



The Market for Small Wind Turbines in Europe: Opportunities and Threats

Proposal for a Financial Subsidy Program for Small Wind
Turbine Manufacturers as Support for Sustainable
Development in Switzerland

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1. Introduction

In the context of the global climate crisis and increasing social and economic pressures for sustainable actions, the development of renewable energy sources is becoming not only an environmental protection issue but also an economic and social imperative. Europe faces the challenge of transforming its energy sector towards more sustainable and renewable energy sources. Wind energy, as one of the most promising and technologically advanced sources of renewable energy, offers significant opportunities for industry and the economy.

Although many European countries have already taken significant steps in developing renewable energy, including wind energy, this sector still faces numerous challenges. This document aims to present a proposal for the creation of a financial subsidy program that will enable small wind turbine manufacturers in Switzerland to increase their production and innovation potential, thereby contributing to the growth of green energy in the energy mix. The program aims to provide direct support to business and stimulate broader economic and environmental benefits, contributing to the achievement of climate goals and international commitments.

By outlining the situation, the global and European context, and identifying key challenges and needs, this document lays the foundation for a detailed discussion of the benefits and implementation strategies of the proposed subsidy program.

2. Wind Energy—the context and current situation

2.1. Current situation in Switzerland

Switzerland's wind energy sector has seen modest growth, supported by policies like the cost-covering feed-in tariff (FIT) since 2009 and a new investment subsidy scheme covering 60% of project costs introduced in 2022. However, the lengthy authorization process, often spanning 20-25 years, has significantly delayed development, with around 2 TWh of projects currently under development.



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By the end of 2022, Switzerland had 41 large wind turbines with a total capacity of 87 MW, producing 153 GWh of electricity, which accounts for just 0.3% of the national electricity demand. A new wind farm with a capacity of 14 MW is under construction and expected to be operational in 2023.

The Swiss Federal Office of Energy has updated the sustainable potential of wind energy in Switzerland from 4 TWh to 30 TWh annually. The government's Energy Strategy 2050 includes ambitious goals for renewable energy, with wind energy expected to contribute 4.3 TWh/year by 2050.¹

2.2. Main obstacles to wind energy projects in Switzerland

Challenges to growth include the lengthy planning procedures, strong local opposition, and the complex approval process. Despite these barriers, there is ongoing research and development (R&D) focused on optimizing wind energy in complex terrains, cold climates, and improving overall operational performance.

Economic activities in the wind energy sector include the development and production of materials for rotor blades, power electronics, and services related to site assessments and project development. New legislation in 2023 aims to reduce the permitting time for wind projects, which may accelerate the deployment of wind energy in the coming years.

There is significant opposition to wind energy projects in Switzerland, particularly from local communities and environmental groups concerned about the visual and ecological impacts of wind farms. Considerable public concern includes the areas of impact of wind turbines on landscapes, wildlife (especially birds and bats), and noise pollution. This has led to stringent regulations and lengthy approval processes for new wind projects.

It is worth noting that small wind turbines do not have the drawbacks that make wind energy investments in Switzerland challenging. For example, the low-noise design of vertical-axis turbines makes them suitable for installation in both remote and residential areas, which means that such installations could increase the share of wind energy in the

¹ https://iea-wind.org/wp-content/uploads/2024/01/Switzerland_2022.pdf



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national energy mix while preserving the rural landscape. Moreover, vertical axis turbines are safer for the environment, due to the design that does not pose as much of a threat to birds and insects as large turbines.

2.3. The Renewable Energy Industry in Europe

The wind turbine production sector requires significant technological innovations and investments, as well as fair market conditions to ensure sustainable growth. Unfortunately, this market is facing challenges due to unfair business practices, which are currently under investigation by the European Commission concerning Chinese manufacturers. This investigation focuses on the competition distortions caused by subsidies that allow these manufacturers to significantly lower their prices, harming European producers in a manner similar to previous issues in the solar panel sector.

Healthy competition is essential in the wind energy market, including small wind turbines, which are expected to attract increasing interest from investors. Fair competition drives innovation, improves product quality, and reduces costs, benefiting consumers. However, this sector is vulnerable to practices such as unfair subsidies and dumping, which distort competition and stifle innovation.

