

## Turkey's Wind Story : Stages and Drivers

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### Introduction

It is like a tradition to see “Turkish energy policy” articles centered around geopolitics and pipeline politics. However, surrounded by the three seas, this geographically diversified landmass also offers a renewable potential at a substantial scale.

Turkey's 53.422 MWs of installed electricity generation capacity is shared nearly equally between coal, natural gas and hydro resources. The demand growth is over 6% per year. This makes Turkey both an attractive market and an interesting case, particularly in terms of wind power development. Installed capacity of wind turbines has reached 1400 MW without any application for FIT (Feed-in -Tariff). The application volume reached 78.000 MW with a FIT of only 5-5.5 eurocent/kW. And recently wind projects are offering rents per kWh to the transmission operator for connection permits. This article reviews the dynamics of this process.

There are four major trends that will be discussed in this article

1. High demand for electricity and rapid economic growth
2. Spot and day-ahead market development
3. Increasing share of natural gas in electricity generation
4. Marginal prices determined by gas prices

### Introduction

Turkey is one of the founding members of both OECD and IEA (International Energy Agency). It is also an attractive emerging economy with its fostering economy and stable political atmosphere. Between 2002 and 2010, its average annual GDP growth was more than 5 % whereas electricity demand growth was around 6.2%. Including the 2011 statistics these figures are subject to increase since in 2011 both GDP and electricity demand were higher than these averages. On the one hand, there is a growing need for infrastructure investments, on the other hand limited domestic resources translate into bigger trade deficit. In this booming economic environment, there is an ever growing demand for both domestic and foreign financial resources. Naturally, like all the other sectors (transport, telecom, etc) the energy sector is also competing for these resources.

### Turkey's GDP and Electricity Growth

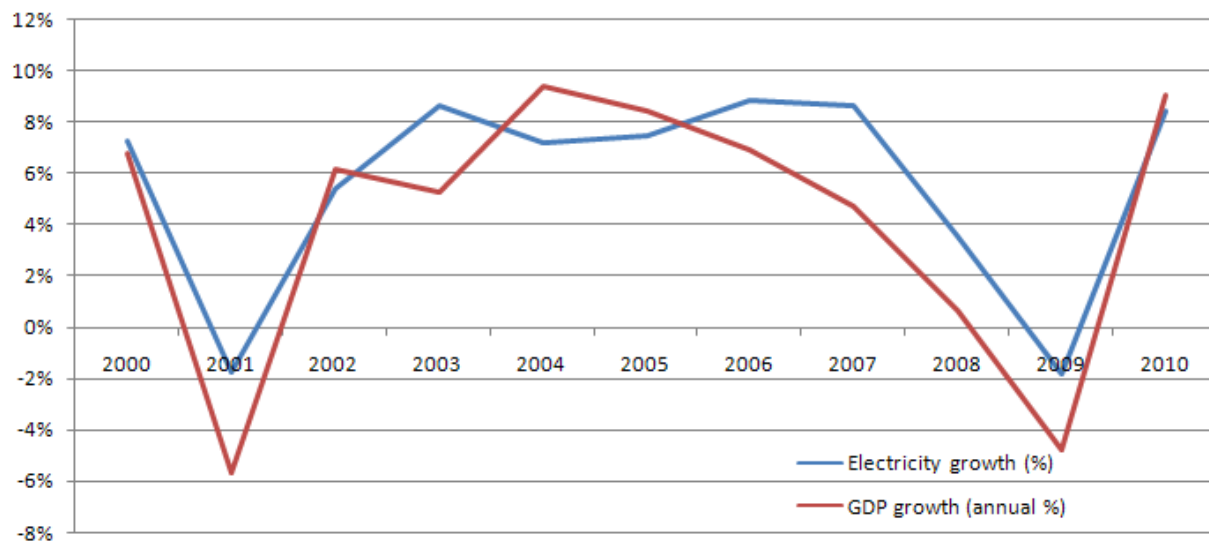


Figure 1 - Turkish GDP and electricity growth rates

The level of investment needed for electricity generation is quite high. Every year Turkish electricity system requires some 3000-4000 MWs(10-15 TWh) equivalent of generation capacity. If this capacity requirement is expected to be met by natural gas power plants, it will cost around \$3-4 billion each year excluding infrastructure investment costs. But if these needs are to be met purely by wind and solar generation units, the requirements in terms of MWs would be 7500-10000 MWs with a cost of roughly \$10-20 billion each year.

