POLITICAL ASPECTS OF WIND POWER

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INTRODUCTION

Wind Power as the futuristic dream of environmentalists, has evolved into an industrial "big business" activity. It has attracted debates among its advocates as a non-carbon green-energy and its opponents as an industrial process with associated environmental and social issues.

After the signing of the Kyoto Protocol on climate change in 1998, wind-generated electricity has grown 20 times from the equivalent of two New York Cities, to 200 Giga Watts (GWs) by 2012; enough to power six UK-size countries.

It must be admitted that wind power holds great promise as part of the new low-carbon renewables age, yet it is unequivocally an industrial process, and should be considered as such. It involves heavy rotating machinery, large structures, high voltages and work at great heights.

In addition it is affecting local civil rights, creating rivalries and unforeseen social and political conflicts. Wind turbines with rotor blades 30 yards in length are installed in groups in wind farms and parks using large tracts of land world-wide. The control and acquisition of that real estate has sometimes caused a violent flash point referred to as the new "wind rush" and are accused of resembling the colonial land grabs.

POWER UTILITIES HURDLES

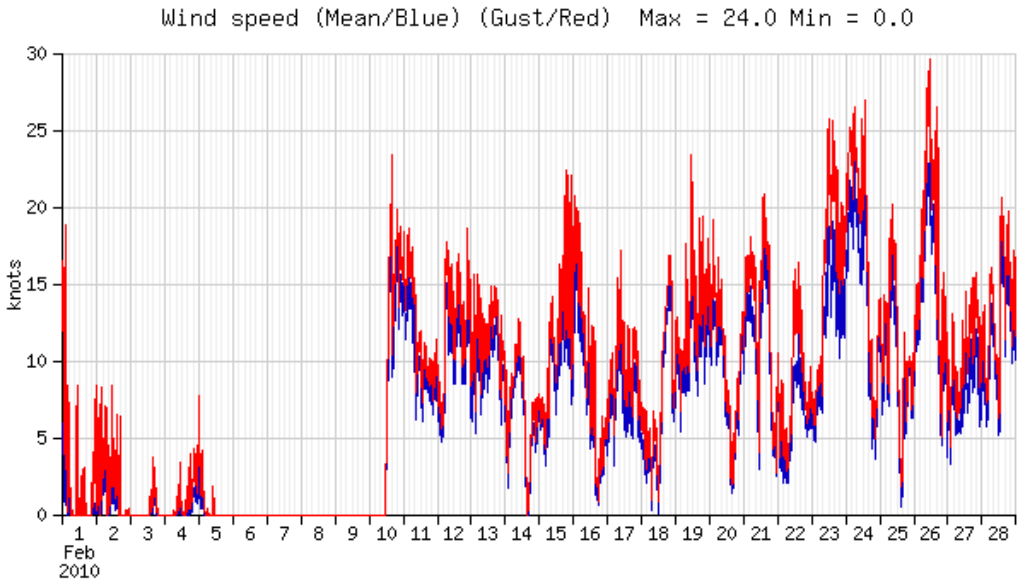

Figure 1. Wind speed and wind gusts variability as measured at the Hilbre Island, Coastal Observatory, Liverpool Bay, UK, weather station in February 2010. A wind speed of 7 knots is needed for wind power generation. Source: National Oceanography Centre, Natural Environment Research Council, UK.

Wind turbines have to overcome the intermittence or capacity value problem in that the wind does not blow all the time. Depending on the chosen location, a 1/3 capacity value means that to get an average of 100 Mega Watts (MWs) of power at a wind farm location, one must install at least 100 / (1/3) = 300 MW of rated-power wind generators.

Because wind is unpredictable there is not a reliable match between supply and demand. No more than 30 percent of the potential capacity is actually produced and sold. Having 20 percent of the turbines in a wind farm down for periodic maintenance at any one time is a common feature.

Utility power dispatchers struggle to “chase the load” in a synchronous electric power grid system. In the USA the “base load” is covered by the most thermally efficient coal-fired plants, nuclear power plants, hydroelectric plants, and base-load combined cycle natural gas turbines plants. The increases or decreases in demand are chased up and down with easily throttled hydroelectric, pumped energy storage, peaking gas turbines, oil-fired units and scheduled power exchanges, sales and purchases with neighboring utilities that have different supply demand characteristics.

