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## **Offshore Wind Energy in Denmark**

*Scale Economies and Institutional Choice*

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## **SDWS2011.0095 Offshore Wind Energy in Denmark: Scale**

### **Economies and Institutional Choice**

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#### **Abstract**

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Offshore wind energy has developed in terms of turbine and project size, and currently undergoes a significant up-scaling to turbines and parks at greater distance to shore and deeper waters. Expectations to the positive effect of economies of scale on power production costs, however, have not materialized as yet. On the contrary, anticipated electricity generation costs have been on the increase for each increment of technology scale. Moreover, the cost reductions anticipated for progressing along a technological learning curve have not been apparent, and it seems that not all the additional costs can be explained by deeper water, higher distance to shore, bottlenecks in supply or higher raw material costs. This paper will attempt to explain the paradox of increasing costs of offshore wind energy despite larger scales and technological development by looking at other factors: The limited availability of locations, driven by accelerating requirements of environmental concern, park size and public acceptance, is one important driver. Mounting risk of mega-projects and the infinite demand for renewable energy is another likely cause.

The present paper addresses the scale of offshore wind parks for Denmark and invites to reconsider the technological and institutional choices made. Based on a continuous resource-economic model operating in a geographical information systems (GIS) environment, which describes resources, costs and area constraints in a spatially explicit way, the relation between project size, location, ownership and costs is analysed. A scenario is proposed, which aims at locally owned smaller parks that may have several economic advantages but require a greater deal of tolerance and acceptance because of higher visual impact. Higher specific costs in some areas are outweighed by lower costs in other, by reduced expectations to profit and by the distribution of risk.