

Marine oasis in Finland: scenarios for combining wind energy and fish farming in the Gulf of Bothnia

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Multi-use of marine space

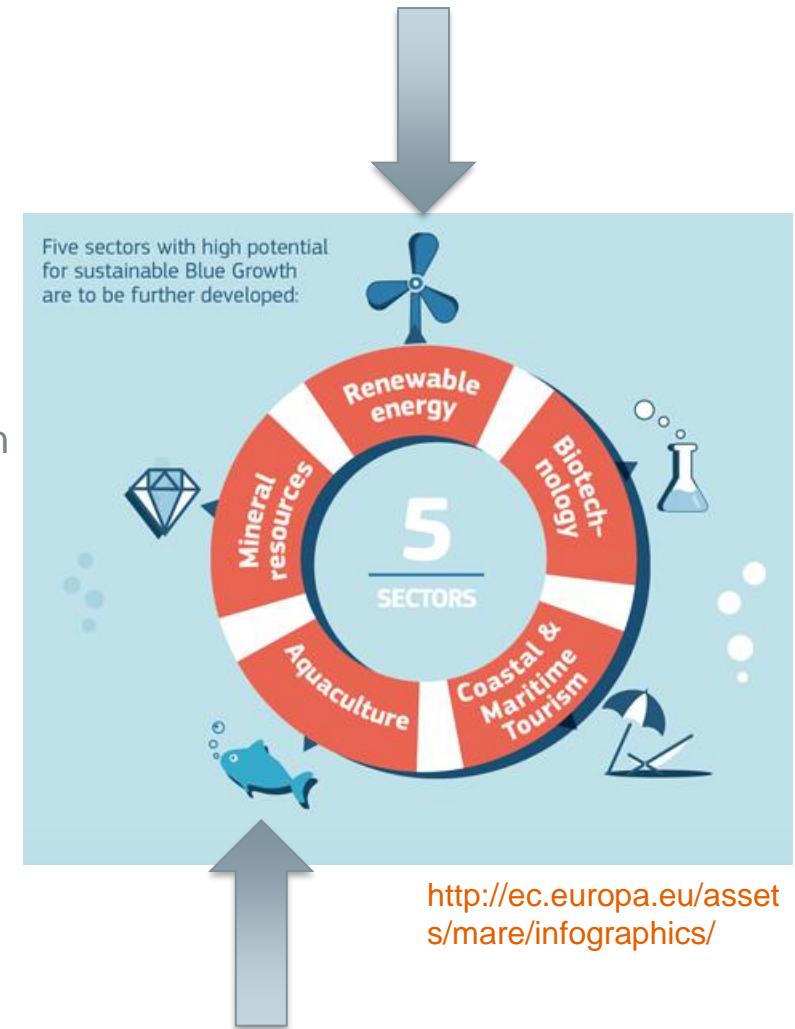
Multi-use = Co-location of sustainable marine businesses

Why multi-use? What are the targets?