#### Wind Story

Turkish on-shore wind potential is estimated to be more than 35000 MW. However, Turkey's modest wind development story was started in 1980's by General Directorate for Electricity Affairs (recently renamed as General Directorate for Renewable Energy). In 1998, first wind turbines began operating in beautiful Aegean coastal town of Çeşme, İzmir. By June 1, 2008, installed capacity reached 249 MWs. By the end of February 2011, it was around 1792 MWs. The dynamics of this rapid development, which are discussed below follow the global trends, the developments in Turkish Electricity Market and its pricing structure.

#### Step 1- Opening the Market

After the completion of electrification of the country by the end of 1980s, the major policy motivation was to match surging electricity demand with enough capacity investments. Between 1990 and 2001, the discussions were centered on financing the projects, increasing the attractiveness of the market and attracting more capital especially from abroad.

We can divide the Turkish electricity history into several parts, but it is relevant for this article to divide it into two parts by taking the year 2001 as a milestone. In the midst of Turkey's most severe financial crises in 2001, the parliament enacted the "Electricity Market Law" (EML). Before 2001, most of the electricity market investments were in government hands. Electricity as a "public service" could only be served by state or within the framework of concessions given by state. These concessions were either BOT or BO (Build-Operate-Transfer). EML established institutions and procedures for private sector to invest in the once state owned electricity sector.

In 2001, (pushed by the free floating of foreign exchange rates) the electricity prices surged since most of the BO and BOT projects were selling electricity to state companies in dollars. This suddenly made the electricity generation business a very profitable business, but since the market was not wholly open (only state permitted BO-BOT projects!), the investors had to wait till 2003.

Two years after the enactment of EML, first licenses were granted to the State Electricity Generation Company (EÜAŞ)'s existing plants. Afterwards, in 2003, we have witnessed the rush of private investors to hydroelectric projects. The road was not smooth, but the economics were there. Then the typical symptoms of liberalized electricity markets, namely dash for natural gas has taken over the trend. The gasification of the market was due to several reasons such as "urge to fulfill take-or-pay contracts (by the government), air quality and meet rapid electricity demand growth".

