High calorific value coal
Turkish and global outlook
Executive Summary

Despite the fact that coal has notorious perception due to its impacts on the environment, it’s not possible to neglect its share in the global energy supply. Especially, in emerging markets with ever growing energy demand, cost and eligibility advantages bring coal into prominence.

When a coal consumption analysis is conducted, it is evident that electricity and heat generation sector maintained its leadership with more than 3.8 billion tonnes in 2012. This situation can be seen in Turkey as well.

Installed capacity of imported coal PPs in Turkish electricity market has passed 3.9 GW by the end of the 2013. On account of increasing Turkish electricity demand and economic advantages of imported coal, it wouldn’t be wrong to expect that imported coal PPs will show significant growth. In the first seven months of 2014, additional installed capacity of 950 MW connected to the grid. After the natural gas investment boom in 2011, Turkish electricity market has a new tendency to imported coal power plants.

Uncertainties related to natural gas power plants and unexpected delays in lignite projects lead investors to hard coal as a relatively more eligible and cheaper energy source. Within this respect, many imported coal power plant projects emerged. In addition to 7 imported coal power plants in operation, 33 PPs projects under either construction or evaluation stage indicate the significance of the investors’ intention.

On the other side, all locations available to imported coal power plants are already held by investors and some of these projects will be naturally driven out of the competition.

When global coal market is analysed, trends like China’s growing coal demand, shale gas impact on coal prices and carbon policies can be defined as major indicators that have determining role on coal pricing.

As a reflection of our more than 20 years of energy sector expertise, we hope that our report prepared by Deloitte Turkey Energy and Natural Resources team will meet your expectations.
Coal is a combustible black or brownish-black sedimentary rock usually occurring in layers close to surface and can have different organic and physical characteristics which are used to determine the coal categories.

Although, there are different international coal classifications and some revisions related to those classifications, generally accepted classification for coal is stated below:

Brown coal category includes coal types that have calorific value less than 5,700 kcal/kg. Lignite, sub bituminous coal and half bituminous coal are considered as brown coal. Hard coal category includes coal types that have calorific value more than 5,700 kcal/kg. Other bituminous coal, anthracite and coking coal are considered as hard coal.

As a commercial term, steam coal category includes coal types consumed in similar commercial areas. Half bituminous coal, other bituminous coal and anthracite are considered as steam coal.

In this report, Turkish lignite reserve and production also include asphaltite which is categorised/considered as bituminous coal in generally accepted coal classification.

Although, lignite has important role as a major local coal source of Turkey, this report does not include detailed analysis related to lignite sources. Relevant to this matter, we suggest you to look at our report "Contribute lignite coal fields to the economy" published in 2012.
Global coal market outlook

In parallel with developments in economies that consume coal intensively; ever-growing global coal production reached 7.9 billion tonnes and hit the record high level in 2013.

Despite to all environmental concerns, coal continued to increase its significance among the energy sources and satisfied majority of increment in the global energy demand. During the recent years, advancements in production helped coal to get ahead of petroleum and have biggest share in the global primary energy supply.

In parallel with developments in economies that consume coal intensively; ever-growing global coal production reached 7.9 billion tonnes and hit the record high level in 2013.

With 5.3 billion tonnes, Asia & Pacific region constitutes 69% of global coal production whereas Europe & Eurasia and North America represents 28% in total.

OECD countries accounted for 25% of global coal production in 2013 with 2 billion tonnes and EU member states under OECD represented 7% of global coal production.

Total proven reserves of coal around the world are estimated to be 891 billion tonnes in 2013. Lignite reserves accounted for %55 of global coal reserves with 488 billion tonnes and hard coal reserves represented 403 billion tonnes. Europe & Eurasia region was on the first rank and held 305 billion tonnes which constitutes 35% of global coal reserves whereas Asia & Pacific and North America accounted for 32% and 28% of global coal reserves respectively. In parallel with advancement in coal consumption activities, Asia & Pacific region has the lowest reserves to production ratio of 54 years whereas North America and Europe & Eurasia have reserves that can meet their production activities for another 250 years.
As a commercial type of coal, steam coal is used generally in electricity and heat generation sectors. It is mainly consist of asphaltite and sub/other bituminous coals.

Also known as metallurgical coal, coking coal is generally used in cement, iron & steel and chemistry sectors. Due to its low sulphur and phosphor content, coking coal is also the most expensive coal type. Asia & Pacific region represents 72% of total coking coal production whereas Europe & Eurasia and North America regions have 15% and 12% market shares respectively.