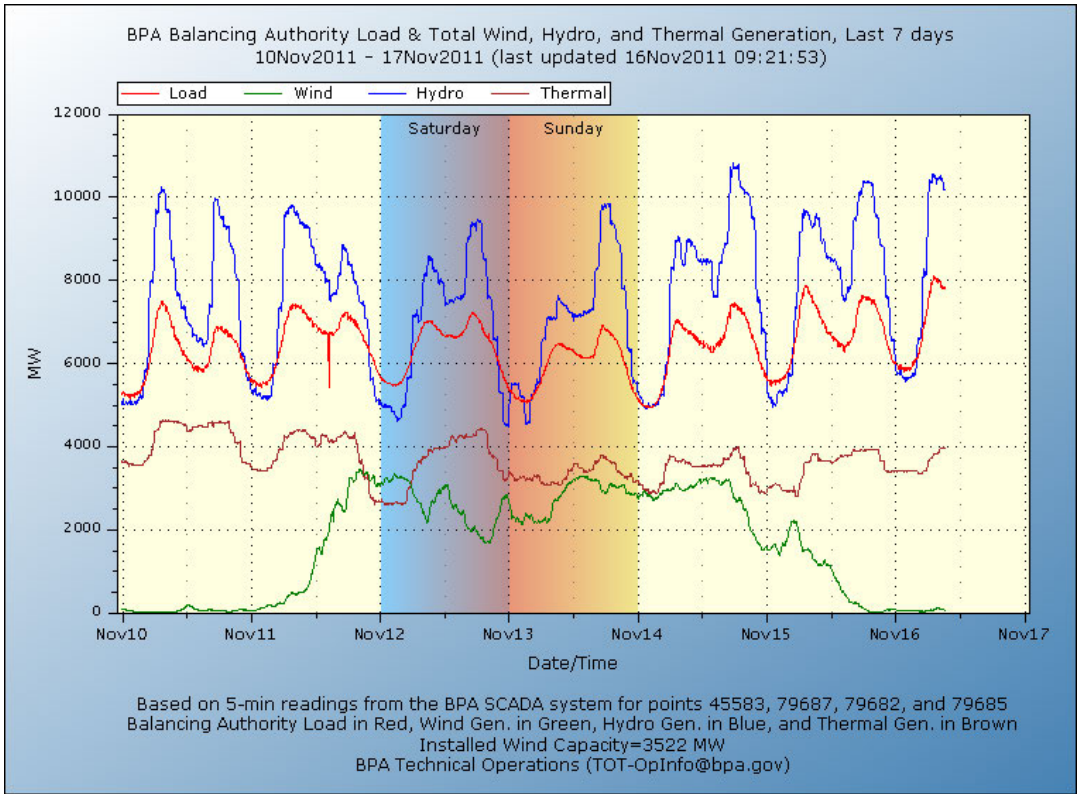

Figure 2. The Bonneville Power Administration (BPA), Oregon, USA, load balancing graph is shown over the period of November 10-November 17, 2011. As wind power was generated, the operators were reluctant to throttle down the other thermal and hydroelectric units. Without any energy storage capabilities, unless the generated wind power was sold to neighboring utilities maybe for pumped storage, as a use-it or lose-it commodity, it went unused for about 4 days out of 7 days, possibly benefiting from the Production Tax Credit (PTC) government incentive. Source: BPA.

The utilities and rate payers in the USA are required to accept whatever output wind and solar can generate whenever they can generate it, except during system emergencies. That randomness and unreliability of renewable power output, especially with wind and solar, can be overcome with judicious energy storage schemes such as pumped storage or flywheels.

In the absence of energy storage capabilities, the electrical utilities are faced with problems in matching electric generation with load. It is hard to turn off and then turn up thermal plants since this subjects them to thermal stresses. Hydroelectric plants may be controlled by irrigation needs. Nuclear power plants are currently designed as base load sources and not as load-followers.

Since wind and solar sources are effectively "base loaded" from a utility perspective, their capacity values should be appropriately compared with other base load plants for the purposes of establishing their economic value. This yields less than 30 percent as capacity value for the best wind farms compared with about 90 percent, including refueling and other maintenance downtime, for coal, base loaded combined cycle gas turbine plants and nuclear power plants.

Market distortions occur in subtle ways. During times of low demand and high wind power production in Germany, the price at the energy exchange an turn negative, and owners of pumped storage facilities in Austria are in that situation paid for accepting the produced electric energy. Conventional thermal power plants will in that situation try to feed in as little electricity as they can, as they will get a negative price for their energy. Wind power producers are guaranteed to get the European Union (EU) established feed-in tariff no matter what the current bulk price for electricity at the exchange is. So they continue electrical production to collect the feed-in tariff. A similar situation may be occurring in the USA to collect the Production Tax Credit (PTC).

The pumped energy storage operators in Austria benefit by being paid to accept surplus wind electricity from Spain, as well as nuclear energy from France, that they store in their pumped storage lakes then sell at the time of peak demand at the green hydroelectric electricity tariffs; to their great benefit.

In Idaho, USA, the Avista utility faces problems with too much wind power at times when it is not needed. There is no spare grid capacity to carry the power away from the area. This is caused by the local weather pattern. The coldest and warmest periods of the year possess high atmospheric pressure and hence no wind. The wind blows hard during transitional periods when the temperature is moderate and the power usage is lower.

ABANDONED WIND FARM SITES

Eventhough the wind resource is free, wind power production is a labor intensive industry where the Operation and Maintenance (O&M) costs are approximately half of the average wholesale rate of electric power at the electrical trading sites.