2.4. Prospects for Wind Energy Development – Small Wind Turbines

Small wind turbines play a crucial role in increasing the share of sustainable energy sources, wind energy in particular, in the energy mix. Unlike large wind farms, small wind turbines are adaptable to various conditions and can be used in diverse environments, from rural to urban areas. They are a key component in diversifying renewable energy sources, helping to reduce dependence on fossil fuels and carbon emissions.

Small wind turbines are utilized in various scenarios, such as powering both remote and residential areas, improving grid reliability in urban settings, or creating autonomous power sources for IoT (Internet of Things) devices. Their flexibility in location and scalability makes them ideal for a wide range of applications, from individual households to industrial facilities.



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The European renewable energy market is seeing growing interest in small wind turbines, which are viewed as a green and cost-effective alternative to traditional energy sources. However, companies involved in installing these systems report challenges in finding reliable manufacturers and suppliers. Most turbines available on the market are made in China, where local businesses benefit from government subsidies. This allows Chinese manufacturers to offer products at very low prices, making it difficult for European producers to compete. This situation could lead to the dominance of Chinese products in the market, risking the loss of competitiveness for local products. Additionally, the quality of small wind turbines from China often does not meet expected standards, which could undermine investor confidence in small wind installations as a viable investment in renewable energy.

In summary, wind energy in Europe is experiencing a period of rapid growth, becoming one of the pillars of the energy transition in many European countries. Proper management and support through well-thought-out regulations can help achieve not only economic but also environmental goals.

3. Opportunities Offered by the Small Wind Turbine Sector in Europe

3.1. Economic Efficiency of Small Wind Energy

The economic advantages of micro wind energy are becoming increasingly evident due to the declining costs of production and installation, as well as the availability of government incentives and subsidies in various markets.

Advancements in production technology and the scaling up of small turbine manufacturing are reducing the overall costs of wind energy. This expands access to affordable wind energy for a broader range of users, including small private households and small businesses, which previously could not afford such a significant investment.

Some countries offer tax breaks, subsidies, and other forms of support to promote the use of small wind energy. These initiatives significantly enhance the viability of wind energy,



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making investments in wind turbines more lucrative and accelerating the return on investment for projects.

3.2. Opportunities for Innovation and Future Development

The future of small wind turbines is tied to the integration of the latest material and design technologies, increasing their efficiency and reliability, and the development of hybrid systems. Research prospects foresee the use of advanced materials for blades, integration with adaptive control and maintenance systems, and improvements in energy conversion technologies to enhance the overall efficiency of the system.

Technological breakthroughs in the small wind turbine sector are crucial for increasing their efficiency and accessibility:

Improvements in Blades Materials and Design: Modern materials such as carbon fibers and fiberglass composites make turbines lighter and more durable, extending their lifespan and improving efficiency by reducing rotor inertia. Additionally, innovative blade profiles, modeled after natural shapes like bird wings, significantly reduce noise levels and increase the efficiency coefficient.

Control and Monitoring Systems: The implementation of intelligent control and monitoring systems allows for real-time optimization of wind turbine operation. This increases the overall reliability of the systems and lowers maintenance costs.



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4. The Role of Government Subsidies in the Development of the Renewable Energy Industry – Examples

4.1. Germany

The Renewable Energy Sources Act (EEG) in Germany has provided substantial subsidies to the wind energy industry, contributing significantly to the increase in production and export. As a result, Germany has become a global leader in wind energy technology, creating thousands of jobs in the sector. These subsidies have also spurred innovation, making German wind turbines some of the most advanced and efficient in the world.

Thanks to government support, Germany has significantly increased the production of electricity from renewable technologies since the beginning of the 21st century. According to the International Energy Agency (IEA)², by 2008, the share of renewable energy in Germany's total electricity production reached approximately 15%, more than doubling the renewable energy output from 2000. Germany greatly exceeded its minimum target of 12.5% set for 2010.

In 2008, wind energy accounted for 6.3% of electricity production in Germany, making it the leading source ahead of biomass and hydropower, which contributed approximately 3.6% and 3.1%, respectively. In contrast, the amount of energy produced by photovoltaics was minimal, accounting for only 0.6% in 2008.