Among all other coal types, lignite has the least calorific value. For this reason, lignite is not favoured by industrial and residential use but consumed only in power plants to generate electricity. Europe & Eurasia region represents 76% of total steam coal production whereas Asia & Pacific and North America regions have 15% and 9% market shares respectively.

Regional coal production by types (2012)

- **North America**
- **Latin America**
- **Europe & Eurasia**
- **Asia & Pacific**
- **Middle East & Africa**

**Lignite**
0.9 billion tonnes per year

**Hard Coal**
6.9 billion tonnes per year

**Lignite**
0.1 billion tonnes per year

Source: IEA Coal Info 2013
With the help of recent developments in steam coal production, hard coal enjoyed consistent growth and increased its share in global coal market up to 76% whereas lignite production had rise and fall throughout the years.

Steam and coking coal production increased by 3% in 2012 and reached to 6.9 billion tonnes production level with the 230 million tonnes increment.

In 2012, steam coal production, considered under the hard coal category, showed 3.8% increase and also constituted the 94% of hard coal production growth. Coking coal production increased a slow pace whereas lignite was the only coal type that performed downfall and its production decreased by 0.7%.

In terms of hard coal production, Asia & Pacific countries took the leadership and top 5 countries represented 84% of global hard coal production with more than 5.8 billion tonnes.

Europe & Eurasia countries maintained their lead in lignite production and top 5 countries, including Turkey, constituted 53% of global lignite production.

Top 5: Hard coal and lignite production (million tonnes)

<table>
<thead>
<tr>
<th>Countries</th>
<th>Hard Coal</th>
<th>Lignite</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>(1) 3,549</td>
<td>-0</td>
<td>3,549</td>
</tr>
<tr>
<td>US</td>
<td>(2) 863</td>
<td>(4) 72</td>
<td>935</td>
</tr>
<tr>
<td>India</td>
<td>(3) 552</td>
<td>44</td>
<td>595</td>
</tr>
<tr>
<td>Indonesia</td>
<td>(4) 443</td>
<td>-</td>
<td>443</td>
</tr>
<tr>
<td>Australia</td>
<td>(5) 347</td>
<td>(3) 74</td>
<td>421</td>
</tr>
<tr>
<td>Russia</td>
<td>276</td>
<td>(2) 78</td>
<td>354</td>
</tr>
<tr>
<td>Germany</td>
<td>12</td>
<td>(1) 185</td>
<td>197</td>
</tr>
<tr>
<td>Turkey</td>
<td>3</td>
<td>(5) 68</td>
<td>71</td>
</tr>
</tbody>
</table>

Source: MENR Energy Balance 2012, IEA Coal Info 2013, Deloitte Analysis

84%

Top 5 Hard Coal Producing Countries’ Global Share
Countries represent 5.8 billion tonnes of hard coal production.

53%

Top 5 Lignite Producing Countries’ Global Share
Countries represent 477 million tonnes of lignite production.
Global coal consumption increased by 2.7% and reached to 7.7 billion tonnes at the end of 2012. OECD countries consumed 2.2 billion tonnes in total whereas OECD members such as U.S., Europe countries and Asia countries represented 12%, 10% and 6% of global coal consumption respectively. Non-OECD countries, including China, had 71% of total coal consumption with more than 5.5 billion tonnes.

When 2011 sectorial coal consumption analysis is conducted, it has been seen that conversion sector including electricity and heat generation built up 76% of global coal consumption with 3.8 billion tonnes whereas industries and residential & other sectors consumed 1.0 billion tonnes and 0.2 billion tonnes respectively.

Coal consumption of 1.33 billion tonnes in conversion sector constituted 87% of total OECD consumption yet this ratio was 71% in non-OECD countries.

**Sectorial Coal Consumption, 2011 (btce***)

- **Conversion Sector**
  - OECD 35% * Non-OECD 65%
  - 3.8 billion tonnes

- **Industry**
  - OECD 14% * Non-OECD 86%
  - 1.0 billion tonnes

- **Others**
  - OECD 28% * Non-OECD 72%
  - 0.2 billion tonnes

On the leadership of OECD countries, global coal consumption reached to 7.7 billion tonnes in 2012. Electricity and heat generation sectors came into prominence as the most coal consuming sectors.
Global hard coal trade

In parallel with production activities, in 2012, coal trade volume increased by 12% and reached at 1.2 billion tonnes which represents 15% of total hard coal production.

In 2012, coal trade volume increased by 12% and reached at 1.2 billion tonnes of which 1.1 billion tonnes is transported by sea freight and only 82 million tonnes is carried by land transport among countries like Mongolia, Russia and China.

