PPAs to support renewables - Key Trends and Themes in the Nordic markets

Montel Nordic Energy Day 2023
Dominique Hischier, Head of Analysis
More than half of the European onshore wind capacity under PPAs is in the Nordics

Top 5 PPA markets by technology (GW contracted)\(^1\)

<table>
<thead>
<tr>
<th>Technology</th>
<th>SE</th>
<th>ES</th>
<th>FI</th>
<th>NO</th>
<th>NL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind onshore</td>
<td>4.3</td>
<td>3.6</td>
<td>2.5</td>
<td>2.4</td>
<td>1.6</td>
</tr>
<tr>
<td>Solar PV</td>
<td>12.7</td>
<td>2.4</td>
<td>1.6</td>
<td>1.6</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Evolution of capacity under PPA by market (GW)

- Rest of Europe
- Nordics

Source: PexaQuote, PPA Tracker based on publicly announced long-term PPA deals (July 2023) excluding Hydro PPAs. Notes: 1 For PPAs with unreported capacity under PPA, a volume to capacity conversion is performed based on industry standard capacity factor per market and technology.

More than half of onshore wind capacity under PPAs is in the Nordics
Pexapark at a glance

- 25+ GW PPAs supported
- 8500+ Software users
- 19 Markets covered
- 100+ Employees
- Offices: Zurich, London, Copenhagen, Lviv, Madrid

SELECTED CUSTOMERS

PARTNERS

- BloombergNEF
- Fluence
- eex
- RE-Source
- S&P Global

Software users
Markets covered
Employees
Offices
Overview

1. Nordic PPA markets in 2022
2. Key market trends and themes
3. Outlook and Q&A
PPA Deals in the Nordics from 2020 to 2023

Nordic LT PPA deal capacity by country (GW)¹

- 2022 activity by market:
  - Stark drop in **Swedish onshore PPA deal activity** on the back of dropping capture rates and a slow-down in investment
  - **Norwegian market** affected by regulatory uncertainty, with little new renewable capacity currently under construction
  - **Denmark and Finland** relatively steady activity

- Utility PPA market activity has decreased substantially as a result of the energy crisis and market volatility
- Market normalising on the back of lower volatility and price levels

Source: PexaQuote, PPA Tracker based on publicly announced long-term PPA deals (July 2023) excluding Hydro PPAs. Notes: 1 For PPAs with unreported capacity under PPA, a volume to capacity conversion is performed based on industry standard capacity factor per market and technology.
Capture risks increasing – Example of Finnish onshore capture factors

- Period of **low capture factors** and high volatility in capture factors
- Price capture for wind onshore decreasing as more gets built (Cannibalization)
- Lower capture rates mean higher price spread between hours with and without the wind production
- Capture Factors eventually translate into PPA pricing
Risk associated with baseload PPAs have increased last year as a result of volatility and decreasing capture factors

- Increasing *cannibalization* in the Nordics combined with a lack of flexibility and the *price lift* during the energy crisis stressed the economics of many wind projects operating under Baseload hedges
- Projects had to buy volumes during times of high market prices while producing more than the requirement during times of low prices.
- Underperforming assets seeking to terminate or *renegotiate agreements* (e.g. reducing the hedge ratio); or *buying back volumes*
- Similar challenges in other price zones

20MW Baseload hedge for 50MW onshore wind asset, Finland, November 2022
Bankability has shifted from baseload to pay-as-produced PPAs, and allocation of profile risk a key challenge.
Overview

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Emerging themes across the PPA markets in the Nordics

1. New buyers entering the market with different profile risk appetite
2. Hybrid PPAs / storage to mitigate capture risk
3. Need for PPA Price & risk transparency
Emerging themes across the PPA markets in the Nordics

