The German 250-MW-Wind-Program

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Overview

The German 250 MW Wind Programme is perhaps the most direct and sizable effort of any country to support the piloting and demonstration of new wind turbines and wind turbine designs, with a focus on those turbines owned by domestic companies. Such a program does not replace the need for basic and applied R&D, but can fill the critical niche between that R&D and the full commercial deployment of new technologies. It does so by piloting prototype or early-commercial turbines in the field, thereby preparing them for full commercial deployment. Germany's 250 MW Programme demonstrates a possible model that China might utilize as it seeks to support its local wind manufacturers as they move from R&D to full commercialisation.

Functioning

This German programme was initiated in June 1989 as the "100 MW Wind Programme" and was extended to the "250 MW Wind Programme" in February 1991. The programme provided grants for the installation and operation of wind turbines at suitable sites. The last grants were approved at the end of 1996 for turbines that had to be commissioned by mid 1998. The programme will end at the end of 2006 when the last operation grants will be paid out and the measurement and the "Scientific Measurement and Evaluation Programme" will be terminated.

The programme provided investment grants of € 102 per kW. Grants up to 60% of the total investment to a maximum of € 46,000 were provided. Alternatively, the programme provided operation-based premiums of € 0.041 until 1991 and € 0.031 after 1991 for every kWh fed into the public grid for a period of 10 years. These premiums were granted in addition to the remuneration wind project operators received from the utilities for their electricity production (i.e., the electricity price negotiated with the utility, after 1991 the feed-in tariff respectively). Since the Electricity-Feed-In Law established a higher remuneration scheme for wind power in December 1990, the operation premium according to the 250-MW programme was lowered to € 0.031 in 1991.

As noted below, the programme had a specific purpose to support the construction and operation of promising new and innovative wind turbine technologies and designs, and not simply to support the commercial deployment of already-fully-commercial technologies. In support of this goal, from the beginning of the programme, a "Scientific Measurement and Evaluation Programme" (WMEP) has been part of the support scheme. As such, all turbines that receive financial support are monitored for 10 years to assess technical performance.

1,467 wind turbines with a total capacity of 354 MW have been promoted within this programme. The total capacity supported exceeds 250 MW because the capacity of the wind

power plants were rated uniformly at 10 m/s wind speed in the support programme, whereas nameplate capacity is usually rated at 12-14 m/s wind speed otherwise. The total grants amount to € 161 million by end of end the year 2005. The bulk (88 %) of these funds has been provided as operation grants, the rest (12 %) as investment grants. Additionally, € 27 million of public money has been spent on the "Scientific Measurement and Evaluation Programme" as of the end of 2005.

In total there were 6,042 applications for support covering 10,466 wind turbines. 1,205 applications were accepted, translating to a success rate of 20 %.

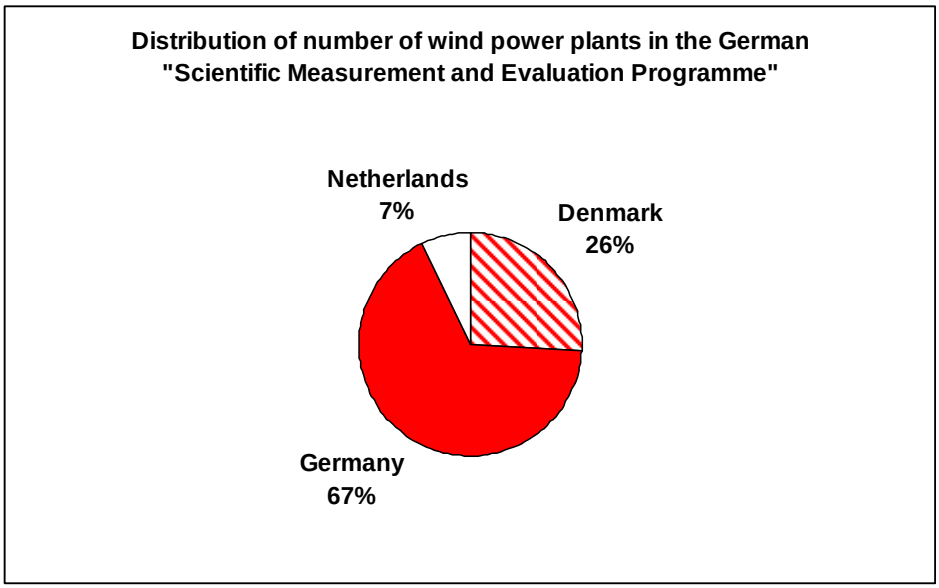
Criteria for the selection of winning applications included the following:

- new power plant
- technical maturity
- development status
- contribution to progress of wind power technology
- need for demonstration of a particular model
- need for demonstration of a particular type of site
- well balanced participation of different groups of operators (i.e. private, independent power producers, operator groups, utilities, companies having their commercial focus outside electricity supply).

As suggested by these criteria, the program sought to support technologies and companies that were mature enough to demonstrate the likelihood of commercial success, but at the same time specifically sought to support projects that would contribute to progress in wind power technology and demonstrate particular turbine models and new project/technology types.

In practise, certain quotas were allocated to certain manufacturers. These quotas were negotiated with all manufacturers including Danish and Dutch manufacturers, though the majority of the quotas were used to support German manufacturers. As long as the specific quota of a manufacturer was not exhausted, applications with wind power plants from this manufacturer were accepted. An overview on the different types of turbines supported by the programme is provided in Annex 1.

According to data of the "Scientific Measurement and Evaluation Programme," which covers an additional wind power capacity of 20 % outside the 250-MW-Wind-Programme, two-thirds of all plants came from German manufacturers, followed by Danish and Dutch manufacturers (see graph below). In terms of capacity, German manufactures achieved a share of twothirds as well, whereas Danish manufacturers captured 32 % and manufacturers from the Netherlands 2%. A majority of the funds were used to support domestic German manufacturers in the hope of building national capability in the growing wind turbine manufacturing industry.



Motivation

By the mid-1980s substantial public support had been provided for R&D in wind power technologies. Large industry from the aerospace sector had been commissioned to develop very large wind power turbines with a capacity of 3 MW and more. This concept failed at that time because the dynamic stresses in wind power plants were underestimated. On the other hand, smaller specialized companies had developed successful wind turbines with a capacity of up to 100 kW, supported in part also with public R&D budgets. So the technology of wind power plants was available as a result, in part, of public R&D support and in part from the initiative of smaller private firms.

However, application of this new technology was lacking. The electricity industry was highly regulated, characterized by large vertically integrated monopolies. Since the incumbent monopolistic players had built up excess capacities of electricity generation they were reluctant to invest in new additional power plant capacity. Moreover, the small size of the wind power plants available at that time did not fit in the philosophy of the power supply industry, which was used to running several 100 MW large power plants but were not prepared to operate a large number of small decentralised power plants with fluctuating output. As a result, the power supply industry opposed the application of wind power. Specific regulations stipulating grid access of independent power producers did not exist. Independent power producers got only unfavourable remuneration, if at all, for their power sales. The German Feed-In-Law granting a fixed tariff for power from renewable energies did not exist at that time; it was not introduced until December 1990.

The conditions for applying wind power technology were therefore rather poor, and technology developers and turbine manufacturers were too small and lacked the capital to finance the commercial deployment of their technologies themselves. It was therefore felt that the gap between Research & Development (R&D) and full commercial market deployment needed to be bridged with public support. Technology developers and manufacturers needed to get the chance to apply the then-new wind power technology in modest-sized applications in order to prepare for full commercial deployment. The German program would give these manufacturers direct field experiences with what were sometimes new wind turbine models and designs. The feedback from the markets and this field experience would give manufacturers invaluable input for further technology development. which could not be replaced by pure laboratory based R&D.