As a result of increasing coal demand, China’s coal import activities showed great advancement by reaching over 235 million tonnes and for the first time China got ahead of Japan whose coal import accumulated to 185 million tonnes. India and South Korea from Asia & Pacific region also Germany, England, Turkey, Italy and Spain from Europe were rated among the other major coal importing countries.

Source: VDKI Annual Report 2013, IEA Coal Info 2013
Global coal market volume

In 2012, global coal market volume increased by 4.7% and hit the 606 billion USD mark.

In regional perspective, Asia & Pacific constituted 74% of total coal market and remained in the leading position.

Especially, the production of top 10 hard coal companies accumulated for 1.8 billion tonnes of production and 123.3 billion USD of market value. This also indicates that top 10 hard coal companies held 24% of hard coal production and 20% of hard coal market value.

In the company ranking, Coal India was in the leading position 3 years in a row with 554 billion tonnes of production. Shenhua and Peabody had second and third place in the ranking with 304 and 249 billion tonnes of production respectively.

In 2012, Shenhua achieved revenue of 39.5 billion USD and took place on the top in terms of market value. Coal India, China Coal, BHP Billiton and Glencore Xstrata were the other companies which exceed the 10 billion USD revenue level.

As global coal market volume increased by 5% in 2012, Asia & Pacific countries and top 10 hard coal companies maintained their leading positions.

Top 10: Hard Coal Producing Companies

<table>
<thead>
<tr>
<th>Countries</th>
<th>Hard Coal (m tonnes)</th>
<th>Revenue (billion USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal India</td>
<td>431 436 554</td>
<td>13.0</td>
</tr>
<tr>
<td>Peabody</td>
<td>246 268 249</td>
<td>8.1</td>
</tr>
<tr>
<td>Shenhua</td>
<td>225 282 304</td>
<td>39.5</td>
</tr>
<tr>
<td>Arch Coal</td>
<td>163 157 141</td>
<td>4.2</td>
</tr>
<tr>
<td>China Coal</td>
<td>123 160 176</td>
<td>13.8</td>
</tr>
<tr>
<td>BHP Billiton</td>
<td>103 104 105</td>
<td>13.6</td>
</tr>
<tr>
<td>Anglo American</td>
<td>107 103 84</td>
<td>7.3</td>
</tr>
<tr>
<td>SUEK</td>
<td>90 92 98</td>
<td>5.6</td>
</tr>
<tr>
<td>Glencore Xstrata</td>
<td>80 85 90</td>
<td>12.4</td>
</tr>
<tr>
<td>Rio Tinto</td>
<td>91 29 32</td>
<td>5.8</td>
</tr>
</tbody>
</table>

Source: Deloitte Analysis, VDKI Report 2013, Dow Jones Factiva, Annual Reports: BHP Billiton, Glencore Xstrata, Rio Tinto, SUEK, Arch Coal, Anglo American

Global Coal Market Value
Market Value Growth Rate

Source: MarketLine
* Total revenue of global coal sales

Asia & Pacific Region’s Share in Global Coal Market
Top 10 Companies’ Share in Global Coal Production
Turkish coal sector activities such as exploration and mining operations are subject to the mining Law No: 3123 and also majority of these activities are carried out by both private and public companies.

Exploration activities include mining site selection, drilling activities and proven reserve studies and these activities are regulated by exploration licence.

Mining operations include mineral processing (breaking, screening, grinding and enriching), building facilities and substructures and these activities are regulated an operating licence.

Coal production is either sold under free market conditions or consumed in the related facility.

In the process of contributing coal mines to the economy, it is MENR’s responsibility to control evaluate and audit all the mining related activities performed in Turkey. Along with MENR’s affiliated and related companies, private sector players also actively participate in mining activities like exploration, operation, and trade.
In Turkish coal balance 2012, coal consumption reached 100 million tonnes yet only 71% of it was met by local sources and the remaining supply deficit was closed by coal imports.

In 2012, Turkish proven coal reserves increased to 14.7 billion tonnes and also coal consumption reached to 100.7 million tonnes. As an important source in the total coal supply, local companies produced 2.3 million tonnes of hard coal and 69.2 million tonnes of lignite. TTK represented nearly all of the local hard coal production and public companies like TKİ and EÜAŞ held more than 90% of lignite production. Hard coal import of 29.2 million tonnes dominated hard coal market and represented 93% of total hard coal supply. As a leading coal consuming sector, conversion and energy sector constituted 73% of total coal consumption. On the other side, residential & services and industry represented 17% and 10% of coal consumption respectively.

* Private sector’s lignite production is subjected to approval
** Includes asphaltite production
*** Includes agricultural consumption
Turkey has 1.3 billion tonnes of coal reserves of which 514 million tonnes is classified in proven category. However, in the recent years, reserve volume of major hard coal fields remained at the same level.