New buyers entering the market with different profile risk appetite

<table>
<thead>
<tr>
<th>#</th>
<th>Project</th>
<th>Electrolyser Capacity</th>
<th>Country</th>
<th>Status</th>
<th>Planned COD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>H2 Green Steel</td>
<td>800 MW</td>
<td>Sweden</td>
<td>Financing secured</td>
<td>2025</td>
</tr>
<tr>
<td>2</td>
<td>FlagshipONE</td>
<td>70 MW</td>
<td>Sweden</td>
<td>Financing secured</td>
<td>2025</td>
</tr>
<tr>
<td>3</td>
<td>Glomfjord</td>
<td>20 MW</td>
<td>Norway</td>
<td>Financing secured</td>
<td>2025</td>
</tr>
<tr>
<td>4</td>
<td>Højøvalla</td>
<td>20 MW</td>
<td>Finland</td>
<td>Financing secured</td>
<td>2024</td>
</tr>
<tr>
<td>5</td>
<td>HySynergy Phase I</td>
<td>20 MW</td>
<td>Denmark</td>
<td>Financing secured</td>
<td>2023</td>
</tr>
<tr>
<td>6</td>
<td>HySynergy Phase II</td>
<td>300 MW</td>
<td>Denmark</td>
<td>Announced</td>
<td>2025</td>
</tr>
<tr>
<td>7</td>
<td>Esbjerg</td>
<td>1 GW</td>
<td>Denmark</td>
<td>Announced</td>
<td>2026</td>
</tr>
<tr>
<td>8</td>
<td>Holmneset</td>
<td>300 MW</td>
<td>Norway</td>
<td>Announced</td>
<td>2027</td>
</tr>
<tr>
<td>9</td>
<td>Host PX Esbjerg</td>
<td>1 GW</td>
<td>Denmark</td>
<td>Announced</td>
<td>2029</td>
</tr>
<tr>
<td>10</td>
<td>Megaton</td>
<td>2 GW</td>
<td>Denmark</td>
<td>Announced</td>
<td>2030</td>
</tr>
</tbody>
</table>

Financing secured: ~900 MW
Announced: 4.6 GW
Many new corporate entrants, and higher Nordic PPA activity for smaller deal volumes

- Energy crisis as an accelerator for corporate PPAs: Strong motivation to enter into PPAs as a long-term price hedge, hand in hand with the desire to procure green electricity
- First movers IT, metals & mining industries
- Many new mid-sized corporate entrants, multi-buyer deals

PPA size (MW)

Source: PexaQuote, PPA Tracker (July 2023) excluding Hydro PPAs.
Emerging themes across the PPA markets in the Nordics

1. New buyers entering the market with different profile risk appetite

2. Hybrid PPAs / storage to mitigate capture risk
Co-located energy storage can have meaningful impacts to the project’s capture rates

Our analysis has shown that the addition of an energy storage asset (100% of AC nameplate with 2 hours of duration) can have meaningful impacts to the performance of a wind asset operating in the Nordics:

- Increase in capture factor in November 2022 from 0.53 to 0.77 (2-hour battery), and even to 0.98 (4-hour battery)

For complete investment case, revenue stack needs to be considered (wholesale arbitrage, ancillary services, imbalance reductions)

Finnish onshore wind capture rates vs. hybrid capture rates (2018-2022)
Emerging themes across the PPA markets in the Nordics

1. New buyers entering the market with different profile risk appetite
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3. Need for PPA Price & risk transparency
Two key ingredients to unlock the next chapter of growth in the Nordic PPA markets

A. Create understanding around underlying value and risk components of PPA pricing

- Pexapark’s signature waterfall chart for PPA pricing
- Prices observable through exchanges
- Non-observable / modelled PaP PPA Risks
- Expected Baseload value
- Profile Costs
- Price Risk
- Volume Risk
- Cannibalization risk
- PPA Price

B. Understand how the market values pay-as-produced PPA risks

- Anonymous PPA price quotes
- Anonymous market feedback

Transparency creates market opportunities
- Lowering transaction costs & more efficient negotiation
- Benchmarking of positions allows easier risk management & ability to hold more risks
- Increasing confidence
- Unlocking number of transactions
Pexapark’s PPA Price Poll allows to track market shifts

PPA price transparency deteriorated as a result of 2022 energy crisis, with the range of price quotations strongly diverging for a given product.

- Decreasing scattering of PPA market quotes since last September, indicating improving pricing consensus.
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Your Presenter today

Dominique Hischier
Head of Analysis

- Joined Pexapark in March 2022 to build the company’s Analysis & Research department
- >7 years of experience in advancing the global energy transition in a variety of roles, including management consulting, international organisations, power trading and academia
- Holds a Master’s Degree in Energy Science & Technology from ETH Zurich
Get in touch!

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