Optimization of Wind Farms | Vattenfall GmbH mbH

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A wind turbine

- Electricity from renewables in Germany now is $\sim$ 30%
- Plan for 2025: 40 - 45 %
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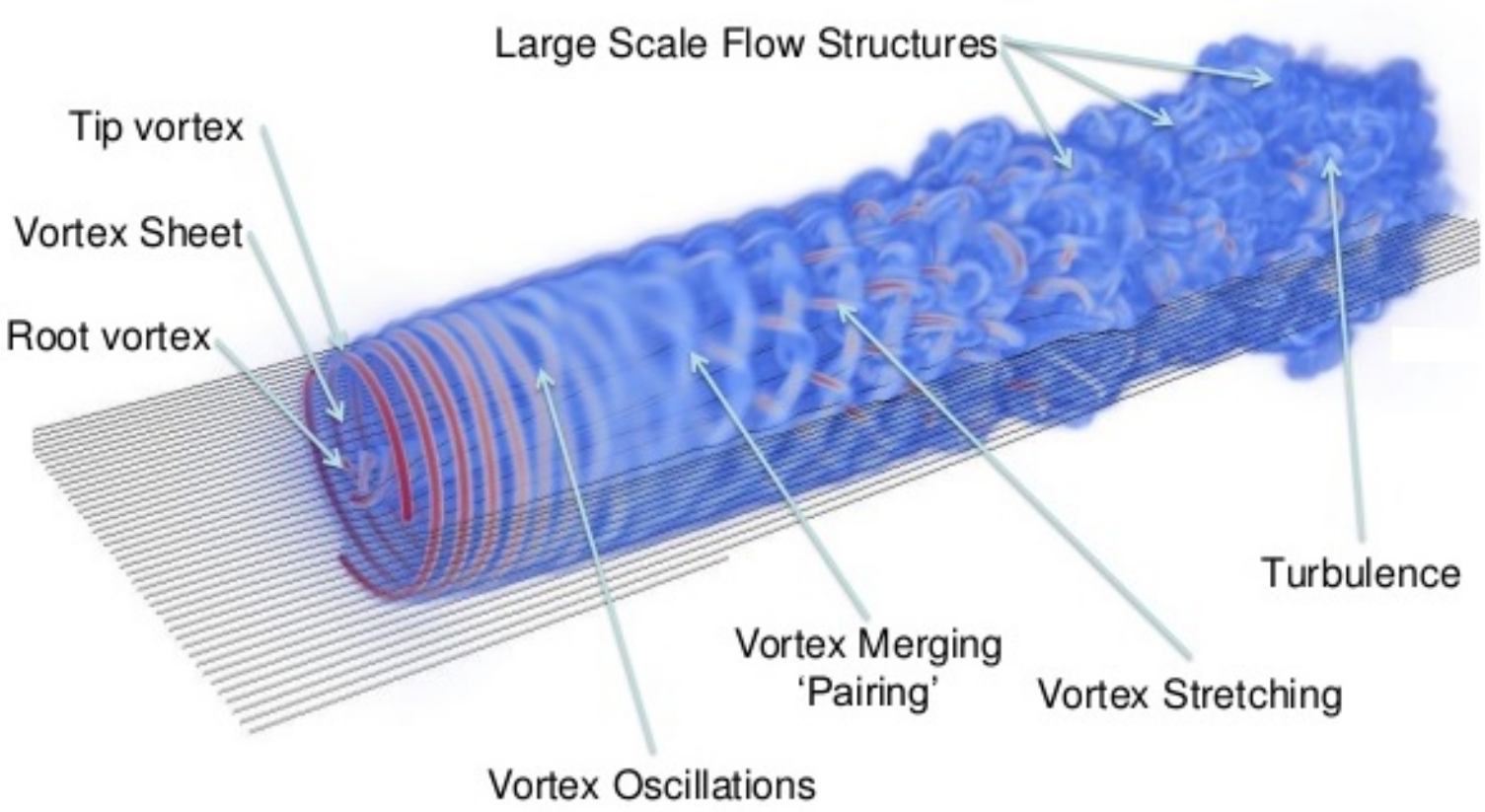
Goal: minimize energy losses and costs regarding wind farms