Existing utility scale designs of wind turbines are net importers of about 5 kW of power from the electric grid to remain on a standby basis with their controls kept unfrozen in the winter and ready to catch the wind. This makes them useless in the case of a power blackout. Alternate designs using forms of energy storage such as flywheels and permanent magnets are needed.

Wind farms must be established in locations with rich wind resources otherwise their operation would become uneconomical, leading to their abandonment. Carefully written wind

farm land leases call for removal of all equipment and foundations and restoration to approximate original grade. In some unfortunate cases these leases were not honored as the companies involved went bankrupt.

A proposed alternative is to require the establishment of an escrow account financed from the wind turbine income to be established with an independent financial institution for the eventual decommissioning of the turbines and the associated access roads, foundations, electrical cabling and steel equipment after the useful lifetime of the wind turbine.

Figure 3. Decaying abandoned truss tower style wind turbine in California.

Driving by some established wind farm sites in California one can notice that about 1 in 4 wind turbines are non-operational. The problem is sometimes bad siting. The location, may be perfect for wind, but could be treacherous for work and support equipment. Even on a flat terrain, like in Texas or Iowa, performing maintenance operations at great heights is not an easy matter.

Many of the non-rotating turbines are not necessarily non-operable. Some of the electrical capacity could be held in reserve. Some hydroelectric turbines could sit idle during periods of low demand such as at night. This also is used to prolong the useful life of generators. Worry about unused generation capacity is only warranted on peak demand days when the generation capacity is operating around 70 percent. Fifty percent operating capacity does sometimes occur.

Current designs of wind turbines actually work better in low wind conditions. At high wind conditions they are “furled” with their pitch controls eliminating the lift on the blades and the yaw mechanisms turning the turbine away from the wind and protecting it. That is a reason some turbines are seen stopped under high wind conditions.

A poorly written permit allowing windmills to be built at Palm Springs, California did not include a decommissioning clause, so that they sat there as rusting skeletons at the end of their useful life of about 20 years. Palm Springs decided that if windmills are going to exist around the city, they must be operational. A city that has welcomed windmills since it was first approached about them in the early 1980′s found that many of those windmills are no longer

working and it wants them fixed. The situation raised the issue of who is responsible for fixing or decommissioning them. Florida Power and Light (FPL), the owner of the inoperable windmills, was allowed to install and operate the local windmill farms under a conditional use permit (CUP) stipulating that if the windmill does not run for six months, it is declared a public nuisance, and without a hearing, must be abated.

DEFUNCT COMPANIES

Carefully written wind farm land leases call for the removal of all equipment and foundations and restoration of the ground to approximate original grade. In some unfortunate cases these leases were not honored as the companies involved went bankrupt.

Political opposition has arisen lamenting the condition of the Zond Company, a subsidiary of the defunct Enron Company that was acquired by the General Electric Company, wind power sites:

> "Throughout the Tehachapi-Mojave area look for turbines without nose cones, turbines without nacelles (blown off and not replaced), oil leaking from blade-pitch seals, oil leaking from gearboxes, road cuts in steep terrain, erosion gullies, non-operating turbines, and "bone piles" of junk parts. One Zond bone pile of abandoned fiberglass blades is visible on the east side of Tehachapi-Willow Springs Rd. near Oak Creek Pass. (Kern County does not permit on-ground disposal of fiberglass.) While touring wind farm sites look for blowing trash and litter (plastic bags, soft-drink cups, bottles, electrical connectors, scrap bits of metal, and so on). These all reflect management's attention to maintenance and general housekeeping. At the better sites, you won't see any of this."

Regarding the Kamaoa Wind Farm in Hawaii:

> "Built in 1985, at the end of the boom, Kamaoa soon suffered from lack of maintenance. In 1994, the site lease was purchased by Redwood City, CA-based Apollo Energy.
>
> Cannibalizing parts from the original 37 turbines, Apollo personnel kept the declining facility going with outdated equipment. But even in a place where wind-shaped trees grow sideways, maintenance issues were overwhelming. By 2004 Kamaoa accounts began to show up on a Hawaii State Department of Finance list of unclaimed properties. In 2006, transmission was finally cut off by Hawaii Electric Company."

Figure 4. Abandoned and cannibalized Kamaoa wind farm turbines, Hawaii.

THE MAINTENANCE ISSUE

Wind power is a labor-intensive industry with rotating and electrical machinery that requires continuous maintenance. Lack of maintenance will inevitably lead to failures. A crew of about three personnel is required for every 6 wind turbines. Changing oil filters and seals and electrical parts at great heights is a demanding and hazardous job.

Gearboxes or transmissions have been failing in wind turbines since the early 1990s and need to be replaced every 5 years on-average over the 20 years design lifetime of a typical wind turbine. Only the gearless designs of wind turbines have escaped the epidemic. This is leading to a second generation of gearless wind turbines with multi-pole electrical generators replacing the first generation of wind turbines using gearboxes.

