Overview of Lignite in Turkey

In recent years, parallel to climbing energy demand, energy investments gained momentum in Turkey. According to today’s paradigm, energy is not only a basic need but also a political, strategic and environmental issue. Considering all of these, Turkey should plan the capacity developments under the aim of cheap, secure and environmentally friendly energy procurement.

Considering its geographical position, utilization of lignite sources seems to be a remedy for Turkey’s increasing foreign dependency on imports. Since electricity generation from imported coal and natural gas constitutes approximately 60% of the total generation, use of local sources play an important role for easing this foreign dependency.

LIGNITE USE BREAKDOWN OF TURKEY

As it can be seen from the Graph 1, the main consumption area of lignite is the electricity generation sector, by covering 80% of the total. About 8-9% of the rest is consumed for heating purposes and the remaining amount by industry.

**THE ROLE OF LIGNITE IN ELECTRICITY GENERATION**

As of February 2014, installed capacity of lignite firing power plants is 8,180 MW and this constitutes 12.7% of the total installed capacity. In terms of the share in total generation, lignite firing power plants supplied 12.2% of the total generation in 2013. Graph 2 represents the yearly development of the lignite firing power plants:

It can be clearly observed that in recent years there is no significant change in the installed capacity. Most of the lignite power plant capacity is operated by EÜAŞ and its affiliates. Together with the privatization of Seyitömer and Kangal power plants, private sector operates ca. 1,700 MW of the total installed capacity.

In order to have a grasp about the geographical spread of the lignite fired power plants and appropriate lignite fields for electricity generation over Turkey, Figure 1 can be studied.

Especially Inner West Aegean regions distinguish themselves with vast lignite fields and corresponding power plants. Moreover, Konya Basin and Afsin-Elbistan, which is located in Kahramanmaras, contain the largest lignite fields and therefore, it can be said that both locations embody a very high potential in terms of lignite.

Lignite fired power plants are appropriate for base load generation considering their technology and marginal costs. Therefore, they are expected to operate with high capacity factors. Capacity factors of the power plants in 2012 highlight the fact that Yeniköy, Seyitömer and Soma power plants operate under relatively higher capacity factors while other power plants contribute to generation with lower capacity factors due to aging technology, and problems related to lack of investments. Impacts of investments realized by private sector are expected to be observed in terms of efficiency and capacity factors for privatized plants.

As the capacity factors of EÜAŞ and its affiliates are analyzed for the period between 2007 and 2012, Afsin-Elbistan A power plant’s very low capacity factor (29% on average) becomes striking. Lacking rehabilitations on boilers, turbines, generators and electro filters, and design mismatch of the lignite contained in the basin and the equipment are believed to be the main reasons for such low capacity factors. On the other hand, Kangal Power Plant is expected to realize the necessary rehabilitation investments through its new private owner and therefore, capacity factor of this power plant is expected to rise in the near future. Another remarkable fact is

According to 2012 Lignite Sector Report of TKİ (Turkish Coal Enterprises), proven reserves are around 13.4 billion tones. If the ownership of these are analyzed, EÜAŞ (State Generation Company) owns 7.6 billion while MTA (Gen. Dir. of Mineral Research and Exploration) owns 2.5 billion, TKİ owns 2.3 billion and private sector owns 1 billion of the total.
the variation of capacity factors of the power plants between the years. For instance, while Yeniköy Power Plant was working with 24% capacity factor in 2011, this ratio climbed to 79% by 2012. Main reasons behind such variations can be generalized as planned or unplanned outages, rehabilitations processes, problems during lignite supply in mines and prolonged failures.

LIGNITE POWER PLANTS UNDER CONSTRUCTION

Analysis of the project pipeline should assist in clarifying the picture about the future development of the lignite fired installed capacity:

The main hurdle related to lignite fired power plants is the prolonged construction periods. Even if the exterior factors such as license approval, legal issues, mining license challenges, are completed smoothly, construction periods take nearly 60-66 months. As it can be seen from Table 1, although there are some power plants that have obtained licenses in 2004 and 2008, according to 2013 July Progress reports, they were still not operative. In terms of supply security and low cost electricity generation, operations of these power plants play a crucial role.