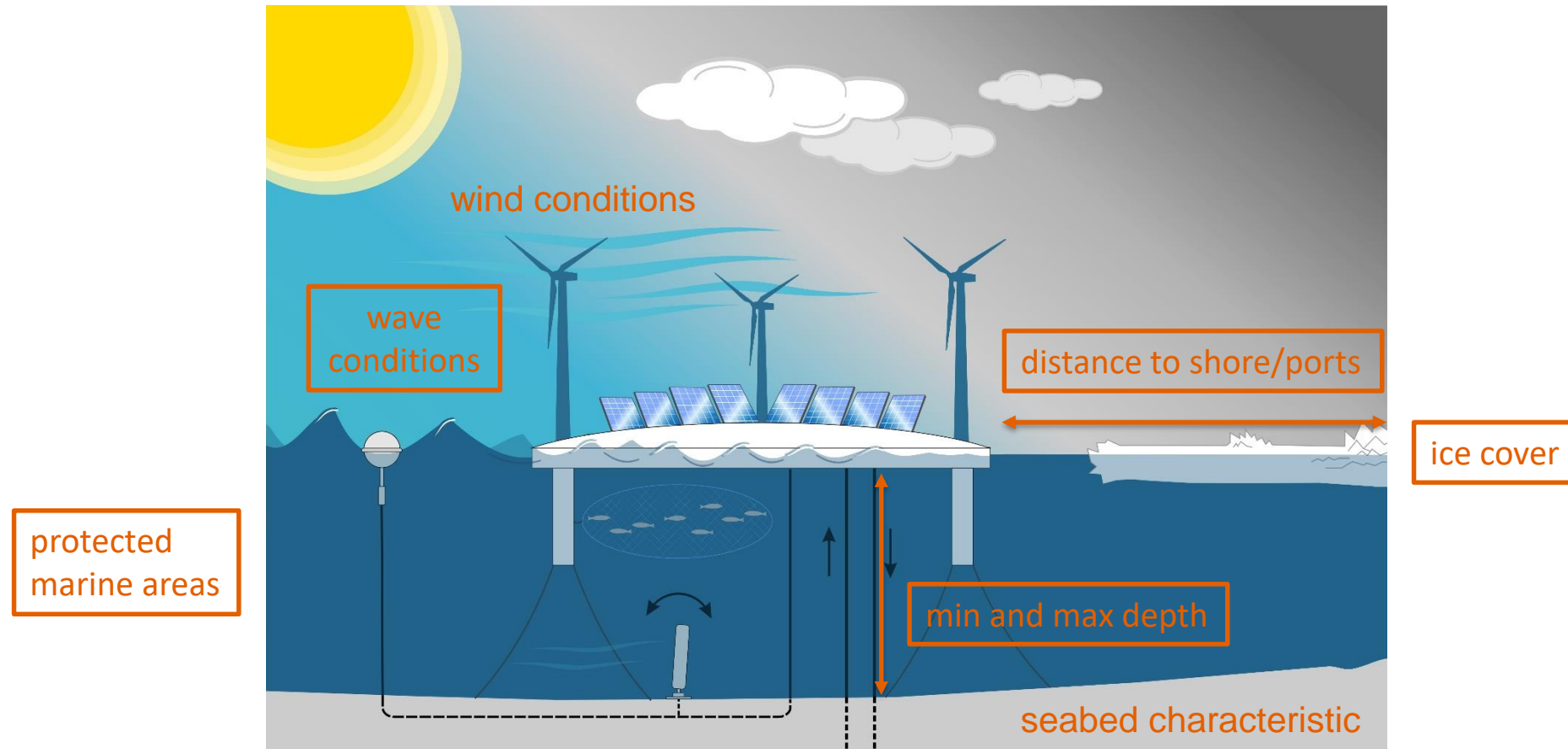
- EU target: 35% of energy consumption from renewables by 2030
- All EU members required to have marine spatial plans in 2021 – focus on sustainable development
- Divide and reduce costs of offshore operations
- Reduce the demand on space needed for different activities

What we did: a case study on co-location of offshore wind power and fish farming in the Gulf of Bothnia