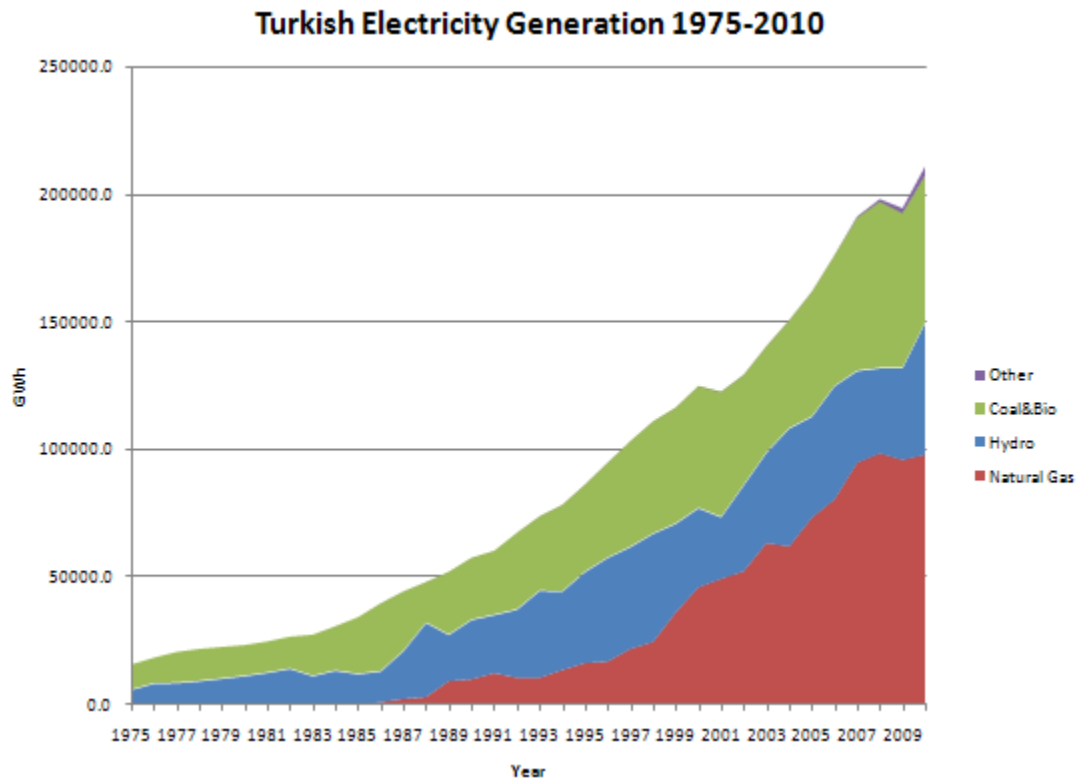


Figure 2- The Turkey's electricity generation 1975-2010

In 2005, Renewable Energy Law (RewEL) has been enacted by parliament. The law reflects the economic crises days of 2001. Neither the parliament nor the bureaucrats were ready to give away generous FITs. Instead, it was settled to be determined between 5-5.5 eurocent, limits given by Turkey's average whole sale electricity price.

## Step 2 - Blackout and PMUM

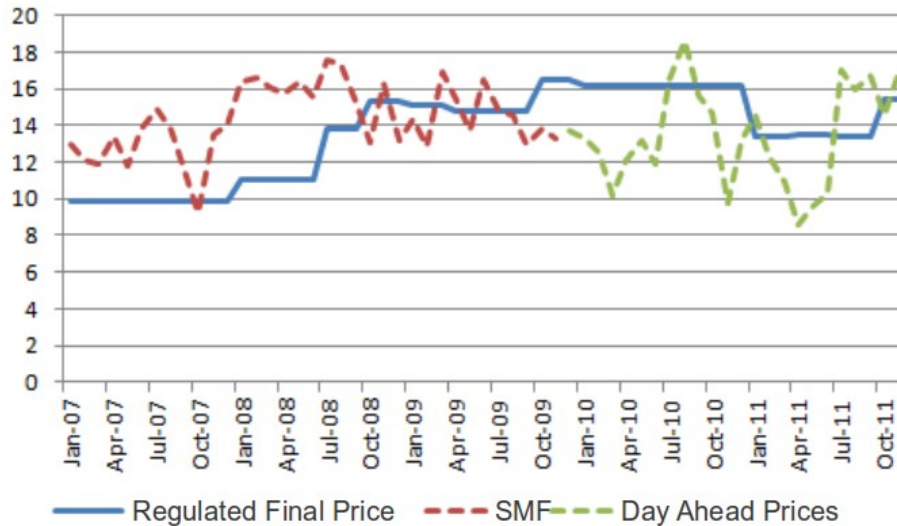


Figure 3- Regulated and System Marginal Prices (Ref: Izak Atiyas)

In addition, electricity prices were frozen between from 2002 to the end of 2007 even though oil, natural gas and other commodity prices continued climbing. Therefore, while the cost of natural gas increased electricity prices stood at the 2002 level. On July 1, 2006, a regional blackout has changed the way Turkish electricity market was functioning. The reason was not the lack of capacity nor it was purely technical. Rather, it was rooted in the price change between peak and off-peak hours. Indeed, a large amount of auto producers shifted from production to consumption as the peak hours and prices (17:00-22:00) were replaced by off-peak hours and low prices after 22:00. Interestingly the blackout occurred at around 22:00 o'clock (the end of peak hours and the start of off-peak hours), when most of the Turks gathered for Brazil-France world cup football game.

