

How to save money, create jobs and protect the climate

Tunisia has vast renewable energy resources. A key issue would be to shift power supply from costly gas imports to cheaper domestic renewable energy. In giving legal access and economic security for wind farms by a transparent legal framework, Tunisia could save 500-800 million Tunisian Dinars per year (240-360 million Euros) on power generation costs, and in the long run much more.

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This spring, the Tunisian Parliament discusses a draft *Bill concerning the production of electricity from renewable energy* [1]. Energy reforms adopted in a rational manner could relieve the strained Tunisian government where ten percent of the national budget was spent on energy subsidies in 2012, and with costs rising [2]. A key issue would be to shift power supply from costly gas imports to cheaper domestic renewable energy, especially wind power and solar which are conceived as being competitive with conventional energy from gas today [3],[4] [5] [6].

Natural gas costs increasing

More than 95 percent of Tunisian electricity was generated from natural gas and 47 percent of natural gas was imported from Algeria in 2012 [7]. The Tunisian Company of Electricity and Gas (STEG) has to purchase this gas at international market prices. Gas resources of Tunisia are in decline; the public Tunisian Company of Petroleum Activities (ETAP) is obliged though to deliver domestic natural gas to STEG for one tenth of the price of imports. This fact represents another source of subsidy because domestic gas production could be exported or used for road transports substituting gasoline imports provided that power generation could be based on renewable energies instead of natural gas.

In the European Union natural gas production is in steady decline since 1996, and decline is accelerating [8]. On the back of the Russian/Ukrainian gas crisis, demand for natural gas from across the Mediterranean Sea is surging, and this comes at a price.

In Tunisia, the natural gas price stood at 539 Tunisian Dinars (DT) in 2010 per ton of oil equivalent (TEP), increasing to 851 DT per TEP in 2013, a rise of 58 percent within less than four years.

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Cost of electricity increasing

Increasing costs for gas translate directly into higher generation costs for electric power. The real cost of electricity in Tunisia stood at 259 millimes DT per kilowatt hour (11.8 €/kWh) in 2012, up from 180 in 2010 [9].

Retail prices however have been raised only slightly from 125 Millimes DT in 2010 to 133 Millimes DT (6,04 €/kWh) in 2012; the effort to keep electricity prices down represents a heavy burden for the Tunisian national budget.

Subsidies for energy in 2013 stood at 5200 million DT (2.6 billion Euros) whereof 41% went into the electricity sector [10]. The additional budget deficits are undermining the creditworthiness of Tunisia and its competitiveness. Rising budget deficits could imply higher interest rates for investments and an additional burden for the private sector and for the consumers.

Expensive power generation from gas

Natural gas plants in Tunisia generate electric power at an overall efficiency of 37 percent, according to official data from the energy ministry. This means that almost 3 kWh of