In 2013, it is announced that Turkey has 1.3 billion tonnes of coal reserves which includes different types of hard coal with calorific values swinging between 5,450 – 7,050 kcal/kg.

Among the reserve types, coking reserves has 66% share in total reserves with 0.9 billion tonnes whereas semi coking and non coking reserves have 33 million and 0.4 billion reserve volume respectively.

Coking coal is appropriate to be consumed together with semi coking coal in industrial use and also it maintains the coking characteristics when mixed with non-coking coal.

### Hard Coal Fields and Characteristics

<table>
<thead>
<tr>
<th>Fields</th>
<th>Reserves (million tonnes)</th>
<th>Moisture</th>
<th>Ash</th>
<th>Volatile Matter</th>
<th>Fixed Carbon</th>
<th>Lower Calorific Value (kcal/kg)</th>
<th>Coking Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amasra</td>
<td>407</td>
<td>3-14</td>
<td>14-15</td>
<td>32-35</td>
<td>41-47</td>
<td>5.450-6.050</td>
<td>Average - Weak</td>
</tr>
<tr>
<td>Armutçuk</td>
<td>33</td>
<td>2-14</td>
<td>9</td>
<td>29-34</td>
<td>47-54</td>
<td>6.050-7.050</td>
<td>Average - Strong</td>
</tr>
<tr>
<td>Kozlu</td>
<td>157</td>
<td>2-14</td>
<td>11-13</td>
<td>25-27</td>
<td>52-57</td>
<td>6.400-6.950</td>
<td>Average - Strong</td>
</tr>
<tr>
<td>Üzülmez</td>
<td>304</td>
<td>2-14</td>
<td>11-13</td>
<td>25-27</td>
<td>52-57</td>
<td>6.400-6.950</td>
<td>Average - Strong</td>
</tr>
<tr>
<td>Karadon</td>
<td>411</td>
<td>2-14</td>
<td>12-13</td>
<td>25-27</td>
<td>51-56</td>
<td>6.200-6.950</td>
<td>Strong</td>
</tr>
</tbody>
</table>

Source: TTK Annual Report 2013
Turkish hard coal supply

In order to satisfy increasing hard coal demand, Turkish hard coal supply leaned to imports and as a result import ratio in hard coal supply reached to 93%.

Although hard coal import volume has shown steady growth in recent years, hard coal imports decreased by 9% and reached to 28.5 million tonnes in 2013.

When local production and import analysis is conducted, it is seen that decreasing production rate of TTK and local private sector players lead hard coal importers to close the increasing hard coal supply deficit.

For the six years between 2008 and 2013, local hard coal production decreased from 2.6 million tonnes to 1.9 million tonnes. At the same time period, coal imports increased by 6% annually and reached to 26.6 million tonnes in 2013.

In parallel with developments in Turkish coal supply, imported coal ratio in the total supply increased form 88% in 2008 to 93% in 2013.

In order to uplift the decreasing hard coal production, private sector players were introduced to mining activities in 2005. Although, this strategy helped to increase hard coal production, decreasing trend re-emerged after 2009.

In 2013, Turkish hard coal production has decreased to 1.9 million tonnes and hit the record low levels since 2000.

In order to uplift the decreasing hard coal production of TTK, mining sites are started to be transferred to private sector players in exchange for royalty fees starting from 2005. As a result of this application, production volumes enjoyed steady growth until 2009. In recent years, both TTK and private companies showed poor performance and hard coal production level decreased to 2005 levels.

In 2013, TTK raw coal production reached to 2.2 and fell behind the production plan by 24% also 1.4 million tonnes of hard coal production could not able to meet the plan and hit the record low level of all times.

Private sectors’ hard coal mining fields have increased hard coal production to 1 million tonnes level in 2006 and yet were not able to maintain this performance due to ups and downs over the years.
As one of the most important sources in hard coal supply, hard coal imports have increased in parallel with ever increasing hard coal demand and hit the record high level in 2012.

In 2012, Turkey imported 29.2 million tonnes of hard coal and reached to highest Import level of all time; however, import volumes decreased by 12% and reached to 26.6 million tonnes in 2013.

In 2013, steam coal imports represented 81% of total hard coal imports with 21.5 million tonnes and also coking coal imports reached to 5.1 million tonnes.

In 2013, Coking coal imports increased by 11% whereas steam coal imports decreased by 12%.

With more than 8.6 million tonnes of steam coal imports, Russia took the lead in Turkish steam coal market where Colombia and South Africa exported 7.2 and 3.3 million tonnes of steam coal to Turkey respectively.