The promotion of renewable energy is often justified by its impact on job creation. Referring to renewable energy sources as a "job motor for Germany," a publication by the Federal Ministry for the Environment (BMU) reports a 55% increase in the total number of "green" jobs since 2004, reaching 249,300 by 2007.

4.2. Denmark

Denmark is a leader in the development and integration of wind energy, achieving significant progress in meeting ambitious renewable energy goals. By the end of 2012, the country had installed over 4,162 MW of wind power capacity, with wind energy accounting for 28.3% of total electricity demand in 2011—the highest percentage in the world at that



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time. This growth was driven by various government initiatives and energy plans focused on increasing the share of renewable energy in the overall energy mix.

Starting in the 1980s, the Danish government introduced subsidies and supported the construction of wind turbines along with other renewable technologies. This included the development of local wind cooperatives and the introduction of feed-in tariffs, which significantly contributed to the growth of the sector. Early government plans also emphasized replacing nuclear energy with renewable sources, a move strongly supported by public opinion and environmental campaigns.

Throughout the 1990s and 2000s, Denmark continued to innovate in its energy policy, setting targets for wind energy production and integrating wind power into the national energy grid. Various plans and agreements ensured the growth of wind power capacity, with significant investments in both onshore and offshore wind farms.

By 2011, the Danish government set even more stringent goals, aiming to achieve a 100% renewable energy mix by 2035 and across all sectors by 2050. Substantial subsidies and supportive policies, including premiums for wind energy production and tax rebates, helped maintain investor interest and drive industry growth.

Companies like Siemens and Vestas, among the world's leading wind turbine manufacturers, are headquartered in Denmark. These companies are highlighted as key contributors to Denmark's position as a global hub for wind turbine production. The economic impact of these companies is significant, as nearly 100% of the wind turbines produced between 2004 and 2008 were exported, underscoring the highly export-oriented nature of Denmark's wind turbine industry.³

4.3. China

Aggressive subsidy programs for renewable energy in China, including wind energy, have rapidly developed this sector. The country has become the largest producer and installer of wind turbines globally. These subsidies have led to widespread job creation, the development of local supply chains, and significant growth in both domestic and international markets.



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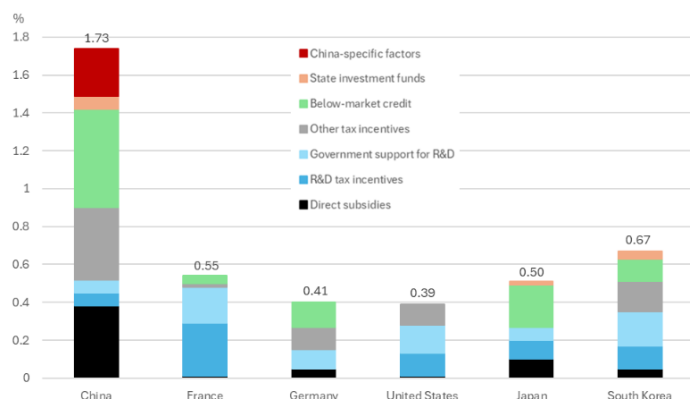


China has secured a leadership position in the production of photovoltaics, batteries, electric vehicles, wind turbines, and railway equipment, primarily due to substantial government subsidies. These subsidies have been criticized in Western countries for potentially distorting international competition. Industrial subsidies in China far exceed those in major EU and OECD countries, with conservative estimates indicating they are at least three to four times larger, while more comprehensive studies suggest a difference of up to nine times. In 2019, Chinese industrial subsidies amounted to approximately 221 billion euros, representing 1.73% of the country's GDP.

In the wind turbine sector, the initial development of this industry in China was significantly supported by government measures such as purchase guarantees and feed-in tariffs, bolstered by strict local content requirements. Although the central Chinese government eliminated preferential feed-in tariffs for onshore and offshore wind turbines in 2020 and 2021, regional governments continue to implement their own subsidy policies for the industry. While some key forms of support have been phased out, both central and regional governments continue to support turbine manufacturers through various instruments, including substantial direct subsidies. The increase in these subsidies in recent years has helped Chinese companies like Goldwind and Mingyang to further expand both in domestic and international markets.