The problem reached epidemic proportions with a massive series failure of gearboxes in the NEG Micon company wind turbines that had to be replaced in large numbers. The NEG Micon brand at some time was the most popular wind turbine in the world. The problem brought the company to its knees causing it to be taken over by its rival Vestas, the present world's largest wind turbine manufacturer. Vestas itself is still challenged by gearbox and rotor failures.

The Der Spiegel magazine reports that the German Insurance Association was upset about the gearboxes as well as rotor blades failures:

> "'In addition to generators and gearboxes, rotor blades also often display defects,' a report on the technical shortcomings of wind turbines claims. The insurance companies are complaining of problems ranging from those caused by improper storage to dangerous cracks and fractures. The frail turbines coming off

the assembly lines at some manufacturers threaten to damage an industry that for years has been hailed as a wild success.

After the industry's recent boom years, wind power providers and experts are now concerned. The facilities may not be as reliable and durable as producers claim. Indeed, with thousands of mishaps, breakdowns and accidents having been reported in recent years, the difficulties seem to be mounting. Gearboxes hiding inside the casings perched on top of the towering masts have short shelf lives, often crapping out before even five years is up. In some cases, fractures form along the rotors, or even in the foundation, after only limited operation. Short circuits or overheated propellers have been known to cause fires. All this, despite manufacturers' promises that the turbines would last at least 20 years."

Vibrational problems challenge the designers of rotor blades. The vibrational mode due to the vertical wind shear is a design difficulty of large wind rotor blades. The blade going over the top of its circular path sees a drag and lift that increase as the square of the wind speed; but going over the near ground point the wind speed is lower, resulting in both an axial blade bending, a thrust bearing load oscillation as well as a torsional blade bending and a circumferential acceleration mode all at the constant rotation frequency. This could lead to a variable frequency vibration mode; which complicates the design of the blades from the perspective of fatigue lifetime.

Wind power is not immune to the principles of sound engineering management. It must be accepted that maintenance costs are 90 percent of the cost of most engineering systems. It takes dedicated people to keep a technology base operational. The older engineering systems get, the more expensive is the maintenance cost as people and the technology base get older and retire from the work force. As some age, engineering systems are retired under wear conditions to be replaced by more modern efficient alternatives.

Successful maintenance requires a motivated management keeping the teams focused, staffed, trained, supplied, and responsive to unexpected conditions. With thousands of complex wind turbines scattered over the landscape, wind power requires a large amount of maintenance per unit of energy produced than other sources of energy.

GLOBAL ASPECTS

The global growth of wind power is driven partly by demand. For instance, China's electric power demand has doubled in just a decade, and India's peak demand is 12 percent higher than its available electrical supply.

National and international subsidies and incentives also play a role in the growth process. Carbon offsets that allow companies to invest in clean energy at some locations to "offset" carbon emissions in their other polluting businesses have contributed to wind industry growth. Critics of the incentives and subsidies process suggest that every new wind turbine represents a blank check for a business to pollute elsewhere. Supporters say it is a market-based solution meant to ease business into a clean energy future.

For the Kyoto Climate Treaty signatory nations, it has meant a global rush to acquire land for wind turbines. Wind projects have been successful in many locations such as Tamil Nadu, India, injecting economic benefits wherever they are built.

On the other hand, the development process sometimes causes anger, especially among the poor landowners. James Anaya, the United Nations (UN) Special Rapporteur on the Rights of Indigenous People critics the process:

> "What we see in many places, if not most places around the world, is very much what I would describe as the colonial model, where Europeans would go to Africa and other places and they say 'OK, we are going to develop this.' And the deal that is being offered, in the end, is not a good one."

In 2001 James Anaya won a landmark case in the Inter-American Court of Human Rights that involved logging rights in Nicaragua and established that indigenous people have exclusive right to their lands. He says that too often a government or business acquires land through unequal negotiations, in which indigenous people are not given all the information or options.

The negotiation of any wind contract is complex. Often in the developing world, communities are poorly educated or largely illiterate and do not understand the implications of a binding legal contract. They may simply have no access to legal and technical advice and they may be powerless to negotiate. And because the parcels that they control are small, they can be harmed by turbine construction.

Biofuels development projects have a far worse record than wind development concerning land grabs. Rampant abuses in Tanzania led to a ban there on all new biofuel investments. Most conflicts involving wind energy deal with land occupied, but not owned, by indigenous groups, such as in the Kutch District of India, where a case pitting local herders against Indian wind giant Suzlon Energy went to the high court there. Similar conflicts are arising with Morocco's nomadic herders.

In Dhule, India, in 2010, 2,000 adivasi or tribesmen were forced to accept hundreds of wind turbines on their traditional lands. They had lived on the land for generations but had dubious title. The government gave the land to Suzlon Energy, which, in some cases, bought out the owners.

In Honduras, a wind energy company forced the indigenous Lenca people, who did possess land title, to take on a wind farm, paying each farmer a meager $80 per year to lease the land. In many cases, the owners were barred from accessing their land.

Such cases in which local landowners are either coerced into a contract or do not understand what they are signing, are beginning to worry indigenous rights activists, on how this affects the survival of local cultures.