To amplify and standardise this feedback, the "Scientific Measurement and Evaluation Programme" was introduced. Experiences and knowledge achieved with operating the wind power plants are made publicly available. All manufacturers benefit. An independent research facility has run the measurement programme. Wind power plant operators who are granted within the 250-MW-Programme are obliged to provide operations data quarterly. In addition to the 1,467 plants within the 250-MW-Programme, approximately 100 wind power plants have participated voluntarily. An evaluation of the plants is published annually as the "Wind Energy Report Germany".

It is common policy in Germany and in other countries to support R&D for new technologies with public money, and to support the commercial deployment of renewable technologies through alternative policies (feed-in tariffs, quotas, etc.). The gap between R&D and full commercial deployment is often ignored, however, making it difficult for new domestic wind turbine manufacturers to enter the marketplace. The 250 MW Wind Programme in Germany was specifically intended to help bridge the gap between R&D and market deployment, and in that way is relatively unique.

Conclusion

Together with the Feed-In-Law and the comprehensive soft loan programme, the 250-MW-Wind-Porgramme was a decisive cornerstone for the fast wind power deployment in Germany. It was specifically targeted toward developing a domestic wind power manufacturing industry. Thereby, the gap between pure R&D and market deployment was bridged. The criteria used within this programme to select projects ensured a wide range of different plant types and different manufacturers. They ensured also that domestic manufacturers benefited adequately from German taxpayers' money. The selection criteria in particular and the approach in the whole may serve as a blueprint for further Chinese wind power technology development.

Annex 1 : Number of wind power plants within the "Scientific Measurement and Evaluation Programme" which gives approximately the distribution in the 250-MW-Programme, too.

Type	Rated power	Number in WMEP
Enercon E 32/33	300	135
Enercon E 16/17/18	80	108
Vestas V 25/27/29	210	102
Lagerwey LW 15/18	70	90
Enercon E 40	500	87
AN Bonus 100/150	150	75
HSW 250	250	70
Tacke TW 45/60/80	70	64
Krogmann 15	50	49
Micon M 450/530/570	230	48
Tacke TW 500/600	550	48
Nordex N 27/29	170	47
Ventis 20-100	100	47
Vestas V 39/42/44/47	520	46
Seewind 110/132	130	44
AN Bonus 450	450	42
W ind World W 2500/2700	160	38
Micon M 700/750	260	37
Nordtank NTK 300	300	37
Südwind Serie 1200	30	32
Enercon E 66	1720	28
Nordtank NTK 150	150	25
Kano-Rotor 30	30	23
Nordtank NTK 500	500	22
Tacke TW 150/250	250	21
WTN 200	200	19
Wenus Inventus	10	18
Aeroman	30	13
Lagerwey LW 27/30	250	12
Vestas V 17/20	100	11
Vestas V 63/66	1640	11
HSW 30	30	11
Fuhrländer astOs 100	100	10
Südwind N 3127	270	10
NEG Micon NM 500/600	590	9
Fuhrländer astOs 250	250	8
GET Danwin 27	230	8
NEW 100	20	8
Adler	170	7
Enercon E 30	200	7
GET 41	600	7
AEE Peters PG 10	10	6
Nordex N 52/54	840	5
AN Bonus 600	600	5
Euroturbine ET 550	550	5
AN Bonus 300	300	4
Tacke TW 300	300	4
Jacobs 500/600	530	4
Micon M 300	60	3
NEG Micon NM 1500	1500	3
AN Bonus 1 MW	1000	3
Wind World W 4100	500	2
Südwind N 715	20	2
NedW ind 40/43/44	500	2
Fuhrländer astOs 30	30	1
WKZ elektrOmat	20	1
Tacke TW 1.5	1500	1
HSW 1000	1000	1
Lagerwey LW 11	20	1