In recent years, U.S.A. has come into prominence in global coking coal supply and constituted 69% of Turkish coking coal imports with 3.5 million tonnes.

### Coal Import 2013

<table>
<thead>
<tr>
<th>Countries</th>
<th>Steam Coal</th>
<th>Share (%)</th>
<th>Coking Coal</th>
<th>Share (%)</th>
<th>Total</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>8.6</td>
<td>40%</td>
<td>-</td>
<td>-</td>
<td>8.6</td>
<td>32%</td>
</tr>
<tr>
<td>Colombia</td>
<td>7.2</td>
<td>33%</td>
<td>-</td>
<td>-</td>
<td>7.2</td>
<td>27%</td>
</tr>
<tr>
<td>U.S.</td>
<td>0.5</td>
<td>2%</td>
<td>3.5</td>
<td>69%</td>
<td>4.0</td>
<td>15%</td>
</tr>
<tr>
<td>South Africa</td>
<td>3.3</td>
<td>15%</td>
<td>-</td>
<td>-</td>
<td>3.3</td>
<td>12%</td>
</tr>
<tr>
<td>Ukraine</td>
<td>1.1</td>
<td>5%</td>
<td>-</td>
<td>-</td>
<td>1.1</td>
<td>4%</td>
</tr>
<tr>
<td>Australia</td>
<td>-</td>
<td>-</td>
<td>0.9</td>
<td>18%</td>
<td>0.9</td>
<td>3%</td>
</tr>
<tr>
<td>Canada</td>
<td>-</td>
<td>-</td>
<td>0.3</td>
<td>6%</td>
<td>0.3</td>
<td>1%</td>
</tr>
<tr>
<td>Others</td>
<td>0.9</td>
<td>4%</td>
<td>0.3</td>
<td>6%</td>
<td>1.2</td>
<td>5%</td>
</tr>
<tr>
<td>Total</td>
<td>21.5</td>
<td>-</td>
<td>5.1</td>
<td>-</td>
<td>26.6</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: McCloskey

![Steam Coal vs. Coking Coal](image)

Source: McCloskey
In parallel with development in coal power plant investments, Turkish coal consumption increased by 20% and reached to 31.5 million tonnes in 2012.

Turkish hard coal demand is mainly generated by 3 sectors such as conversion & energy, household & services and industries.

In 2012, coal consumption increased by 20% and reached to 31.5 million tonnes and 5-year CAGR rose to 8%.

By sectorial consumption, conversion & energy sector increased its coal consumption by 47% from 11.8 million tonnes in 2008 to 17.3 million tonnes in 2012. It also constituted 63% of the hard coal demand increment. As another growing sector, residence & services reached to 10 million tonnes in 2012 whereas industries hard coal consumption decreased by 1.7% and reached to 4.1 million tonnes.

As the biggest hard coal demand contributor, conversion & energy sector constituted 55% of Turkish hard coal consumption. In last 5 years, coking facilities’ consumption was around 5 million tonnes but recent coal power plant investments increased the hard coal consumed in power plants by 18%.

Despite of the advances in natural gas grid, coal consumed for heating purposes still has an important place in total coal consumption. Coal consumed in household & services sector increased by 48% from 6.5 million tonnes in 2008 to 10 million tonnes in 2012.

Although industrial coal consumption decreased by 2%, major coal consumers like iron & steel and cement companies increased their coal consumption by 4%. As one of the top 10 iron & steel and cement markets, Turkish industry is expected to have important place in the hard coal demand.

* Includes agricultural consumption
Hard coal power plants in Turkey

In parallel with increasing demand and imported coal's economic advantages, installed capacity of hard coal power plants reached to 4.3 GW in 2013.

Along with electricity demand growth, Turkish installed capacity showed an increasing performance and grew from 42 GW in 2008 to 64 GW in 2013.

In 2013, hydro and natural gas power plants maintained their leading position and constituted 73% of the total installed capacity. On the other hand, coal power plants, including lignite and hard coal, came as the third biggest installed capacity contributor.

For the six years between 2008 and 2013, lignite installed capacity of 8.2 GW remained at the same level due to incompletion of major lignite projects. However, hard coal installed capacity grew 18% and reached to installed capacity of 4.3 GW, representing 7% of total installed capacity.

Since limited local hard coal production is mainly consumed by Çatalağzı Thermal Power Plant, investors leaned to imported coal power plant projects.
Imported coal power plants in Turkey

In Turkish electricity market, 7 power plants already connected to grid and 33 projects under either evaluation or licensing process accumulate to 30 GW installed capacity.

Uncertainties related to natural gas power plants and unexpected delays in lignite projects lead investors to hard coal as a relatively more eligible and cheaper energy source and as a result great number of projects showed up.