CIVIL RIGHTS EFFECTS

The wind boom is having an effect on civil rights. China has doubled its production capacity each year recently. It has a history of driving people from land for hydroelectric power and dam construction.

In the Great Plains of the USA, Native American communities have joined a movement to direct all development on their lands. According to Robert Gough, a consultant with the Intertribal Council on Utility Policy which represents 10 Great Plains Native Indian tribes:

> "The tribes were no longer satisfied with business as usual ... other people coming in, building some economic development project, owning it, taking the profits out, and leaving the tribe with it at the end of its life."

Many tribal communities say they pay high electricity costs or have no electricity sources at all. So the Intertribal Council on Utility Policy decided that no wind farms will be built on tribal land unless the tribe has a controlling interest. The tribes have struggled to find partners because of this demand and because federal investment incentives are designed to benefit businesses or utilities, not municipalities or reservations.

For these reasons, communal bargaining is being considered. In South Wyoming, 2,000 owners have pooled 2 million acres in "wind associations."

SMALL WIND FARM INSTALLATIONS

In the 1960′s and early 1970′s, before the USA’s government sponsored the process of rural electrification projects, many farmers and ranchers jury-rigged used vehicle electrical alternators to the turning shafts of common American water-pumping windmills. Ranchers used Aermotor windmills, and 12 or 24 volts vehicle alternators. These alternators charged a bank of batteries kept in a shed below the turbine tower.

An inverter attached to the DC batteries provided AC power to the homesteads. These homemade systems, provided enough electricity to run a radio, telephone, some lights, washing machines, small welder, and a few power tools. With careful planning, these farm and ranch houses had enough free electricity for most of their needs.

To power refrigerators, freezers, room and hot water heaters farmers and ranchers paid for propane, that was trucked in as the supply was needed.

The wood or steel rotor blades of that type of drag or impulse type of wind turbine appear solid to birds or bats, in spite of their high rotational speed, so few to no animals ever collided with the blades.

The average height of the towers ranged from 30 to 60 feet making the annual needed maintenance of adding some oil to the gearbox a simple task. The rudder design automatically furled the turbines in high-wind conditions and protected them from stormy conditions by rotating them away from facing the wind. A lightning rod protected them from lightning strikes. They lasted for years with minimum maintenance.

This suggests the need to rethink wind power production along a small size micro-turbines distributed system for electrical power production with interconnection of the local grids to sell and share electricity among the members of small rural communities.

WIND POWER SOCIAL CONFLICT

An example of the possible local conflicts that can be caused by wind power development is Mexico. Mexico has substantial wind resources, particularly at the Isthmus of Tehuantapec. Its petroleum supplies are depleting and need to be replaced. Wind power presents itself as a viable option for electrical power production.

The Isthmus of Tehuantapec, Mexico's narrowest point, like similar geographical locations as the Gulf of Aqaba and the Gulf of Suez in the Middle East, is characterized by a wind tunnel effect of air currents passing through the mountains that separate the Pacific and

Atlantic oceans. On the Pacific side, the wind shapes the miles-long sandspits of Laguna Superior. Gales that average 19 miles per hour (mph) wind speed are a common occurrence along the beaches.

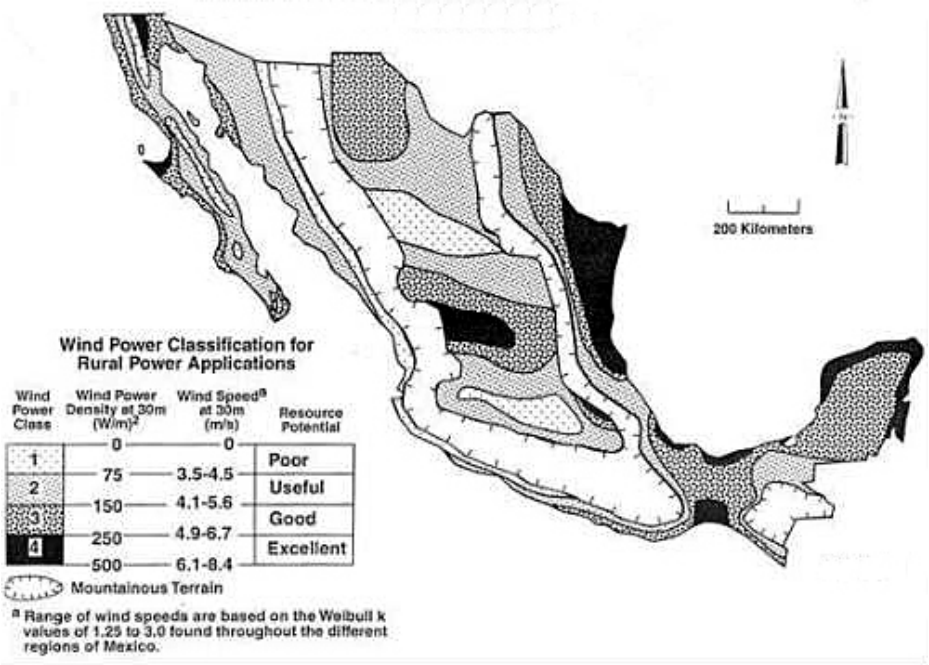

Figure 5. Mexico’s wind resources map.