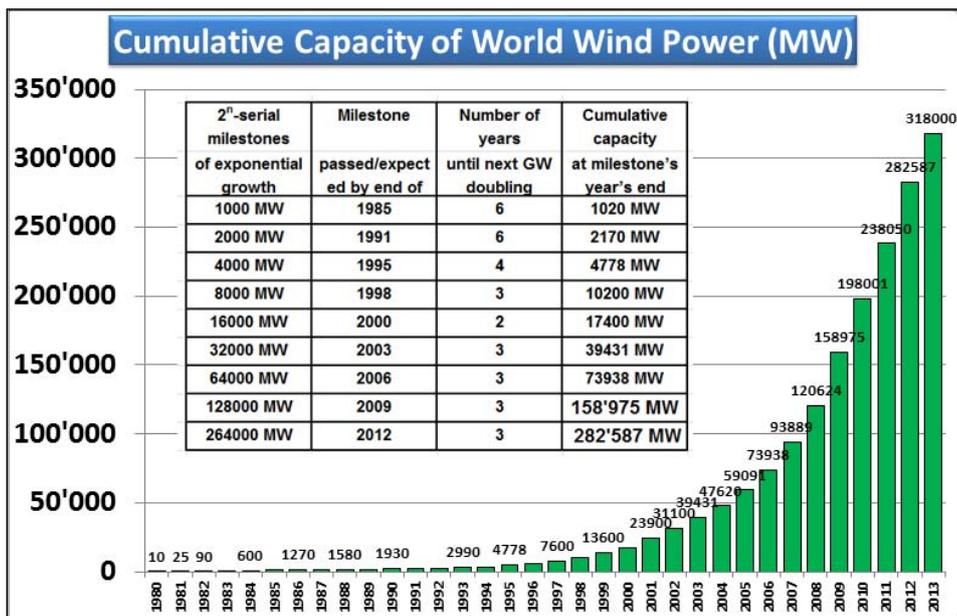


Figure 1 Global wind power capacity is doubling every three years since 1995 (source: GWEC)

natural gas have to be burned to create 1 kWh of electricity.

Since 1990 electricity consumption in Tunisia tripled from 5 Terawatt-hours (TWh) to 15 TWh at an average growth rate of 5 percent per year. Since 2000 domestic oil and natural gas is unable to satisfy domestic demand. Without renewable energy, every additional kilowatt hour of electricity consumed has to be bought from Algeria by importing natural gas at international prices.

50% cheaper than gas: wind power

An alternative to the high cost of electricity from imported natural gas would be to connect modern wind farms to the grid. Tunisia has vast wind resources which have been estimated at 8000 MW [11]. Together with abundant, sparsely populated areas in the desert, wind power production could easily exceed domestic power demand, leaving room for exports to the European Union.

Experts from German International Cooperation body GIZ estimated wind power generation costs at between 4.5 and 5.4 €/kWh (96 Millimes DT/kWh) [12]. Wind power production costs would be just half of the cost for electric power from imported natural gas.

Due to recent progress with longer blades and higher wind turbine towers, wind power systems have increased their efficiency considerably over the last 3-4 years. This directly translates into lower costs.

Brazil, Uruguay, Jordan

There are a number of recent examples how renewable energy can soften the cost of electricity generation.

– A country realizing generation costs between 4.3 and 4.7 €/kWh is Brazil where state-controlled Brazil National Development Bank (BNDES) finances wind power investments.[13]

– Uruguay in Latin America had only 50 MW of wind power by the end of 2013. Constructions are in the works to lift this number to 500 MW in 2014 and 1600 MW in 2016. “Wind is the most mature technology, has reasonable costs and a clearly important potential in Uruguay,” said national director of energy Ramón Méndez. "For us, the price of wind energy is very convenient, between \$0.04 and \$0.05 per kilowatt hour. We have no grants for renewable energy or for any form of energy; there are only tax incentives related to the development of national components. Those who offer the best prices have a guaranteed power purchase agreement, a 20-year contract with the state-owned electricity distribution company." The state-owned National Administration of Power Plants and Electrical Transmissions UTE, is the sole electricity distributor in

Uruguay. "As a result of the introduction of renewable energy in our country, far from increasing energy prices, as has happened in Europe, it has reduced costs. And all this transformation is allowing us to lower our power generation costs by 30%," Méndez said. [14]

- Another example is Jordan. On April 27, 2014 a groundbreaking ceremony officially kicked off construction of a 117 MW wind power plant at Al Tafilah. It is said by its proponents that it will produce clean electricity at half the cost of Jordanian conventional power. [15] Even with market based commercial credits, wind power can offer much cheaper electricity for Tunisia over the long run than with power from gas.

France

France introduced feed-in-tariffs for wind power in 2008. Investors in France receive a guaranteed price of 8,2 €/kWh for at least ten years. After ten years the tariff is maintained or reduced up to a low 2.8 €/kWh for another five years depending on the site specific productivity of the turbine [16]. This flexibility of tariffs after a number of years can be found in many countries. Its goal is to provide appropriate compensation without excess profits. By doing this, sites with lower outputs – that often are less distant of consumers and loads – remain profitable. In many cases there is a trade-off between maximum wind speeds and interconnection costs; therefore it makes sense to have compensation schemes favoring sites with more modest wind speeds, but at smaller distance. The number of usable sites can be increased considerably and conflicts over siting may be eased, compared to compensation schemes where only the most profit-yielding areas would come off as a winner.

