S2-3 Renewable energy technology development and transfer The case of wind energy deployment in Brazil

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Introduction

Unlike hydro and biomass, wind energy is one technology which has not yet made a significant entry into Brazil's energy sector. While ethanol from sugar cane has now become a well-known success story of endogenous technology development, the case of wind energy in Brazil illustrates the challenges to renewable energy development through technology transfer. This paper discusses ways to overcome them in order to promote a low carbon society in developing countries. Despite a potential resource base of more than 150 GW and a feed-in tariff policy which aimed to install 1.4 GW of wind generation by 2006, Brazil counts 550 MW installed on its grid today. The technology remains of interest, however, for its potential to help reduce some part of the fossil fuel capacity expansion planned to complement Brazil's large hydro base.

Summary of Main Points

Brazil's experience with PROINFA, its first policy to promote wind energy (as well as small hydro and biomass), is a source of two important lessons. One lesson from PROINFA is that care must be taken in designing measures to favor domestic production of equipment, though such production has known benefits. PROINFA included a 60% national content requirement which delayed installations because of turbine scarcity. Although delayed, at least one GW of the wind plants which were awarded fixed-price contracts through the program will be built. The second lesson is that PROINFA's lack of a long-term policy for wind to complement the short-term 1.4 GW goal in its first phase ended up impeding the success of such goal. It did not provide the certainty that equipment manufacturers needed to enter and transfer their technology to the Brazilian market. Policy support for wind in Brazil today has evolved from PROINFA's FIT scheme to a tender approach, complemented by additional tax-relief measures and a reasonably attractive finance line available through the national development bank. There will be a tender this year to award 20-year contracts to wind plants, but beyond that the long-term trajectory of support for wind remains undefined.

Such a long-term policy for significant wind deployment could be developed and proposed as a NAMA (nationally appropriate mitigation actions) which would specifically aim to displace some of Brazil's expected fossil fuel expansion with wind. Wind is useful in the Brazilian electricity mix because it is complementary to Brazil's large fleet of hydro plants. Wind speeds are higher and more regular in the dry season of the year, and dryer years or multi-year periods tend to be windier. This means that wind has a good chance of being available when hydro generation is lacking and could be dispatched instead of oil, gas, or coal to fill the gap. Further study is needed to understand how to value this characteristic of wind in the power pricing system and how to optimally dispatch wind on the grid.

To give one example of a possible framing of a NAMA we model the installation of approximately 20 GW of wind power between 2013 and 2030, which would replace the fossil fuel expansion expected during this period, representing 10% of the expansion.

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We estimate that this could reduce 245 million tons of CO_2 at an incremental cost between 6-15 billion USD over 18 years. This 10% scenario would entail slow ramp up of 200-300 MW/yr to 2020 and then quicker growth of 1.8 GW/yr between 2020 and 2030. Installation would not have to follow this schedule, but the expected fossil fuel expansion is mainly after 2020. Conventional CDM payments for such a program of installations would be limited; therefore it is important to examine the additional support which could be provided through the UNFCCC in order to reduce the costs and barriers to the NAMA.

The international community could help reduce the incremental cost of the NAMA by replicating the financing program being planned by KfW and Brazil for wind, and/or buying down the cost of licenses for manufacturers in Brazil to scale up domestic production of technology. Another option beyond licensing would be to encourage the companies who have already demonstrated interest in Brazil to set up joint ventures producing there, which could be done with bilateral public investment, plus tax relief on the part of Brazil. Technical cooperation between foreign wind technology companies and local research institutes, who are working on turbine design optimized for local resource conditions, would also be very helpful.

With only two domestic manufacturers that serve the Brazilian market, there is ample room for technology development and adaptation to local wind conditions. It has been difficult to date for Brazil to attract additional manufacturing without a long-term regulatory framework for wind. The policy to implement the NAMA would need to commit to multiple years of tenders in order to draw the interest of technology suppliers, or turbines will likely continue to be imported. An annual tender with a commitment to buy a known minimum quantity (MW) given a certain (attractive) ceiling price would be one policy option. Complementary policies to address transmission barriers and tax relief for wind are also necessary.

Conclusion

The status of wind energy in Brazil, a country with well over 150 GW of capacity potential and 550 MW installed, shows that there its deployment is still in the initial stage, despite its potential benefits. The generation pattern of wind is thought to be complementary to the hydro resource, which implies that wind could generate in the off-times for hydro when fossil fuel plants would otherwise be run, and reduce significant GHG emissions. We model an illustrative NAMA for long-term deployment of wind energy which would specifically aim to reduce fossil fuel capacity expansions, and discuss the barriers to overcome in scaling up to 20 GW of installed capacity by 2030. There are many ways the international community could support the NAMA: additional concessionary finance, sharing of licensing costs, joint technology development, technical cooperation to adapt turbines to local conditions, to name a few. In addition, Brazil would need to implement a policy which signals a long-term steady market for wind in order to attract local manufacturing and provide the opportunity to scale up the technology.