Mexico's wind energy capacity is substantial: 71 GWs, which is 40 percent more than the nation's entire installed electricity-generating capacity, including coal, gas, and hydropower. Mexican President Felipe Calderón promised at the 2010 United Nations Climate Change Convention in Cancún, Mexico, to double Mexico’s solar and wind energy production from 3.3 percent of the nation's energy production to 7.6 percent within two years.

Wind developers have known about Mexico’s wind potential since the mid-1990s. The region's wind production is about 2.5 GWs, enough to power about 870,000 USA homes. Mexican wind energy capacity has helped push Mexico's total renewable energy production to 26 percent of the total electric output.

Much like in the USA, most renewable energy is provided by experienced foreign European and Asian developers. A few inexperienced local entities are trying to enter the business on their own such as Ixtapec, a community just east of La Venta, which is attempting to create, manage, and profit from its own wind energy in partnership with a wind company. The idea is for the wind farm to fund benefits such as better schools and roads and social services such as health clinics and libraries.. Such business models are emerging elsewhere, but without access to expertise, this is nearly impossible for illiterate communities.

The Spanish wind power developer company Iberdrola Renovables bought the Bii Nee Stipa wind farm in Mexico, from Gamesa. The wind farm has 26 MW of installed capacity, featuring 31 Gamesa G52-850 kW wind turbines. It is located in Juchitán de Zaragoza, in the Oaxaca State, Mexico. This particular area of Mexico has some of the best wind conditions for wind farming in the world, and it is no wonder that the majority of wind energy developments in

this country happen in this region. This purchase of wind capacity enlarges Iberdrola's installed wind capacity base in Mexico to 106 MW. La Venta III wind farm also includes 103 MW of installed capacity adding to Iberdrola's ownership and operation the 80 MW La Ventosa wind farm. Iberdrola Renovables and Gamesa have a strong collaboration, with Iberdrola's commitment to keep Gamesa as the main supplier of wind turbines for its worldwide wind energy developments, including in the USA.

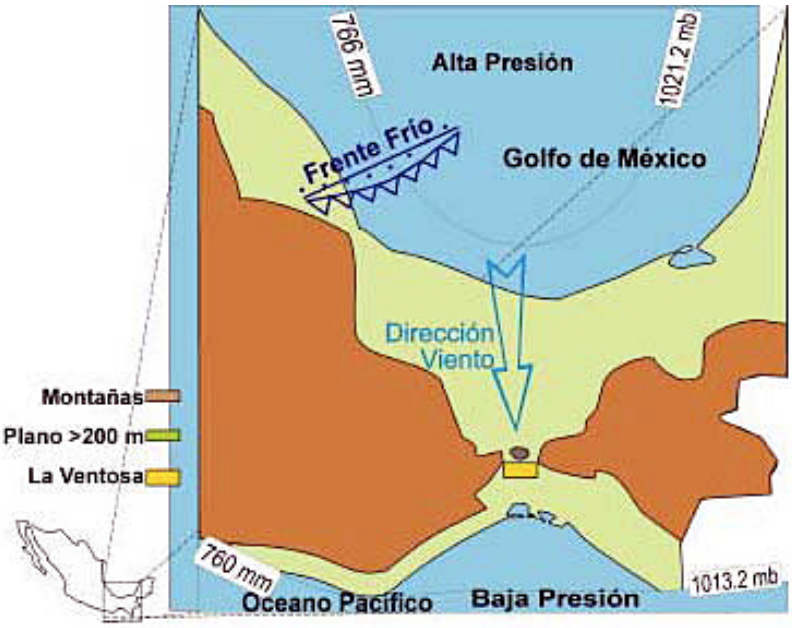

Figure 6. La Ventosa wind farm developed and operated by Iberdrola Renovables with Gamesa wind turbines. It is located at the Isthmus of Tehuantepec known for its substantial wind resources.

The town of La Venta lies in an isolated region of the state of Oaxaca. It is one of the world's most continuously windy spots. In a world seeking alternative energies, a "wind rush" reminiscent of the "gold rush" and the "oil rush" is sweeping the Isthmus of Tehuantepec.

Wind energy companies have plans for wind farms to power the industrial activities in the area. A push to acquire large tracts of land ensued. The "wind rush" for land farmed by locals since ancient times has divided the indigenous population over money, land rights, and changing values. The villagers' distrust of outsiders has led to increasing unrest throughout the Pacific edge of the Isthmus of Tehuantepec for years. Around the Laguna Superior area, it has spawned a paralyzing blockade of one village by another and in October 2011, a deadly shooting at a demonstration.

The first town to have wind turbines installed was La Venta with a population of 2,000, north of Laguna Superior. For those without land, such as restaurant owners, the development has been a boon providing them with lucrative job opportunities.