Algeria

In April 2014, Algeria has introduced feed-in-tariffs for wind power with a similar structure but slightly higher payments per kWh and over a longer period than in France. The price guarantees are valid for a period of 20 years. For small installations with less than 5 MW a uniform tariff for the first

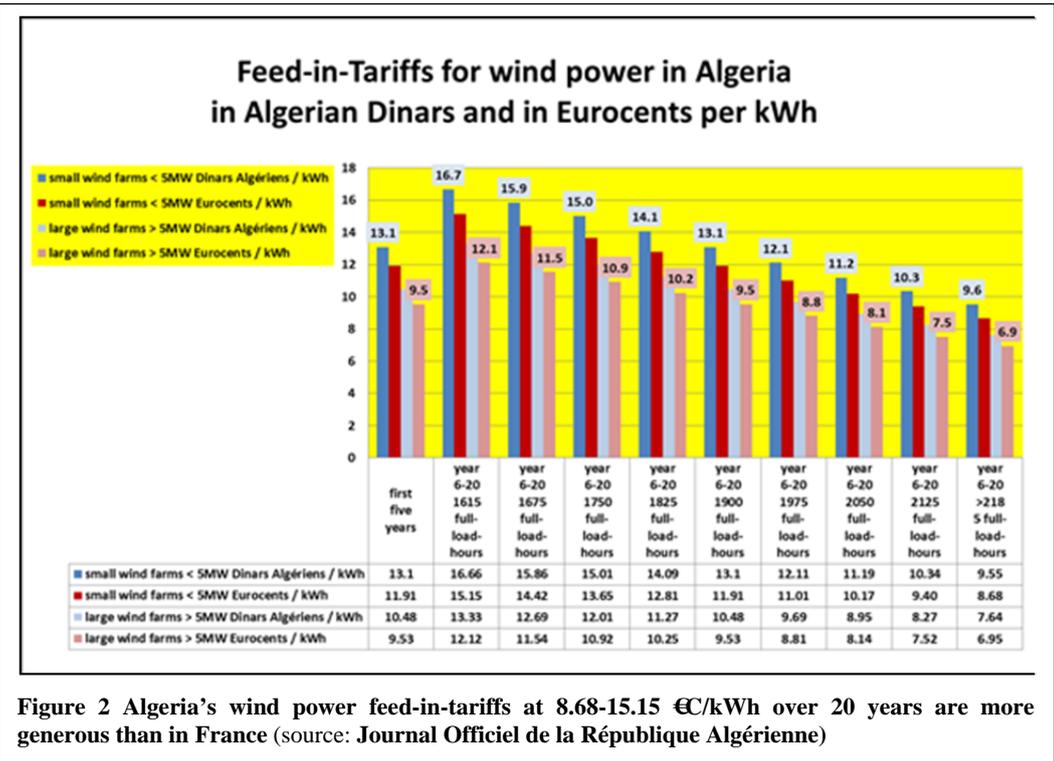


Figure 2 Algeria’s wind power feed-in-tariffs at 8.68-15.15 €/kWh over 20 years are more generous than in France (source: Journal Officiel de la République Algérienne)

five years of 13.1 Algerian Dinars (11.9 €) per kWh is paid. This uniform compensation is based on reference turbine output of 1900 full-load-hours. From 6th to 20th year of the installation the price guarantee the price guarantee ranges from 9.55-16.66 Dinars (8.68-15.15 €/kWh) depending on the full-load-hours per year [17].