In addition, imported coal power plants connected to grid and projects under either evaluation or licensing process are expected to take important role in order to satisfy increasing electricity demand in the future.

As of end of 2013, 7 imported coal power plants are connected to the grid whereas there are 20 projects under evaluation, 10 power plants under construction and 3 power plants in pre-licensing process. In total, current and upcoming imported coal power plants accumulate to 30 GW of installed capacity.

Operational Imported Coal Power Plants (2013)

<table>
<thead>
<tr>
<th>Companies</th>
<th>Licence Type</th>
<th>Installed Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eren Enerji</td>
<td>Generation Licence</td>
<td>1,390 MW</td>
</tr>
<tr>
<td>İskend</td>
<td>Build - Operate (BO)</td>
<td>1,320 MW</td>
</tr>
<tr>
<td>İÇDAŞ Çelik</td>
<td>Generation Licence</td>
<td>1,005 MW</td>
</tr>
<tr>
<td>Colakoğlu Metalurji</td>
<td>Generation Licence</td>
<td>190 MW</td>
</tr>
<tr>
<td>Aksa Akrilik</td>
<td>Generation Licence</td>
<td>100 MW</td>
</tr>
<tr>
<td>Kahramanmaraş Kağıt</td>
<td>Generation Licence</td>
<td>6 MW</td>
</tr>
</tbody>
</table>

Source: EMRA
Since fuel supply of imported coal power plants are transported by sea freight, power plant projects are preferred to be located in regions that have easy access to international ports. In this respect, majority of the power plant projects are located near to the İskenderun gulf whereas İzmir, Zonguldak and Çanakkale come into prominence as other suitable locations for imported coal power plant investments.

Kahramanmaraş and Elazığ are the only cities where there are no port connections yet these 3 power plant projects have installed capacity of 231 MW.

When geographical distribution of power plants is analysed, it wouldn’t be wrong to say that there is great interest for imported coal power plants in every region of Turkey.

Source: EMRA, Deloitte Analysis

As of end of 2013
Global coal market trends

China’s demand growth

In parallel with developments in economies that consume coal intensively; ever-growing global coal production reached 7.9 billion tonnes and hit the record high level in 2013.

Coal is mainly consumed in the same region where it is produced, that is the reason why coal production and consumption activities are affected directly by regional developments. In this respect, economic developments in China and other Asia & Pacific countries are the main factor behind the increasing coal activities.

For the six years between 2008 and 2013, despite the decreasing coal production trend in the rest of the world, Asia & Pacific region coal production increased by 1.2 billion tonnes and uplifted global coal production by 1.0 billion tonnes by itself.

Despite the ever-increasing coal production, Asia & Pacific was still a net coal importer region in 2013. By representing 50% of global coal demand, China came into prominence as the biggest coal importer in the world.

It is expected that economic growth rate of the region will affect the coal activities in the coming years.

**2008-2013 Global Coal Production Growth (million tonnes)**

- China: 878
- Asia & Pacific: 1,249

Source: BP Statistical Review of World Energy 2014
In 2013, coal power plants share in global electricity generation increased by 4% and forecast studies show that coal power plant generation will increase by CAGR of 1.2% and Asia & Pacific region will represent 70% of that generation at the end of 2020.

In global electricity market, coal power plants generated 44% of total electricity demand and doubled the nearest competitor, natural gas power plants.

In 2013, coal power plants' generation increased by 4% and yet electricity generation forecasts show that despite the CAGR of 1.2% coal generation increase, coal power plants will lose their share in total electricity generation down to 39%.

When regional coal power plant generation is analysed, in 2013, Asia & Pacific and Middle East & Africa regions increased by 15% and 22% respectively whereas Europe and America decreased by 15% and 2% respectively.

In 2020, Asia & Pacific region is expected to strengthen its position and hold 70% of global coal power plants generation. Especially, China is expected to increase its share from 45% in 2013 to 48% in 2020.
As a result of U.S. shale gas development, decreasing natural gas prices triggered natural gas preference over coal in electricity generation sector where coal power plants’ share in total generation weakened.

In parallel with hydraulic fraction applications, increase in shale gas production both weakened U.S. natural gas dependence on imports and paced shale gas export progress.

Due to the length of export terminal with other sub-construction investments and slow bureaucratic processes, expectations towards LNG exports are failed to satisfy the market players. In U.S. the first LNG export is expected to start in 2015 and 2016.

As a result of delays in LNG exports, shale gas production in U.S. is mainly consumed internally and over supply of natural gas triggered decline in the natural gas prices.

Natural gas prices were around 5.7 USD/ MMBtu in January 2011 however, increasing supply forced prices down to 2.8 USD/MMBtu in 2012.