The blackout of July 1<sup>st</sup>, 2006 has started much earlier but the biggest impact occurred around 22:00. It affected most of the western Anatolia including, Bursa, İzmir, Çanakkale and even Antalya. It took not less than 2 hours, and even longer in certain regions. The chain of events started due to a problem at a major natural gas plant in Bursa. The technical details were huge, but one of conclusions was the fact that the problem was not rooted in underinvestment but price dynamics. While generating electricity from natural gas costs 10-12 krs/kWh, no one wanted to produce during the off-peak hours at 9 krs/kWh in state dominated market.

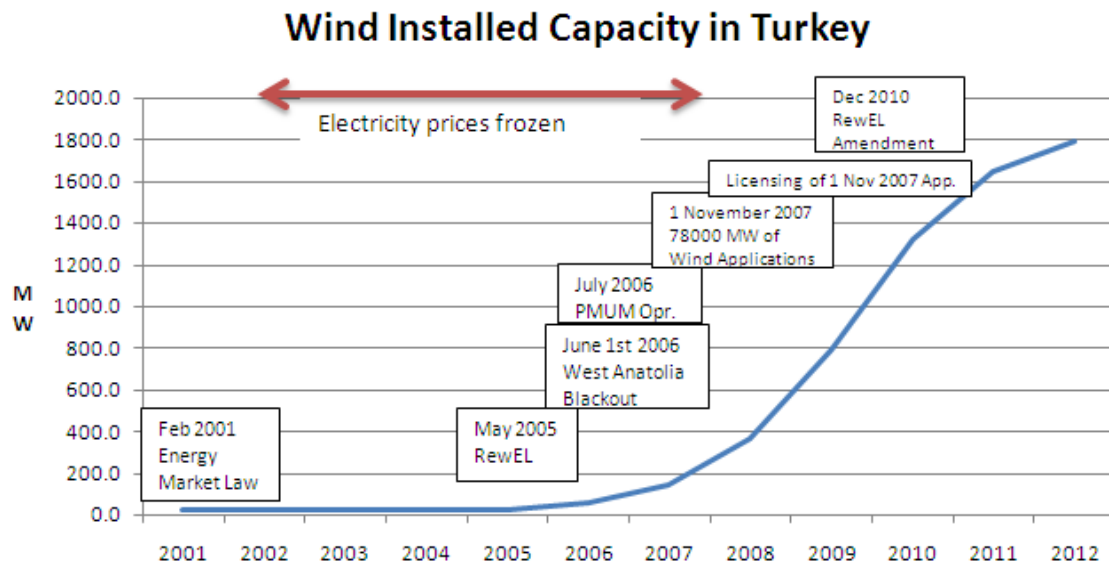


Figure 3 – Change in wind capacity and major events

The wind story has changed from this point on. The wind power was around 50 MW by the end of 2006. After the event, PMUM (Market Financial Settlement Center-organized wholesale market - spelled Pu-MuM) under the Turkish transmission operator (TEİAŞ) has been launched. Initially, PMUM worked as a spot market, without day-ahead prices. So anyone (generally state owned companies) that couldn't balance its demand by bilateral contracts would buy the imbalance according to the prices formed at PMUM. The effect was felt quickly. In 2007 when prices for distribution companies (still state owned) was 9.8 kr/kWh, the prices at PMUM was around 11-13 kr/kWh, nearly 33% higher than state dominated market. The dominant buyers from the PMUM were also state companies.