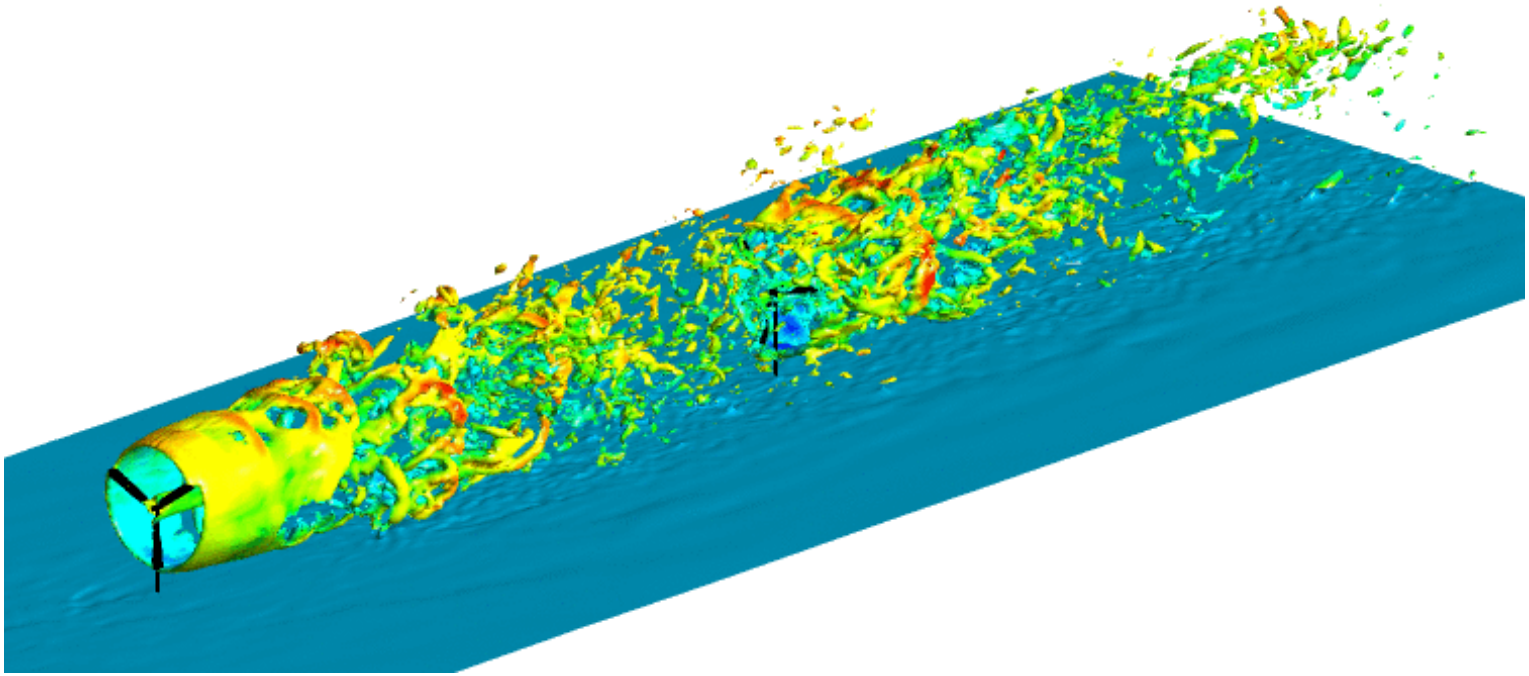
Aerodynamics of a wind turbine

Wake - air flow behind the turbine



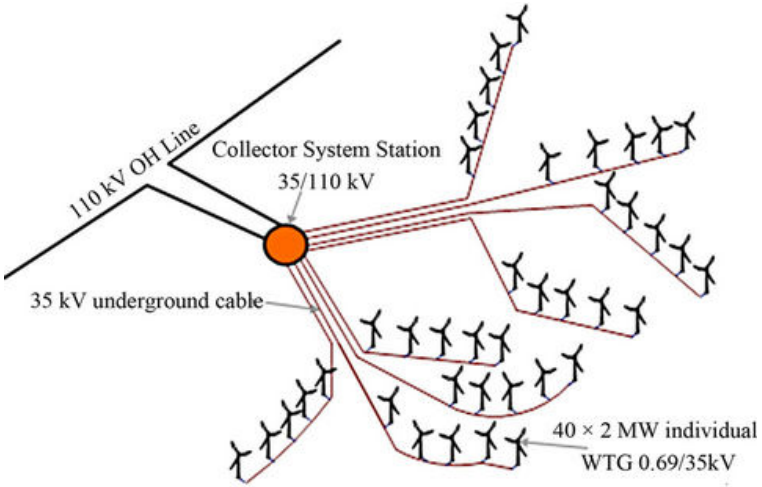
- near wake (1 - 5D)
- intermediate wake (5 - 15D)
- far wake ($>$ 15D)
- offshore wake can reach even 14km

Effect of wake - shading



- wake → less wind speed → less energy production
- wake → turbulence → resonance of individual parts → shorter lifetime

Optimization of Wind Farms



- Area of the farm is preset
- Distance between turbines > 5 diameters
- The turbines have to be connected to one central point
- Rotation in the direction of wind

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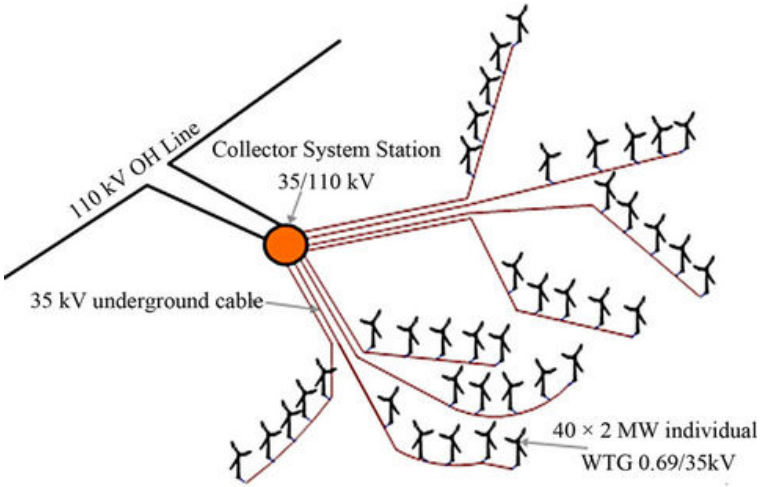

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On a specific area find a layout of the farm so that the energy production is maximized and the wake effect and the cost of cable per meter is minimized.