

# Norway Wind Energy Case Study: Policy Impact on LCOE and Recommendations

Sandeep Sahu  
Centre for Atmospheric and Oceanic Sciences (IISc Bengaluru)  
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## Introduction:

Norway has established itself as a leader in renewable energy, with significant investments in wind power. However, policy decisions have directly impacted the **Levelized Cost of Electricity (LCOE)** for both onshore and offshore wind projects. This case study evaluates how Norway's policies influence wind energy costs and provides recommendations to enhance competitiveness.

## Current State of Wind Energy in Norway:

- Norway's total wind power capacity reached **5,130 MW** in 2023, with **101 MW** offshore.
- Wind power generation contributes **13.9 TWh annually**, accounting for **10.3%** of Norway's electricity mix.
- The government has announced **35 billion NOK (\$3.3B) in subsidies** for offshore wind development.
- A **25% resource rent tax** on onshore wind was introduced in 2024.
- Norway is part of the **EU Emissions Trading System (ETS)**, increasing carbon pricing on fossil fuels.

## LCOE Analysis: Before and After Norway-Specific Policy Adjustments (refer to fig(a) & fig(b)):

### Wind Onshore

- Before policy adjustments, the average LCOE for onshore wind was **\$60–70/MWh**.
- After applying the **25% resource rent tax**, LCOE increased to **\$120–180/MWh**.
- The tax significantly impacts cost competitiveness, making Norway's onshore wind less attractive for investors.

### Wind Offshore

- Before policy adjustments, the average LCOE for offshore wind was **\$130–140/MWh**.
- After applying **subsidies and adjusted financing**, LCOE was expected to decrease but instead rose to **\$250–350/MWh** due to high operational costs.
- Some offshore projects have LCOE values exceeding **\$600/MWh**, highlighting project-specific risks.

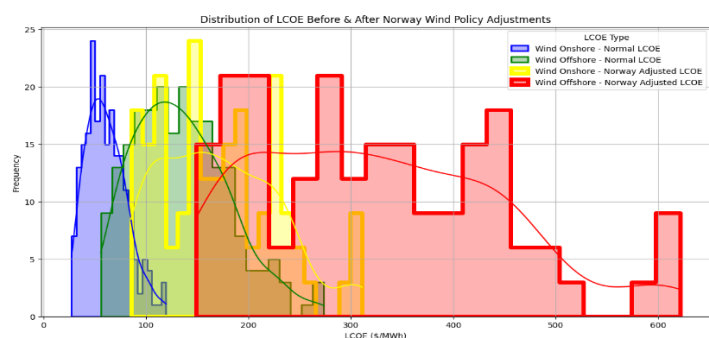
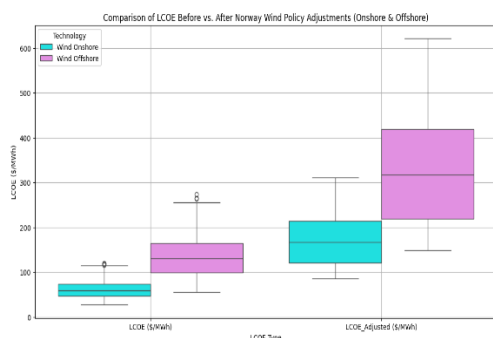


fig.(a) Comparison of LCOE before & after adjustment      fig.(b) Distribution of LCOE before (Normal) & after adjustment

## Key Policy Issues Impacting LCOE:

### High Taxation on Onshore Wind

- The **25% resource rent tax** has led to a sharp increase in LCOE.
- While designed to generate government revenue, the tax discourages new onshore wind investments.

### Subsidies for Offshore Wind Are Not Effectively Reducing Costs

- The **35B NOK subsidy** mainly targets **CAPEX**, but **O&M costs remain high**.
- Floating offshore wind, necessary for Norway's deep waters, has **higher maintenance expenses** than fixed-bottom turbines.

### Grid Infrastructure Limitations

- Offshore wind expansion faces **grid bottlenecks**, increasing transmission costs.
- Norway exports much of its renewable power, but transmission infrastructure is **not optimized for large-scale offshore wind projects**.

### Indigenous Land Conflicts Affect Onshore Wind Expansion

- Several wind projects have faced legal challenges from **Sami reindeer herding communities**.
- Delays and lawsuits add to project costs, further raising LCOE.

### Floating Wind Technology is Still in Early Development

- High costs and limited large-scale deployment keep LCOE elevated for floating offshore wind.
- Without innovation, floating wind may remain **uncompetitive against fixed-bottom offshore wind and onshore wind**.

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## Policy Recommendations to Reduce LCOE and Improve Wind Energy Competitiveness:

### Reform the 25% Resource Rent Tax on Onshore Wind

- Reduce or eliminate the tax to restore LCOE to **\$60–80/MWh**.
- Introduce a **phased tax system**, applying only after **10 years of operation**.
- Offer **tax credits** for developers investing in grid improvements or community development.

### Shift Offshore Wind Subsidies Toward O&M Cost Reductions

- Provide **direct support for offshore wind maintenance**, such as AI-driven monitoring and automated servicing.
- Establish **low-interest financing** for O&M upgrades, rather than only subsidizing installation.
- Encourage **local manufacturing** of offshore wind components to reduce long-term costs.

### Expand Grid Infrastructure for Offshore Wind Integration

- Develop **offshore energy hubs** that can connect multiple wind farms to the grid efficiently.
- Invest in **high-voltage direct current (HVDC) transmission lines** to reduce transmission losses.
- Provide **grid investment incentives** for wind developers.

### Establish a Fair Land Use Policy for Onshore Wind

- Implement **mandatory consultation** with Sami communities **before** project approvals.
- Develop **profit-sharing agreements** where indigenous groups receive a portion of wind farm revenues.
- Create **land restoration programs** to reduce the environmental impact of wind farms.

### Increase Investment in Floating Wind R&D

- Support large-scale **demonstration projects** to lower floating wind technology costs.
- Encourage **public-private partnerships** for technology innovation in mooring, materials, and maintenance.
- Expand **export opportunities for Norwegian floating wind expertise** to make it a global leader in the sector.

### Establish a Long-Term Wind Energy Roadmap

- Define **clear targets for wind energy expansion by 2030, 2040, and 2050**.
- Ensure **stable subsidies and tax policies** to attract long-term investors.
- Develop a **leasing framework** for offshore wind projects to streamline approvals.

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## Conclusion:

Norway has the potential to become a global leader in **both onshore and offshore wind energy**, but current policies are **increasing LCOE instead of reducing it**.

- **Onshore wind is losing competitiveness due to taxation**. A tax reform could restore its **cost advantage**.
- **Offshore wind remains expensive despite subsidies**. Policy changes should focus on **lowering O&M costs, not just CAPEX**.
- **Grid expansion and land policies need urgent reforms** to prevent project delays and cost increases.
- **Long-term investment in floating wind R&D** will determine whether Norway **becomes a leader or remains a high-cost player**.

By **adjusting policies and focusing on cost reductions**, Norway can build a **sustainable, competitive, and scalable wind energy sector** that benefits both investors and the public.