For example, in recent years, subsidies for the wind turbine manufacturer Mingyang increased from 0.02 billion euros in 2020 to 0.05 billion euros in 2022.⁴

Figure 1a:
Industrial support spending in China and key OECD countries, 2019 (% of GDP)



Source: DiPippo et al. (2022); own illustration.



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Pic. 1. Support for Industry in China and Key OECD Countries Expressed as a Percentage of GDP, as of 2019. Source: "Foul Play? On the Scale and Scope of Industrial Subsidies in China," Kiel Institute for the World Economy, ISSN 2195–7525

Extensive subsidization has enabled Chinese companies not only to dominate the domestic market but also to significantly expand into European markets. This expansion is occurring at a time when global markets are becoming increasingly sensitive to competitive advantages derived from subsidies, leading to international disputes and political challenges. It is important to note and emphasize that the EU has expressed concerns about these subsidies, particularly in relation to electric vehicles and wind turbines, leading to investigations and calls for negotiations with China to address the issue.

4.4. The USA

Federal and state subsidies in the USA, such as the Production Tax Credit (PTC) and the Investment Tax Credit (ITC), have significantly boosted the development of the wind industry. These subsidies have contributed to a boom in wind farm installations, particularly in states like Texas and Iowa. The resulting increase in production, installation, and maintenance has created numerous jobs and supported local economies.

The renewable energy production tax credit (PTC) in the U.S. wind energy sector stimulates private investment, contributing to the development of manufacturing facilities, research and development, and worker training.

At the time of the American Wind Energy Association's report, the sector supported 73,000 direct jobs across 50 states, creating a robust national supply chain and contributing to the development of local communities. The same report forecasts that by 2050, the sector will generate around 600,000 wind energy-related jobs and up to \$149 billion in savings.⁵

4.5. Spain

The wind energy sector in Spain has benefited from significant government support through subsidies and favorable policies. This support has contributed to robust growth in wind turbine production and an increase in exports. The economic impact includes job creation, the development of related industries, and the strengthening of Spain's position



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in the global renewable energy market.⁶ Power supply based on renewable electricity sources in Spain reached 46.7% of total energy consumption in 2021.⁷

4.6. Summary

Direct subsidies for wind turbine manufacturers offer numerous benefits, ranging from cost reductions and increased production capacity to job creation and environmental sustainability. These benefits contribute to a more resilient, independent and greener future energy landscape, boosting the economy and supporting industrial sector growth.

Successes achieved in countries such as Germany, Denmark, China, the United States and Spain demonstrate the positive economic and environmental impacts of such subsidies, including increased production, exports and local business growth.

5. The Impact of the Development of the Small Wind Turbine Industry on the Economy and Environment

Government subsidies for the small wind turbine industry (up to 75 kW) can bring various benefits to both the national renewable energy sector and the overall economy. Below are several areas where transparent subsidy programs and preferential loans for domestic manufacturers of small wind turbines could have a significant impact.

5.1. Increasing the Share of Wind Energy in the Energy Mix

Small wind turbines (up to 75 kW) can meet the energy demands of manufacturing plants, large agricultural farms, and residential communities. They are also cheaper, quieter, smaller, and easier and faster to install, which reduces the need for complex infrastructure preparations for investment. Subsidizing the production of small wind turbines could accelerate the increase of wind energy's share in the national energy mix.

Government support through subsidies can improve the public perception of small wind turbines, boosting market demand. Positive public opinion can drive further investments.



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It is worth noting that subsidies lower the initial investment barriers for consumers and businesses, promoting the adoption of renewable energy sources. This shift reduces dependence on fossil fuels and supports sustainable environmental development.

Subsidies, tax reliefs, and preferential loans can shorten the payback period for wind turbine projects. Investors can see profits sooner, making renewable energy projects more attractive and feasible.

Investments in wind turbines, including small wind turbines, help reduce greenhouse gas emissions by replacing fossil fuel-based energy sources. This will contribute to both national and global efforts to combat climate change and bring Switzerland closer to meeting its goals.

