The Future of Wind Power in Finland

Advanced Energy Project
Laura Markkanen
Shivani Mehta
Alonso Conejos Lopez
Monika Krasteva
Henrietta Hirvonen

13.12.2022
What will wind power look like in the future?

Where should we expect higher wind power production?

Is the grid ready for this increase in renewable energy?

How much and how reliable would this power be?
Project workflow

- Determining areas & spreading 30GW of power within each scenario
- Simulating production over 10 years of past wind data
- Analyzing production data
Choosing the locations

- Focus on specific geographical location
- Sufficient grid availability
- Electricity demand
- Wind speed and power generation potential
- Land use
Scenario 1: Western Finland

**PRO:** Dense grid availability

**CON:** Possible overload of the grid

Scenario 2: Western & Eastern Finland

**PRO:** Renewable energy to the east

**CON:** Currently impossible to implement

Scenario 3: Whole Finland

**PRO:** Evens out grid load

**CON:** Currently insufficient grid network in the east and north

Scenario 4: On and offshore wind power

**PRO:** Highly comprehensive model

**CON:** Insufficient transportation network
Modeling process

- Location profile
- Installed capacities
- Hub height
- Standard power curve

CorRES software:
- 10-year range
- ERA5 wind and atmospheric data

- Daily patterns
- Seasonal patterns
- Hourly averages
Total 10-year production

- Scenario 1: Western Finland - 845 TWh
- Scenario 2: Western & Eastern Finland - 842 TWh
- Scenario 3: Whole Finland - 810 TWh
- Scenario 4: On and offshore wind power - 975 TWh
Lowest producing 10-day period

- Scenario 1: Western Finland
- Scenario 2: Western & Eastern Finland
- Scenario 3: Whole Finland
- Scenario 4: On and offshore wind power

Production [GWh]:
- Scenario 1: 221 GWh
- Scenario 2: 345 GWh
- Scenario 3: 285 GWh
- Scenario 4: 358 GWh
Number of low production days

- Scenario 1: Western Finland - 334 days under 5% production
- Scenario 2: Western & Eastern Finland - 214 days under 5% production
- Scenario 3: Whole Finland - 215 days under 5% production
- Scenario 4: On and offshore wind power - 157 days under 5% production
Yearly trends

Hourly production [GWh]

January   February   March   April   May   June   July   August   September   October   November   December
scenario 1  scenario 2  scenario 3  scenario 4
Seasonal trends

Winter months daily profile

- Scenario 1
- Scenario 2
- Scenario 3
- Scenario 4

Summer months daily profile

- Scenario 1
- Scenario 2
- Scenario 3
- Scenario 4
What will wind power look like in the future?

- Best potential in offshore wind power & west of Finland
- Higher reliability with a wider spread of points
- Prioritize grid investments and back-up power sources