On the other hand, for those with land, such as farmers, the economics are complicated: Most of the land is communally held by the Zapotecs; the dominant indigenous group in southern Mexico. The decisions to lease land to the developers are made by the local leaders, but

the prices paid for individual land parcels are a patchwork of different values that have led many farmers to feel cheated where turbines are already up and running.

Many locals who surrendered land are illiterate and not very savvy about the process. They had meetings with developers who informed them that they could continue farming around the installed wind turbines. They were surprised to see large turbines installed across their land. Some feel that their land was permanently damaged by construction or that they are no longer allowed on it. Others say they were pressured to sell land rights for a fraction of their worth and that the community leaders got better deals for their land.

The first person or two that acquiesces gets the equivalent of $8 per m^2; a hundred times better contract than the other people in line. About 98 percent of the farmers who sign afterwards sign on for rock-bottom prices. Those few people who acquiesces first become sales-people in the employ of the developers to sell it to the rest of their neighbors. Some community leaders were flown by the developers to Spain on tours to working wind farms.

HISTORICAL PRECEDENT

The Isthmus of Tehuantepec has a bitter history with outside investors. In the late 1800s the USA eyed it as a potential passage to Asia, and later as an alternative to the Panama Canal. In the 1990s, community groups fought off a Japanese project to build a shrimp farm in the shallow lagoon. The state-run oil company Pemex crisscrossed the region with pipelines that have leaked petroleum.

Most of the Isthmus of Tehuantapec's communal land cannot be sold, so companies lease it instead. A standard lease contract lasts for 30 years, with automatic renewal. Developers in La Venta pay a 1/3 to 1/6 of what energy developers pay in, for example, southeast Wyoming in the USA. In the USA, landowners are paid royalties either as profit-sharing or a flat fee based on how the land is used for turbines installation, access roads, or power lines. In the state of Wyoming, a landowner may lease hundreds or thousands of acres to a developer for tens to hundreds of thousands of dollars. In the Isthmus of Tehuatepec, most farmers control only 2-20 acres. If a turbine does not luckily land on one's plot, the payout may be a meager $300-400 per year.

Profit sharing in developed countries runs close to 5 percent. In the state of Oaxaca the market rate is determined to be 1 percent. Pre-neal, a Spanish company developing a wind farm in the area pays landowners 1.4 percent of the electricity profits. Ac-ciona, another Spanish wind company working there, pays the equivalent of 0.5 percent of the net profits

In the state of Wyoming in the USA, landowners retain the right of ingress and egress to access their land. In Mexico, the locals can lose the ability to work their small plots of land, either by being denied access or because turbine construction would have destroyed the irrigation ditches.

The community becomes divided. Anti-wind power graffiti covers the walls of La Venta. Some people who got a fair deal complain that their children are deserting the region because there is no future on the land. On the other hand, wind farm advocates say that the benefits go beyond just direct payments. Wind farms bring much-needed peripheral job opportunities.

Opponents organized demonstrations to protest La Venta's wind deals. In October 2011, unrest turned deadly: A group of wind turbine contractors returning home from working on a project ran into some anti-wind power protesters blocking the highway. Arguments led to rioting, and a contractor ended up being shot dead.

South from La Venta the shores of Laguna Superior are dotted with the fishing villages of the Huave people. They have dwindled to a population of less than 20,000 people. The lifestyle in this area is different from that of the north: Dirt roads and thatched buildings with high walls to protect from the wind, prevail.

It must be recognized that he wind is considered as sacred at these location in Mexico. Local residents believe that the wind from the north is like a man and the wind from the south is like a woman. And so you must not disrespect the wind. The wind is here considered personally as a spiritual force. Local belief has it that the "male" wind from the north shaped the land while the "female" wind from the south brings shrimp their main food staple and livelihood.

In 2004, the Spanish company Preneal proposed a 300 MWs wind farm on 4,000 acres in the town of San Dionisio. The company had approached the Mexican government to set up offshore turbines in the lagoon, but the government demanded 7 percent of the energy profits. Preneal then approached the town that is composed of two villages, Pueblo Nuevo or New Town on the mainland and the smaller Pueblo Viejo or Old Town on an island attached to land by a thin sandspit. Pueblo Viejo is perfect for turbines, offering offshore conditions in constant wind without having to install the turbines in the water. Preneal offered the town 1.4 percent of profits, in addition to $500,000 per year for the right to use Pueblo Viejo land. The company suggested to the town assembly that the crucial shrimping industry might be hurt if the company was forced back to its plans to build wind turbines in the lagoon. The town assembly unanimously voted to allow a wind farm on town land. Money began flowing to the assembly members, but none reached the people who will host the turbines. There have been no payments to the rest of the community. Preneal's point of view is that it paid the town assembly, and is not responsible for the distribution of the money.

The Mexican law requires "free and informed" consent for land acxquisition. Preneal promised that the turbines would only go on an isolated sandspit alongside the fishing grounds, but the contract clearly covers the whole island.