5.2. Enhancing Energy Independence and Security

By increasing the availability and affordability of small wind turbines, subsidies contribute to building energy independence. With small wind turbines, communities and businesses can generate their own energy, reducing reliance on external energy suppliers and enhancing energy security.

Subsidizing manufacturers directly will also lower the production costs of small wind turbines, enabling them to reduce the final price of turbines more effectively than if end users had to seek financial support on their own. End users often lack the skills and time to navigate financial support systems, leading them to rely on consulting firms. Subsidizing manufacturers eliminates the need for these intermediaries.

Subsidies can also prioritize installations in rural and underserved areas, providing these communities with reliable and affordable energy. This can lead to improved quality of life, economic opportunities, and leveling of regional disparities.

Financial support can be used to expand manufacturing facilities and increase production capacity. This ensures a reliable supply of turbines to meet growing demand and supports large-scale projects such as the electrification of small towns and rural areas.



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Additionally, direct subsidies for manufacturers significantly reduce overall production costs, lowering the sale price and the levelized cost of energy (LCOE). This makes the production of green energy more affordable and accessible.

Subsidizing manufacturers directly reduces production costs. Subsidies and preferential loans also enhance the competitiveness of the subsidized companies' offerings, which, as demonstrated by Chinese enterprises, can result in a competitive advantage that secures market leadership.

5.4. Job Creation and Economic Growth

Investing in the small wind turbine industry stimulates job creation in manufacturing, installation, maintenance, and related sectors. This contributes to economic growth at both local and national levels, as demonstrated by examples from Germany, Denmark, China, and other countries where the wind energy industry received substantial government funding.

Subsidies can help create new markets for small wind turbines, particularly in regions where the adoption of renewable energy has been slow. This can open up new business opportunities for manufacturers and related industries. Increased manufacturing activity will also drive higher material consumption in the region, giving material suppliers an opportunity to increase sales and contribute to economic growth.

Investing in small wind turbine manufacturers brings long-term benefits by creating a sustainable energy infrastructure that supports environmental health and economic stability for future generations.

5.5. Positive Impact on Innovation in the Technology Sector

Government support through subsidies and preferential loans can improve public perception of small wind turbines, increasing market demand and thereby providing opportunities for further investment in innovation and technological improvement.



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As shown by the examples of economies that have adopted extensive wind turbine subsidy programs, including China, the United States, Germany, and Denmark, government subsidies have secured an unparalleled competitive position for their manufacturers.

6. Recommendations for Further Actions

6.1. Recommendations for the Subsidy Program

Based on the collected data, market analyses, and examples from other countries, we recommend the creation of a direct financial support program for producers of small wind turbines (up to 75 kW). This program aims to stimulate the development of domestic wind turbine production and accelerate the adoption of these technologies in the market.

Key elements of the proposed subsidy program:

- **Development of a Direct Financial Support Program for Manufacturers:** We propose the development and implementation of a program that offers direct financial support to domestic producers of small wind turbines. This support should enable technological development, increase production capacity, and improve competitiveness in the market.
- **Introduction of Subsidies for Manufactured Wind Turbines:** We suggest including subsidies in the program that cover up to 70% of the production costs of wind turbines, provided they are sold and installed within Switzerland. This approach will not only increase the availability of turbines in the domestic market but also support the national economy by boosting demand for locally manufactured equipment.
- **Simplified Access to Credit for Manufacturers:** We propose introducing a simplified credit access scheme for manufacturers, offering financing at rates lower than the market average. These loans would be dedicated to activities related to research and development (R&D) and the production of small turbines. This measure aims to lower the entry barriers for new technologies and innovations, which is crucial for the rapid development of the sector.



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6.2. Conclusions

Based on the analysis of the benefits derived from investing in the small wind turbine sector, the proposed subsidy program can significantly contribute to economic growth, energy independence, and environmental protection in Europe. It can also help prevent the domestic market from being dominated by products from countries with high levels of government support for the small turbine/wind energy sector.

We urge political and economic decision-makers to urgently consider and implement the proposed recommendations. The execution of this program will not only support the economy and industry but also contribute to the achievement of national and international green energy goals.

We encourage continued dialogue and collaboration between the government, the manufacturing sector, and financial institutions to ensure the swift and effective implementation of this program.

7. Literature

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