During that time FIT for renewables was 5-5.5 eurocent, around 9 kr/kWh. Since the PMUM prices were hovering around 11-13 kr/kWh, suddenly selling in the PMUM was a major solution and motivation. And wind power plants were not responsible for forecasting or related costs, too.

The operation of PMUM has changed everything. Despite occupying 20% of the volume of daily electricity demand, suddenly there was a market for private companies to sell electricity in an organized liberal market with higher prices reflecting the costs of natural gas. Since Turkey generates 50% of its electricity from natural gas. The marginal price at the PMUM was generally affected by natural gas power plants. Especially during the drought years (remember that a third of the Turkish electricity generation capacity is hydro), the price formation was nearly at the mercy of natural gas prices. It should be noted here that Turkey

imports virtually all of natural gas it consumes, mainly from Russia, Azerbaijan, Iran, Algeria and Nigeria.

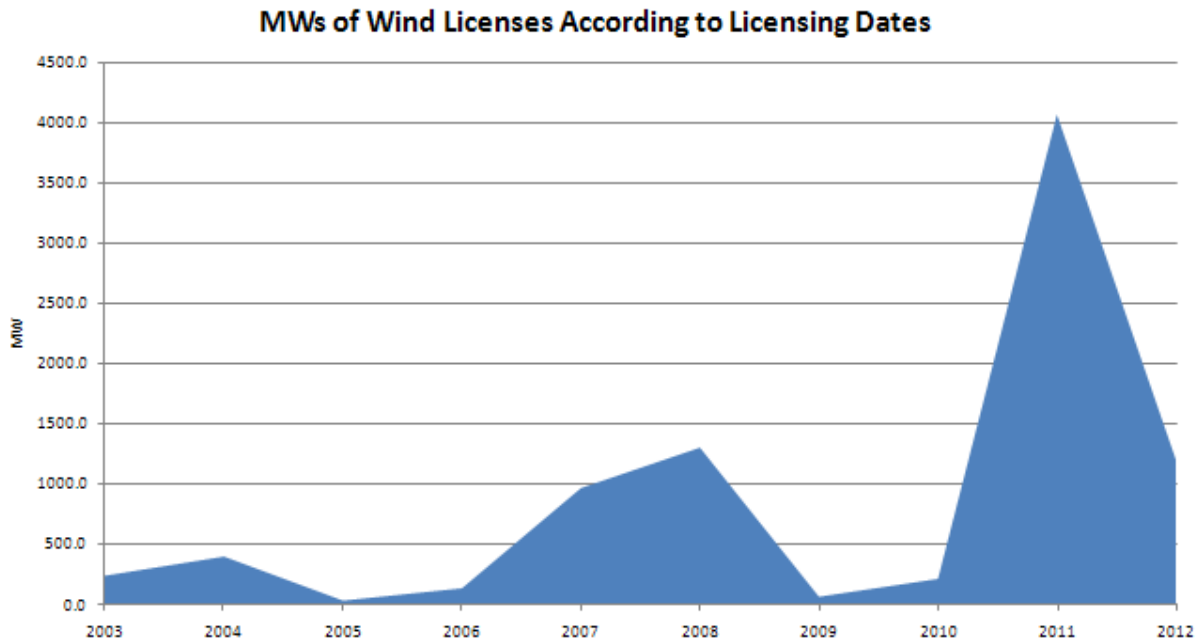


Figure 4 – Licensing of wind applications reflects the developments of 2007.

In order to be able to understand the effect of PMUM, one has to look at the graph above. While the RewEL of 2005 has not boosted the applications for wind, after PMUM's operation, regulator has been overwhelmed by applications of 78000 MWs on a single day in November 2007. But these licenses were granted by 2010 and 2011.

Licensing procedure in Turkey takes around 6 months to 2 years. Prior to 2009, Environmental Impact Assessment (ÇED) was not part of the license, the applicants used to get the assessment after licensing. Council of State (Danıştay) ordered ÇED process to be completed before licensing procedure. Before 2009, licensing procedure was much shorter, but ÇED had to be completed after granting of license. After 2009, ÇED process has been included to the licensing procedure.