James Anaya, the UN Special Rapporteur on the Rights of Indigenous Peoples likens land acquisitions in indigenous areas to colonial-era models of land grabs. Looking at the land deal in Pueblo Nuevo and Pueblo Viejo, he asserts: "No Spanish or any other company would go to the bargaining table on a technical issue without their [own] technicians. And [yet] they expect indigenous people to."

REVIVED OLD RIVALRIES

The wind farms have revived old rivalries. The most divisive and complex fallout from the wind farms is in Santa Maria and San Mateo del Mar, which are two Huave towns sharing a Manhattan-size peninsula. For generations, the two towns have feuded over a strip of land that Santa Maria owns but that the more traditional San Mateo considers as sacred. The village of San Mateo del Mar is renowned among archaeologists for the purest existing form of the Huave culture: Women weave and wear bright huipil or blouses, and men fish from land with nets connected to kites. Roman Catholic priests establish partnerships with the shamans, who worship the natural forces, such as the wind. When Santa Maria sold the rights to the contested land to build devices that harness the wind, San Mateo snapped. Following a series of violent confrontations, San Mateo blockaded the only road to the mainland, trying to starve its rivals.

The wind farm construction in Santa Maria is going ahead, with turbines delivered by boat. However, Preneal will not do the work. It sold, for $89 million, its development rights of

the land in San Dionisio and Santa Maria to an Australian investment company and a Coca-Cola bottling franchise. The partnership says that the disputed land would not be developed. Regardless of who builds them, wind farms are now a permanent fixture on the Isthmus of Tehuatepec.

OPPOSITE PERSPECTIVES

At some point the state of Idaho considered the establishment of a wind power moratorium. At Bonneville County, Idaho, state lawmakers considered a bill that would prevent the construction of any new wind farm for two years.

Dozens of new wind turbines had gone up on East Bench just outside the city of Idaho Falls, Idaho, but many of the neighbors and their legislators desired to place a temporary end to new construction. When the legislature adopted an 2007 energy plan, it did not envision so many energy companies desiring to build wind farms in Idaho.

Local governments needed some direction as to what should be included in some of their ordinances, recognizing some of the wind impacts. One issue is that wind power is not the cheapest way to produce energy yet, and lawmakers want to make sure their constituents do not have to pay top rates for electrical energy.

Some lawmakers were concerned about the environmental effects of construction in pristine wildlife areas. In the UK, part of the planning permission is that above-ground work must be removed after the life is over, but the concrete foundation can be left in the ground, even though carefully-written farm leases require the removal of all equipment and foundations and the restoration to an approximate original grade.

This is opposed by landowners and local farmers who receive lucrative royalties from the power companies. They suggested that a moratorium would limit businesses wanting to come into Idaho, with Southeastern Idaho and Southern Idaho having a substantial wind energy potential.

DISCUSSION

Many countries are trying to start domestic wind industries. Developing countries are energy deficient and they do need electrical power. Wind power is amenable to providing them with local technological development and job creation.

Wind turbines must be built to be very light as the wind loading fluctuates constantly, continuously stressing the machinery resulting to a low time to failure. This should be factored into the designs, maintenance schedules, cost estimates, as well as in their replacement and decommissioning times.

Carefully-written wind farm land leases call for the removal of all equipment and foundations and restoration to the approximate original grade. In some unfortunate cases these leases were not honored as the companies involved went bankrupt, causing an unfortunate backlash against wind power production. A simple remedial alternative is to require an escrow account financed by the wind turbine income to be established with an independent financial institution for the eventual decommissioning of the turbines and the associated access roads, foundations, electrical cabling and steel equipment after the 20 years useful lifetime of wind turbines.

Improved wind turbine design should allow them to operate under high wind conditions up to 100 mph, when wind energy is readily available, with a factor of safety of three. They should be operable with a low cut-in wind speed. They must be provided with energy storage capabilities to be independent of a blackout condition on the grid. Balancing weights would consider rotor blades to be emplaced at both ends of a horizontal shaft. Shorter rotor blades should be considered with operating tip speeds that are below their stress limits. Automatic lubrication or lubrication from the ground level would avoid the need to perform maintenance under hazardous conditions of height or windy days. A partially ducted wind turbine may be capable of accelerating the wind passage of the wind-stream through the turbine. Fully ducted wind turbine designs like a gas or steam turbine may be more efficient in extracting energy from the wind stream.

Energy storage alternatives must be implemented to overcome the intermittent nature of wind and solar sources. Power grids with sufficient capacity to dispatch the available power over long distances using High Voltage Direct Current (HVDC) of power transmission need to be constructed and added to the electrical grid.

From a different perspective, to accommodate a larger market penetration of wind, solar and other renewables, the base-load alternatives such as nuclear plants must be redesigned to become load followers, so that they can be throttled down when the wind blows, or the sun shines.

REFERENCE

1. Erik Vance, “The ‘Wind Rush’: Green Energy Blows Trouble into Mexico,” The Christian Science Monitor, January 26, 2012.