ROYALTY MODEL TENDERS

During the appropriate model search to incentivize the private investors for local lignite fired capacity development, royalty model shined out as a model limiting the prolonged commissioning periods. Similar to hydraulic source contribution fee practice of DSİ (State Hydraulic Works) and wind capacity contests of TEİAŞ (Turkish Electricity Transmission Company), this model foresees payment of a contribution fee for every kWh produced from the power plant which is commissioned near to the}

<table>
<thead>
<tr>
<th>Location</th>
<th>Company</th>
<th>Capacity (MW)</th>
<th>Licensing Date</th>
<th>Construction Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adana - Tufanbeyli</td>
<td>Enerjisa</td>
<td>450</td>
<td>2004</td>
<td>54.1%</td>
</tr>
<tr>
<td>Çumra - Konya</td>
<td>Konya Şeker Sanayi ve Ticaret AŞ</td>
<td>22</td>
<td>2004</td>
<td>92.8%</td>
</tr>
<tr>
<td>Mihalıççık - Eskişehir</td>
<td>Adulya Enerji</td>
<td>290</td>
<td>2008</td>
<td>62.2%</td>
</tr>
<tr>
<td>Kutahya</td>
<td>Polat Elektrik Üretim İşl. İhr. AŞ</td>
<td>51</td>
<td>2008</td>
<td>57.3%</td>
</tr>
<tr>
<td>Sivas - Etyemez</td>
<td>Tam Enerji Üretim AŞ</td>
<td>100</td>
<td>2008</td>
<td>14.1%</td>
</tr>
<tr>
<td>Göynük - Bolu</td>
<td>Aksa</td>
<td>270</td>
<td>2012</td>
<td>50.9%</td>
</tr>
<tr>
<td>Konya - İğil</td>
<td>Konya İğil Elektrik Üretim ve Tic. Ltd. Şti.</td>
<td>500</td>
<td>2013</td>
<td>6.6%</td>
</tr>
<tr>
<td>Soma - Manisa</td>
<td>Hidro-Gen Enerji (Kolin)</td>
<td>450</td>
<td>Pre-License obtained</td>
<td>Project Stage</td>
</tr>
<tr>
<td>K. Maraş - Elbistan</td>
<td>Diler Elektrik</td>
<td>400</td>
<td>Review &amp; Evaluation</td>
<td>Project Stage</td>
</tr>
<tr>
<td>Adıyaman - Gölbaşı</td>
<td>Sanko</td>
<td>150</td>
<td>Review &amp; Evaluation</td>
<td>Project Stage</td>
</tr>
<tr>
<td>Soma - Manisa</td>
<td>Hidro-Gen Enerji (Kolin)</td>
<td>450</td>
<td>Review &amp; Evaluation</td>
<td>Project Stage</td>
</tr>
<tr>
<td>Dinar - Afyonkarahisar</td>
<td>KKL Madencilik</td>
<td>640</td>
<td>Review &amp; Evaluation</td>
<td>Project Stage</td>
</tr>
<tr>
<td>Tufanbeyli - Adana</td>
<td>Teyo Yatırım</td>
<td>700</td>
<td>Review &amp; Evaluation</td>
<td>Project Stage</td>
</tr>
</tbody>
</table>
corresponding lignite field. The most important characteristics of this model is that generally first 6 years is seen as investment period and if power plant becomes operational and generates electricity beforehand, only half of the royalty fee is due. If the 6 year investment period is exceeded, even if the power plant is not operational, royalty fee still accrues.

Table 2 summarizes the tenders realized in 2012 and 2013. Level of competition and resulting royalty fees differ in each tender. Graph 3 exhibits the interest of private sector for operating these fields:

As the royalty fee bids offered in the tenders are considered, it can be asserted that companies developed approaches based on their strategic expectations from the projects. For instance, closeness of fields and mining techniques and reliability of the existing data mainly shaped the bids of companies. However, while bidding a royalty fee, foreseeing the prospective market structure, electricity prices, and costs drive the profitability of the investment directly. Diligent studies for financial modelling, debt structuring, technology selection for power plant and turbines should boost profitability of the investments and create additional value for the projects.

**INTERGOVERNMENTAL AGREEMENTS**

The model preferred for utilizing the large lignite fields in electricity generation is investment through intergovernmental agreements. As the total amount of lignite contained in the fields tendered using royalty fee model (ca. 800 million tons) is compared to reserves of Afşin-Elbistan field, investors from Korea, China and UAE showed interest and in 2013 an intergovernmental agreement was signed with TAQA company from UAE. But later on, TAQA declared the postponement of the investment until the end of 2014 and Turkish government accelerated the negotiations with other international investors again. On the other hand, for Konya Karapınar field, negotiations with international investors from Slovakia, Thailand and Saudi Arabia are currently ongoing.

According to the recent declarations, instead of a purchase guarantee, price level determination mechanisms are on the table for the intergovernmental agreements in order to avoid direct impact on market mechanisms.

**CONCLUSION**

Prominence of the utilization of local lignite as a means of energy source diversification, establishment of supply security, decreasing import dependency and controlling electricity prices is a crystal clear fact. If all projects, including the royalty model fields and project stock, are commissioned, an installed capacity of ca. 5,000 MW will be operational. When the other suitable fields and ongoing projects are considered, prospective power plant capacity is expected to create a positive acceleration for the stagnant lignite fired installed capacity. On the other hand, the environmental impacts due to high sulphur and content should not be ignored, and investments which prevent negative environmental impacts must also be considered. Therefore, decision makers should plan capacity developments by weighing costs and benefits.

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