For large installations with more than 5 MW a uniform tariff for the first five years of 10.48 Algerian Dinars (9.53 €) per kWh is paid. From 6th to 20th year the price guarantee ranges from 7.64-13.33 Dinars (6.95-12.12 €/kWh) depending on the number of full-load-hours per year.

An undisclosed maximum limit of the number of hours paid per year has been introduced. Beyond this limit the price per kWh paid is the same as for electricity from conventional power plants which are cheap in Algeria due to domestic natural gas that is delivered much below international prices. In the regulation there is no reference of a cap for the volume of capacity that can apply for the FIT.

Least cost in the golden end

Wind power facilities normally can run much longer than fifteen or 20 years. Many manufacturers of wind turbines have life extension programs that stretch the life time of wind farms to 30 years and beyond.

Once the initial investment is paid off, generation costs are reduced to pure operation and maintenance costs that range between 1 and 2 €/kWh (22-44 Millimes DT). With the feed-in-tariffs expired, electricity from wind receives the same price on the market as conventional energy, in case there is an electricity market. In countries with a national power company as a unique buyer, a reasonable compensation should be mandated by law. Sometimes a price level of about half of the international price for fuel costs such as imported natural gas can be sufficient to cover the costs of older wind turbines.

No fuel price risks ever

With wind power there is no risk that the cost of wind will ever go up. Tunisia by large has enough domestic sites to create least cost wind parks within a promotional legal

Germany where more than 20'000 wind turbines deliver electric power.

All over Europe, China, The US and Latin America, wind and solar power installations are growing at a very high speed eased by costs dropping for years now, and no fuel expenses. Wind and solar power generation costs in no extent are linked to the rising price of hydrocarbons. Due to longer blades, wind turbines at a given capacity today can run twice as much full load hours per year on low wind sites compared to ten years ago.

Wind power can deliver job opportunities for poor countries. Site preparation such as road and cabling, tower production and building can be managed by domestic industries. Wind farms usually pay a rent to land owners. In many countries neighboring communities can reduce taxes or spend more on education, health or social security due to wind farm revenues.

Tunisia has vast areas with a very low population density that can be used for wind power or solar, provided the legal framework finally would fit. Algeria has given a good example by publishing a law including all payment schemes. By each wind power kWh produced at good sites in a big wind farm at the Algerian rate for wind farms (> 5 MW) Tunisia could reduce its generation costs of 260 millimes DT (11,8 €/kWh) to 210 millimes DT (9.53 €/kWh) and save 50 millimes per kWh (2,3 €/kWh) immediately on each kWh produced by wind instead of natural gas.

After five years, the feed-in-tariff in large farms could be reduced to 152 millimes DT (6.95 €/kWh) which would save some 110 millimes DT per kWh (4.9 €/kWh).

Based on a calculation where wind power would contribute 33% - 50% of overall Tunisian power consumption which stood at 15 TWh (2013) annual savings would be in the order of 500-800 million DT (240-360 million Euros).

These economies could rise even more, once the upfront cost will have been paid down and the turbines end their feed-in-tariff-career. To realize these savings, the legal framework needs adjustments.