It will be safe to say that there are around 3000 MWs of projects to be completed before 2013 (4-5 year expropriation and construction times). Afterwards there will be a brief silence, whereas by 2014 another capacity surge is expected to happen.

### **Step 3 - Dealing with Dash for Wind - 1 November 2007 Applications**

By November 1st, 2007, for a single day, Turkish market regulator (EMRA) opened the applications for wind projects. Previously, applications were closed in May 2006. A massive 78000 MWs of applications poured in but it will take 3 more years to license these applications. The so called "1st November Applications" (1 Kasım Başvuruları) projects were problematic because of lacking analytical analysis including measurements, conflicts due to same transformer connection requests, overlapping project areas, and other legal problems.

Most of these problems were more of a legal challenge than an engineering one. Applicants with their lawyers were ready to sue the regulator and transmission company. To sort out the 78000 MWs of applications, policy makers decided to organize bids among applicants for the capacities. In 2010, transmission operator issued a regulation for the competition for wind energy applicants.

The competition procedure was simple. Transmission operator would issue the available capacities for each substation and every applicant had to apply to the nearest available capacity. If the capacity is enough for all applicants, no competition would be carried out. But if the applications are higher than the capacity, the applicants had to bid for the capacity. The bidding would be in kWh (krş/kWh) and escalated every year of operation for 20 years according to CPI.

Around 6663 MWs of capacity has been competed for a capacity of 5500 MWs. For these 5500 MWs, a weighted average of 1.9 krş/kWh (1.1 \$cent/kWh) has been offered by winners to the transmission operator for every kWhs they would produce.

The installed capacity of 1792.7 MWs now (March 2012) does not include any of the "1<sup>st</sup> November Applications" (1NA).

### **Road Ahead**

In May 2009, "Electricity Energy Market and Security Supply Strategy Paper" published by the government outlined the targets for the future electricity market structure. Among them was the wind generation capacity of 20000 MWs by 2023, the 100<sup>th</sup> anniversary of the Republic of Turkey.

In the last days of 2010 and in the early 2011 several amendments to RewEL has been made. This time the incentives for renewable resources have been separated depending on the renewable resource type. The law has 2 tables. The first one is the incentives according to renewable energy sources. The second one is the addendum to the incentives in Table 1 for the domestically produced parts. For example for wind energy, generator and power electronics add 1



\$cent/kWh, tower adds 0.6 \$cent/kWh and mechanical parts 0.8-1.3 \$cent/kWh to the FIT of 7.3 \$cent/kWh for wind. Table 1 is applied for 10 years, whereas Table 2 can be added for at most 5 years.

Renewable Source	Prices (US\$cent/kWh)	Domestic Part	Addition to Table 1 (US\$cent/kWh)
Hydro	7.3		
Wind	7.3	Blades	0.8
Geothermal	10.5	Generator and Power	1.0
Biomass	13.3	Tower	0.6
Solar	13.3	Rotor, nacelle parts	1.3