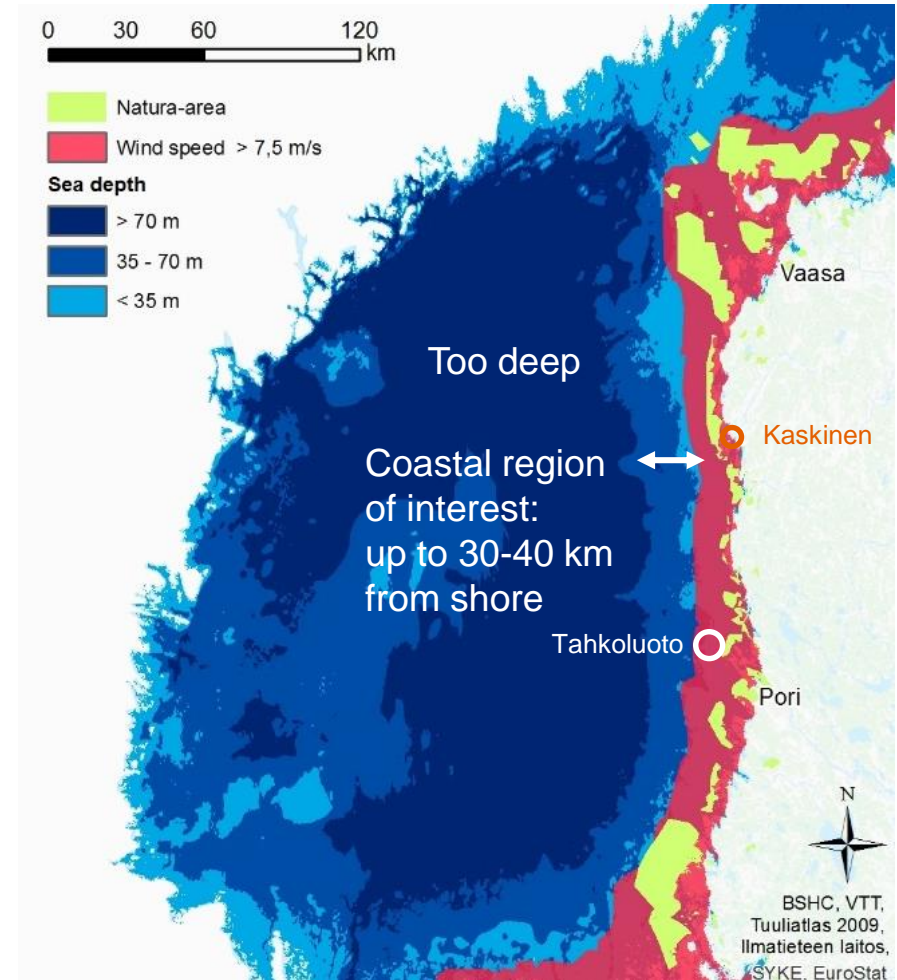
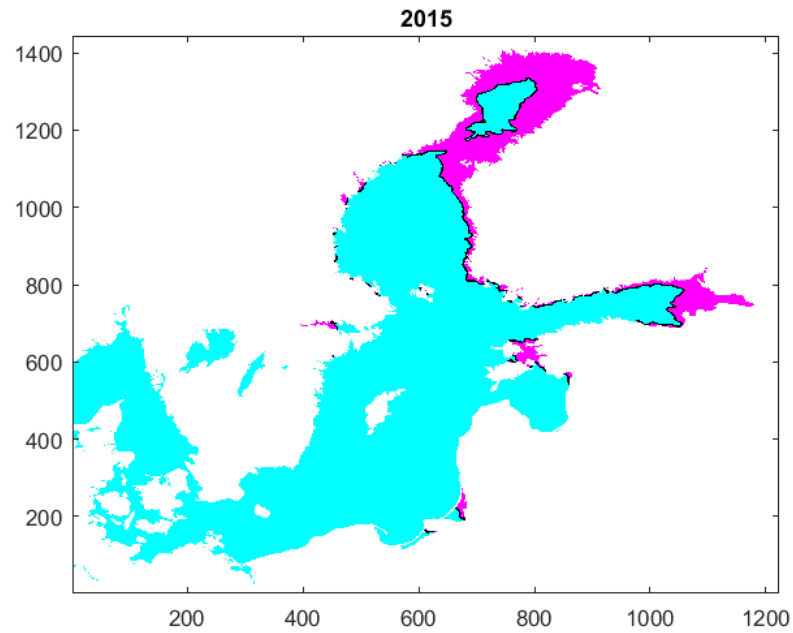
1. Are there suitable locations?
2. What kind of production scenarios could we envision?