Hereby, natural gas power plants came in more favourable position against the coal power plants that used to dominate the U.S. electricity generation market.

In March 2012, natural gas prices reached to the record low level and natural gas power plants share in total electricity generation became equal to coal power plants’. 

In line with these developments, coal power plants share in generation decreased from 47% in 2012 to %40 in 2013 and also U.S. coal consumption dropped off within this period.
Decrease in U.S. coal consumption resulted excess coal supply in the market and as a result of increase in coal import activities forced global coal prices to drop.

Coal consumption decrease in electricity generation sector triggered increase in U.S. coal export volumes.

Especially, in the first half of 2012 when the coal power plants hit the lowest consumption rates, tendency to export the excess coal supply in the market peaked.

In the third quarter of 2012, coal exports grew by 31% and reached to 34 million tonnes and it caused coal price (FOB ARA) to drop by 11%. Underperformance of carbon markets, decrease in demand and growth of generation from renewable sources were the main factors that sustained the fall of coal prices at that moment.

Hereby, shale gas developments and delays in export licensing processes in U.S. affected the coal sector and caused all coal prices indexes to fell by %45 in average.

Source: McCloskey, Deloitte Analysis
Global coal trade development

Developments in coal market provide opportunity for financial & physical trading to have more widespread, liberal and liquid market structure.

Coal trade activities are carried out in ports physically and price indices related to these ports enable traders to fulfil the financial activities.

Physical trading can enable to structure strong and reliable price indices by providing continuous and accurate trading information flow.

Coal price indices set up a standard platform to enable both physical and financial trade activities properly. As a result, these price indices support development of trade related to the indices and also provide better risk management opportunities for trades.

Price indices serve as a reference point for global coal trade and development of these indices enable coal market to achieve higher trading volumes and market liquidity.

In terms of market liquidity, both Richards Bay (South Africa) and Kalimantan (Indonesia) ports showed great performance also European trading point, ARA, came in the third place. However, most of the international coal ports showed similar performance on market volatility.

As an important European index, API 2 has the highest trade volume and liquidity whereas API 4 came in the second place. New indices like API 5 and API 8 have the lowest volume and liquidity performance.

Developments in global coal market will increase the trading volume of coal trading and also enable the coal market to be more liquid and stable.
In recent years, financial derivatives and standard coal trading contracts has shown great advancement and helped the market to be more liquid and stable.

In 2000, global coal trading activities performed in financial and standardized markets had a very small volume however trading volume showed a steady increase in the last 6 years.

Volume of steam coal derivatives grew by 13% from 1.3 billion tonnes in 2007 to 2.4 billion tonnes in 2012.

Ever-increasing coal derivatives’ trading activities will increase the volume of the trading deals performed by the medium of these derivatives.

Trading done by SCoTA, standard contract developed by private company, is likely to increase in parallel with the growth in coal derivatives.

SCoTA, a financial intermediary among traders and bankers, is used to perform coal trade of 40 million USD in 2007 and SCoTA’s trade volume increased to 95 million USD in 2012. As of end of 2012, steam coal trades done by using SCoTA represented 13% of total steam coal trade and the rest is done by bilateral contracts.

Volume growth of financial derivatives in global coal trade and standard trading contracts will enable coal market to be more liquid and stable.

Source: globalCoal, Deloitte Analysis

* Standard Coal Trade Agreement
Within the scope of environmental policies, carbon markets’ low performance caused continuation of the coal power plants’ advantages against the greener competitors like natural gas PPs and renewables.

In order to decrease global carbon emission, several actions are taken; however, EU-ETS (European Union – Emission Trade System) was the first and biggest practice that was introduced to carbon markets.

EU ETS was initiated in 2005 and as of end of 2013 more than 10,000 factories and power plants were given limited carbon emission allowance. If any factories or power plants exceed their pre-determined carbon emission limits then they are obliged to buy EUA, EUR or CER carbon credits from either secondary markets or tenders.

Although, EUA emission credits started from 21 EUR/tonnes in 2005, it showed poor performance afterwards. Carbon credit prices were 6.45 EUR/tonnes in 2006 and decreased to 0.02 EUR/tonnes in 2007.

After the Kyoto Protocol, EUA market was lifted again and additionally CER & ERU credits were introduced to the market.

In the time period between 2008 and 2011, EUA fell by 54% and became 7 EUR/tonnes whereas CER dropped by 69%.

For many years CER liaised with EUA prices, however, as of June 2012 this correlation was broken and CER prices plummeted to the record low 0.15 EUR/tonnes level.

