- From 13 to 99.6 % RE-supply in 8 years (1997 to 2005)
- 35 % use of local biomass resources
  - Straw 67 % (Still available: ~ 40 TJ)
  - Biogas 0 % (Still available: ~ 145 TJ)
  - Wood 100 % (Still available: ~ 0 TJ)

Completely successful

2. Supply and utilization of heat

A: District heating

- Master plan: from 25 to 65% coverage (35 → 90 TJ)
  4 new plants
  - Biogas/surplus heat/woodchips-plant
  - Straw/heat pumps-plant
  - Biogas/energy crops/wood chips-plant
  - Wood chips/solar heat plant

- Obtained: 43 % coverage (60 TJ)
  3 new plants - Wood chips/solar heat plant
  - 2 straw plants

Mostly successful
Evaluation of the Samsø RE-energy project

2. Supply and utilization of heat

B: Individual heating

- Heating oil consumption reduced from 133 TJ to 74 TJ
- Half of the year-round houses in the countryside has installed RE systems to meet all or part of the heat demand
- Use of wood pellets has risen from zero to 21 TJ – demand 300 houses
- Few or no ‘exotic’ RE solutions for demonstration – wind turbines for heat production, farmyard biogas plant etc. - have been installed
- Very little change in heat supply of summer cottages

Partly successful

C: Consumption and savings

- Master plan: 25 % reduction (140 TJ → 105 TJ)
- Obtained: 10 % increase (140 TJ → 155 TJ)
  5 campaigns have been held
  500 households have been involved
  Number of inhabitants reduced with 5 %

Not successful

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3. Electricity

A: Consumption and savings

- Master plan: 15 % reduction (83 TJ → 70 TJ excl. heating)
- Obtained: 3-4 % reduction (83 TJ → 80 TJ excl. heating)
  A number of campaigns remains to be held

Successful to a lesser extent

B: Production

- Master plan: On-shore wind turbines 11 (86 TJ)
  Offshore wind turbines 15 (260 TJ)
- Obtained: On shore wind turbines 11 (100 TJ)
  Offshore wind turbines 10 (285 TJ)

Production covers fully electricity consumption plus energy consumption for transportation
Not established yet: household wind turbines and common biogas plants

Completely successful

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4. Transportation

- Master plan: Consumption 200 TJ. Savings 5 - 10 % (10 - 20 TJ)
- Obtained: Consumption 210 TJ. Increase 5 %
  Few projects:
  Electric cars in the public sector was given up because of bad batteries and insufficient services
  Surplus heat from ferries for district heating was technical realistic but organizing, ownership and taxes were complicated
  The pragmatic solution of the master plan: increased wind turbine capacity has proven to be realistic

Not successful
### Evaluation of the Samsø RE-energy project

#### 5. Economy

**Investment, public subsidies and local savings**

<table>
<thead>
<tr>
<th></th>
<th>€</th>
<th>€ per inhabitant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master plan</td>
<td>78.7</td>
<td>17,900</td>
</tr>
<tr>
<td>Public subsidies</td>
<td>9.1</td>
<td>2,070</td>
</tr>
<tr>
<td>Savings</td>
<td>8.8</td>
<td>2,000</td>
</tr>
<tr>
<td>Obtained</td>
<td>53.3</td>
<td>12,900</td>
</tr>
<tr>
<td>Public subsidies</td>
<td>4.0</td>
<td>1,100</td>
</tr>
<tr>
<td>Savings</td>
<td>6.0</td>
<td>1,450</td>
</tr>
</tbody>
</table>

Very successful

#### 6. Employment

- No exact data available
- Great effect in the phase of construction (especially DH plants)
- Lesser effect in phase of operation
- More use of biomass would create more permanent jobs

Successful

#### 7. Communication and RE tourism

- Local media have been effectively used in mobilizing the population
- The Samsø RE project is known all over the World
- Great numbers of RE tourists visit the Island every year

Very successful

#### 8. Local involvement and participation

- Effective involvement of the population → widespread feeling of ownership for the project
- Pronounced willingness for individual investments in RE technology
- The Municipality of Samsø has invested in half of the offshore wind turbines
- Local firms have participated actively e.g. in educating their employees

Very successful

#### 9. Environment

<table>
<thead>
<tr>
<th>Kg per inhabitant</th>
<th>1997</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2-emission</td>
<td>10600</td>
<td>-4000</td>
</tr>
<tr>
<td>NOx-emission</td>
<td>75</td>
<td>2</td>
</tr>
<tr>
<td>SO2-emission</td>
<td>20</td>
<td>-1</td>
</tr>
<tr>
<td>Particles</td>
<td>7</td>
<td>2</td>
</tr>
</tbody>
</table>

- National reduction of production of ashes approx. 4,500 t per year
- Remains: positive environmental effects of biogas production

Very successful

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[www.energiakademiet.dk](http://www.energiakademiet.dk)
[http://www.inforse.org/europe/seminar07_samso.htm](http://www.inforse.org/europe/seminar07_samso.htm)
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10. Summary

- 100% self-sufficiency is obtained using local resources within 8 (!) years
- Most of the intermediate aims have been achieved more or less in full
- Savings in consumption of both heat and electricity have failed almost completely
- Transforming transportation towards sustainable fuels have not succeeded
- Demonstration of some ‘exotic’ RE technologies still remains

11. Conclusion

A: Samsø results transferred to DK

- Average energy consumption is 25% greater for DK as for Samsø per inhabitant
- Population density in DK is 4 times the density on Samsø
- A similar project for DK is correspondingly greater and a correspondingly greater effort should be used to ensure energy savings (as saved energy is of greater value than produced)

B: Samsø results transferred to DK

- Total investment €90,163
- Saving per year €8,150
- Simple pay off time 11 years (excl. financing and interests)

Corn as energy crop

Grass for ensiling

Silage for biogas production

www.energiakademiet.dk
http://www.inforse.org/europe/seminar07_samso.htm
Common biogas plant

Thank You for Your attention – Peter J. Jørgensen, Plan Energy