Concept and requirements for co-location



MSP tool: location search results

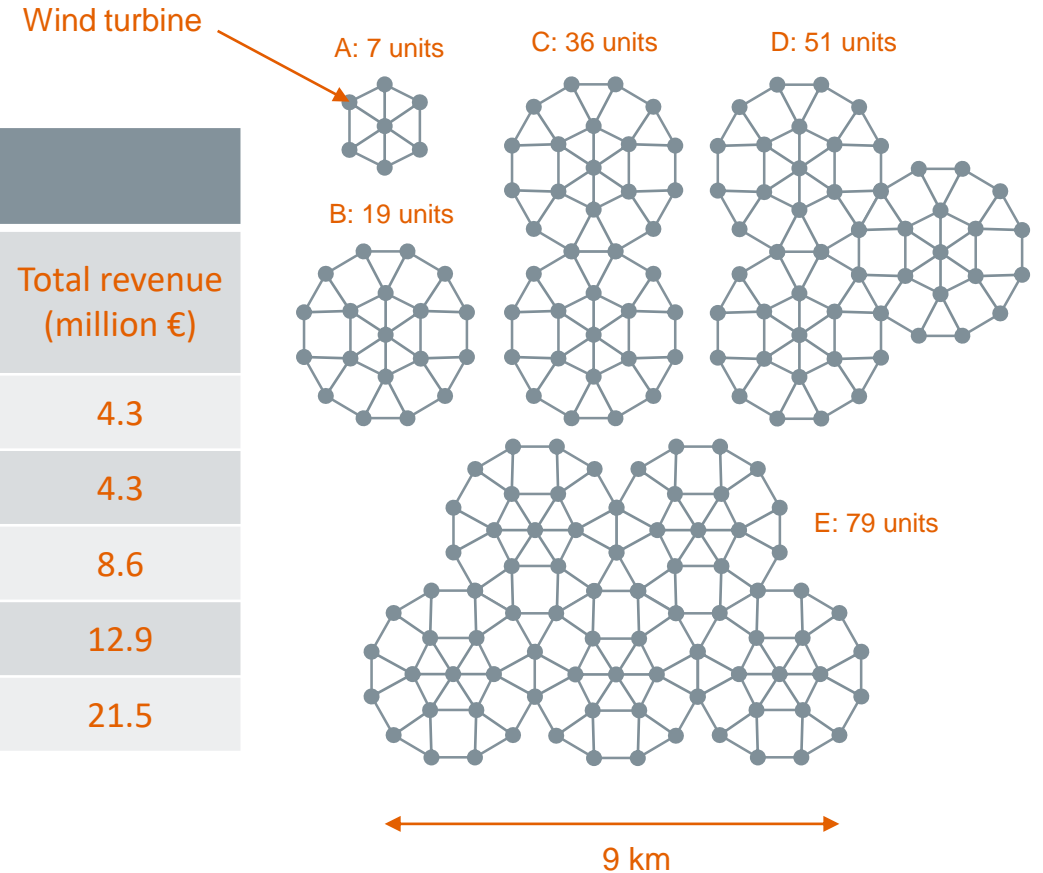


Production scenarios

Scenario	Wind power LCOE = 65 €/MWh		Fish farming			
	Nominal capacity (MW)	Investment costs (million €)	Production capacity (ton)	Investment cost (million €)	Profit (€/kg)	Total revenue (million €)
A	49	123	1075	3	0.44	4.3
B	133	333	1075	3	0.44	4.3
C	252	630	2150	5	0.56	8.6
D	357	893	3225	7.3	0.59	12.9
E	553	1 383	5375	12	0.61	21.5

* 7 MW turbines,
40% production capacity

* Maximum production in an area limited



Multi-use: observed challenges

High investment risk due to new type of business model

- Extreme conditions: ice and water depth
 - Submersible cages need deeper water that does not fully freeze
 - Land-fast ice more favourable for fixed structures such as the wind turbine foundations
- Lack of regulatory framework
 - Development of local marine spatial plans
 - Opposition of wind energy and fish farming – benefits from co-location and marine spatial planning?

Summary

Case: co-location of offshore wind power and fish farming in a freezing sea area

Conclusions

1. Possible location – Kaskinen (between Pori and Vaasa)
 2. Economic viability
 - Investment costs arise primarily from wind power
 - Structural solutions for ice loads and submersible fish cages increase costs but are still considered realistic
 3. Challenges
 - Risks: large scale of the investment combined with opposition of wind energy and fish farming
 - Permission processes do not exist for co-location of offshore activities
- **Promotion of multi-use for local marine spatial planning**

Future work: how to move from early concept visions to piloting



Thank you for your attention!

Questions?