Due to the low performance of carbon prices, coal power plants maintained competitive advantage over natural gas power plants. Up to now, carbon markets could not be a treat to coal investors.
If carbon emission sanctions fail to achieve emission targets in the years ahead, it is expected that different actions will be introduced.

When carbon credit related future contracts analysis is conducted, it is expected that EUA and CER are not likely to reach 2010s price levels even in 2020. This forecast shows that coal power plants will keep the competitive advantage against the natural gas power plants.

Despite the underperformance of carbon markets, EU member countries are expected to take new actions to reach carbon emission targets.

In order to incite low carbon power plant investments, UK has introduced a carbon pricing method that will affect end-users’ electricity bills and determined 18 GBP/tonnes as upper limit for carbon price.

Within the scope of carbon emission targets, these carbon pricing applications seem to cause coal power plants to lose their cost advantages unexpectedly in the years ahead.

### Forward Contract Prices

<table>
<thead>
<tr>
<th>Carbon Emission Credits (EUR/tonnes)</th>
<th>EUA</th>
<th>CER</th>
<th>ERU</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>5.61</td>
<td>0.14</td>
<td>0.8</td>
</tr>
<tr>
<td>2015</td>
<td>5.78</td>
<td>0.35</td>
<td>0.8</td>
</tr>
<tr>
<td>2016</td>
<td>6.09</td>
<td>0.47</td>
<td>-</td>
</tr>
<tr>
<td>2017</td>
<td>6.46</td>
<td>0.48</td>
<td>-</td>
</tr>
<tr>
<td>2018</td>
<td>6.84</td>
<td>0.52</td>
<td>-</td>
</tr>
<tr>
<td>2019</td>
<td>7.24</td>
<td>0.6</td>
<td>-</td>
</tr>
<tr>
<td>2020</td>
<td>7.64</td>
<td>0.7</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: ICE (Intercontinental Exchange), Deloitte Analysis
Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARA</td>
<td>Amsterdam, Rotterdam, Antwerp</td>
</tr>
<tr>
<td>CER</td>
<td>Certified Emission Reduction</td>
</tr>
<tr>
<td>CFR</td>
<td>Cost &amp; Freight</td>
</tr>
<tr>
<td>ERU</td>
<td>Emission Reduction Unit</td>
</tr>
<tr>
<td>EUR</td>
<td>Euro</td>
</tr>
<tr>
<td>EUA</td>
<td>EU Allowance Unit</td>
</tr>
<tr>
<td>EU-ETS</td>
<td>European Union Emissions Trading System</td>
</tr>
<tr>
<td>EÜAŞ</td>
<td>Electricity Generation Company, an affiliate of Ministry of Energy and Natural Resources</td>
</tr>
<tr>
<td>FOB</td>
<td>Free on Board</td>
</tr>
<tr>
<td>GBP</td>
<td>Great Britain Pound</td>
</tr>
<tr>
<td>Kcal</td>
<td>Kilocalories</td>
</tr>
<tr>
<td>MİGEM</td>
<td>General Directorate of Mining Affairs, an affiliate of Ministry of Energy and Natural Resources</td>
</tr>
<tr>
<td>MTA</td>
<td>Mineral Research &amp; Exploration General Directorate, an affiliate of Ministry of Energy and Natural Resources</td>
</tr>
<tr>
<td>NYMEX</td>
<td>New York Mercantile Exchange</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
</tr>
<tr>
<td>SCoTA</td>
<td>Standard Coal Trade Agreement</td>
</tr>
<tr>
<td>TKİ</td>
<td>Turkish Coal Enterprises</td>
</tr>
<tr>
<td>TTK</td>
<td>General Directorate of Turkish Hard Coal Institution</td>
</tr>
<tr>
<td>USD</td>
<td>United States Dollar</td>
</tr>
</tbody>
</table>

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- BHP Billiton
- Glencore Xstrata
- Rio Tinto
- SUEK
- TKİ
- TTK
- VDKI
Our services

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- EMRA Audits
- Financial Reporting and TFRS Transformation Services
- Financial Model Audit

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- Enterprise Risk Management
- Fraud Investigation and Prevention
- Corporate Governance Services
- IT Governance and Risk Advisory Services
- Cyber Security Services
- Climate Change and Sustainability

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- Data Analysis
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- Operating Regime Analysis
- Optimum Stock and Source Planning
- Long Term Contract Negotiations

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- Valuation Services
- M&A Advisory
- Financial Due Diligence Services
- Legal Services

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- Custom and Foreign Trade Advisory
- New TTK Advisory
- Investment Incentive Advisory
- Accounting Services

Country of Supply Analysis
- Regulation Support
- Enterprise Applications
- Technology Integrations
- HR Management
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