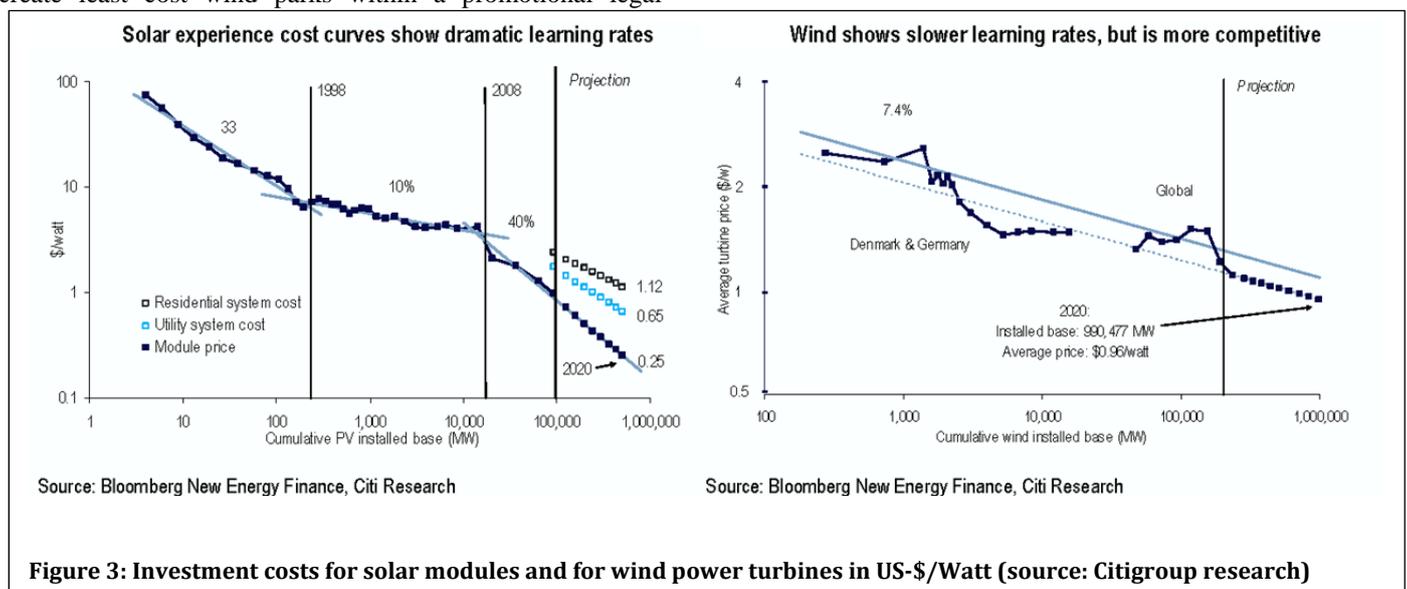


Figure 3: Investment costs for solar modules and for wind power turbines in US-\$/Watt (source: Citigroup research)

framework that can be similar in size to those in France or

Early attempts not successful

Investors need confidence – they will not put their money into wind farms if they risk losing money. The Tunisian draft bill has many good points and should be enacted as soon as possible, but a number of improvements are recommended:

- The feed-in-tariff (price per kWh of wind power and solar) should be published as part of the law like in Algeria.
- The rules for connection costs should be regulated in a fair way by law, too. If it is up to the investors to pay for grid extensions, sites in the desert with best wind resources might stay idle.
- National power company STEG should be free to invest into wind farms, but it should not get a monopoly and the rules for grid access should be the same as for private investors.
- To create a transparent and competitive Tunisian wind industry renewable energy should get legal priority access for grid transport in case of congested grids.
- For fair rules, an independent regulator is a necessity. Conflicts between independent power producers and single buyer STEG should be submitted to independent arbitration.
- Instead of a huge number of permits, investors in renewable energies should be encouraged by priority access rules to the grid and by a one-stop-shop (guichet unique) for legal permission of their projects, with maximum time frames for decisions set by law.

Electric power consumption is constantly on the rise; the energy ministry hence should create a long term planning framework for grid extensions, based on permit requests and investments in wind and solar farms.

STEG should be obliged to use the cheapest power assets first – which normally is renewable energy based on marginal costs of nearly zero – while existing natural gas plants could work as back-up. Additional capital costs for stand-by which are minor could be shared in a fair way.

A previous Tunisia energy law on renewable energy (from 2009) failed, due to insecurity regarding single buyer STEG and lack of transparency. To make a difference, the new bill should come at zero-defect. This means that examples and experiences from other countries should be scrutinized and included in the new law.

The Parliament by law should ask also for regular revision of renewable energy goals such as formulated in the Tunisian solar plan, based on cost experiences and a continuous monitoring of power supply. With these elements integrated in a new legal framework, Tunisia could become a hotbed of wind power. Power deficits could be reduced and exporting renewable energy to the European Union could become a serious choice.

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