Table 1 - Renewable Resource

Table 2 - Domestic Component Support for Wind

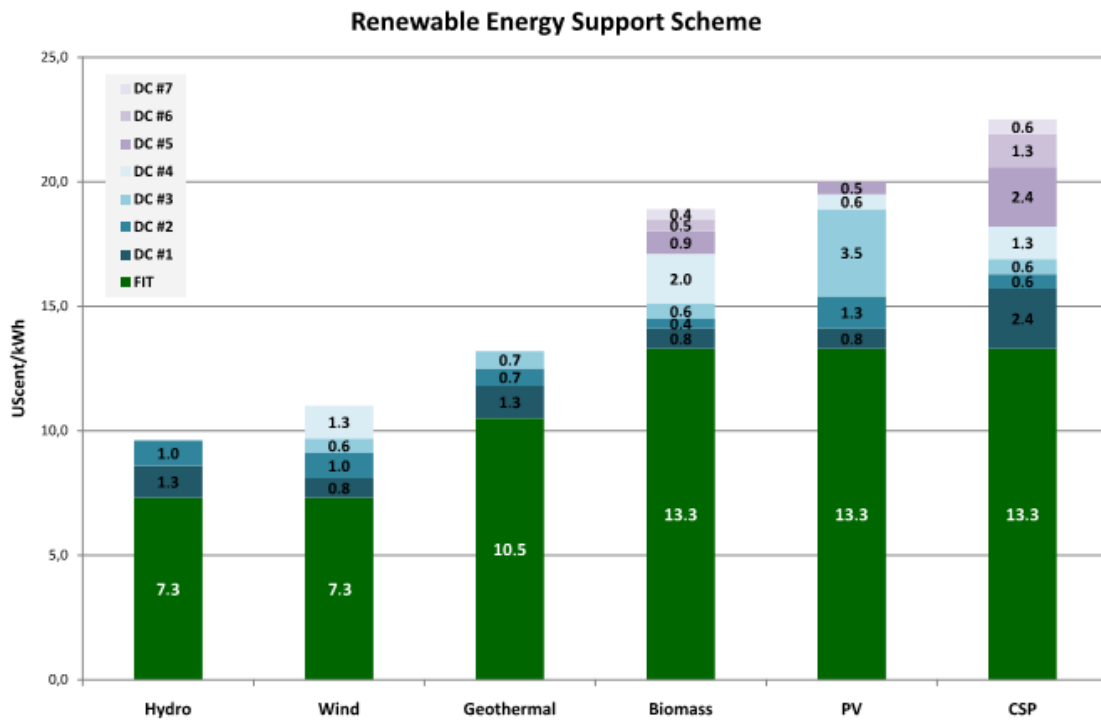


Figure 5 - FIT and DC (domestic component) addition (EMRA-Energy Investor's Guide, 2011)

## Conclusion

The whole story boils down to the following lines. Turkey has a young, energetic and dynamic population. Its industrial base and growing middle class is the engine for infrastructure needs and demand growth. Electricity is one of them. Every year 3000-4000 MWs (10-15 billion kWh) of new generation capacity is needed.

Electricity market itself was reformed after 2001. Yet, the price controls were not relaxed instantly. After the blackout of 2006, PMUM was put in operation in order to open the path for market price formation. Initially, the mechanism was not designed for day-ahead prices but for system marginal prices. It worked like a spot market. However, the prices formed at PMUM were 30% higher than state controlled prices, enough to motivate investors. Roughly this was 8 \$cent/kWh at that time, which is highly correlated with the natural gas prices.

The 2005 version of RewEL has paved the way for FIT that is between 5-5.5 eurocents.(7-7.7 \$cent/kWh.). Practically, no one applied for this FIT. However, PMUM itself has become the new incentive for wind developers. They could sell at PMUM without any risks for balancing with an average income of around 8 \$cent/kwh, approximately the average cost from natural gas plants. A rush for wind happened, not because government offered luxurious FITs but because relatively high natural gas prices were determining the marginal prices.

As the demand increases 6-7% per year, it is certain that natural gas prices will be the key determinant of whole sale prices. When prices at the wholesale market are driven by natural gas prices, wind power plant owners are more likely to reject FIT and sell in organized wholesale market, PMUM.

As the Turkish electricity demand continues its rapid growth and natural gas dominates the electricity generation, wholesale prices will closely follow the natural gas prices. As the natural gas prices increase, so do the wholesale electricity prices. Higher wholesale prices, in turn, give an attractive message to the renewable energy investors. In the end, Turkish experience humbly demonstrates that renewable energy market is standing on the shoulders of natural gas prices...

### Note:

The opinions and conclusions expressed in this article are the authors' and do not necessarily represent those of the insitutions they are affiliated with. We would like to thank Yücel Yaman for his valuable contributions.

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