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Background

Harvesting wind energy has become increasingly feasible due to decreasing costs. However, onshore wind energy can in many parts of the world only be increased to a certain point due to limited social acceptance.

This was addressed in a recent study carried out for the entire Finnish marine areas, where suitable marine areas were identified for the construction of large-scale wind power, and when economic, ecological and societal considerations are to be balanced. Analyses were implemented using a spatial prioritization approach that is able to maintain the high dimensionality of relevant societal factors and biodiversity potentially impacted by wind power development.

Biodiversity features included underwater biodiversity – data which relies on the Finnish Inventory Programme for the Underwater Marine Environment (VELMU) – and represent around 200 species, as well as various underwater habitat types along the Finnish coast. Moreover, biodiversity above the sea surface was also included, and for instance consisted of features such as bird migration routes, nesting sites of white-tailed eagle, and moulting islets of seals. Societal factors accounted for major livelihoods, such as commercial and leisure fishing activities, as well as nuisance to people, such as visual and noise detriments.

In addition, a major sub-model was created, which was used for the estimation of wind power life cycle costs. Cost formulae for five life cycle phases were derived, and levelized cost of energy, and its breakdown, were calculated using spatial data, such as wind climate, water depth, seafloor type, and distance-based factors that affect the installation, commissioning, operation, maintenance, and decommissioning costs. Sensitivity of model outputs was studied by using random variables with Monte Carlo simulation and sensitivity analysis. Number of turbines, cost of capital and turbine power rating determined the base level of life cycle costs, although spatial variables affected the costs crucially.

As an outcome, earlier and planned proposals were evaluated for offshore wind farms, and new areas suitable for large scale wind power deployment were recognized, where construction costs would be moderate, and disturbance to biodiversity and people limited. Overall, this approach provides a generic template for analysis of offshore wind energy development potential. The approach is also structurally suitable for planning of impact avoidance and conflict resolution in contexts where resource use competes with ecological and societal factors.

Action requested

The Meeting is invited to take note of the presentation.