
Financing Coal

(High Carbon Arithmetic of Turkey)



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Prepared by
Önder Algedik

The cover pictures are taken from Çöllolar Coal Basin, which provides coal for Afşin – Elbistan –B Thermal Power Plant. 1 worker passed away in the collapse that occurred at the plant on February 6th 2011 and 10 people were trapped under debris as a result of the second collapse that occurred on February 10th 2011. 9 people, who were trapped under 70 million m³ material, could not be reached.

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Executive Summary

The 1st Working Group (WG1/Working Group 1) released its first report within the framework of AR5/Assessment Report 5 of IPCC (Intergovernmental Panel on Climate Change) in 2013. In accordance with the report¹, human activities have released 555 giga tons of carbon (GTC), in other words, 2035 giga tons of carbon dioxide (GTCO₂) emissions to the atmosphere between the years 1750 and 2011. AR5 studies include scenarios of future emission projections. While there is no scenario keeping the temperature rise under 1,5°C according to the average for the period between 1850 – 1900 in the report, a temperature increase above 2°C is forecasted in scenarios except RCP2.6². Although scenario RCP2.6 is more optimistic in comparison with the other scenarios, the tipping point of climate change (changes that tip Earth's climate in to new form) carries the risk of an approaching irreversible period.

...There is no more space in the atmosphere for more fossil fuels...

While AR5 report shows that 990 GTCO₂, corresponding to an average of 270 GTC, has remained within the global carbon budget for keeping the temperature rise under 2°C;

1- The existing coal, oil and natural gas reserves exceed the carbon budget. **IPCC reports and the following studies show minimum 80% of coal reserves, 30% of oil reserves and 50% of natural gas reserves must be kept in the ground and must not be utilized.**

2- On the other hand, IPCC studies indicate the fact that **the emissions need to peak before 2020 which is a significant** criterion for today and for the future steps.

3- Scenario RCP2.6, which keeps the temperature rise under 2°C level, highlights that it is necessary to **reduce energy consumption and to abandon the use of fossil fuels**. In this case, the scenario prioritizes financing of climate-friendly energy and projects that reduce energy consumption rather than fossil fuels.

...Turkey does not finance combatting climate change, but utilization of fossil fuels...

Today, the agenda of global finance leads to cancellation of subsidies provided for coal, transfer of resources to climate-friendly energy types, and several export credit agencies have started declaring that they have limited or canceled their financial support for coal investments. Besides, a new economic transformation is initiated by global funds such as Green Climate Fund or national financing institutions provided by the countries . **Considering Turkey, the situation is the exact opposite. Turkey has been, on the one hand, utilizing existing international climate funds, and on the other hand, developing privileges in order to utilize the coal reserves to the market.** Thanks to the privileges, Turkey has been creating a financing infrastructure, which strengthens the way of producing and importing more fossil fuel production and imports.

¹ IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

² Representative Concentration Pathways Scenario

...Turkey's economic policies are based on more fossil production...

Turkey's total energy consumption has increased to 121 million TOE in 2012 from 53 million TOE in 1990. This high increase in energy consumption was due to the increase originated from the use of fossil fuels. **While the fossil fuel-sourced energy consumption has been 43.1 million TOE in 1990 and has increased to 108 million TOE in 2012; the increase in fossil fuel production has been 152%, which is a higher figure compared to the 128% increase in total energy consumption.**

Turkey has signed natural gas agreements with foreign countries in order to increase energy diversity at the end of 80s, which resulted in an extension of natural gas use. Although natural gas is an alternative to coal, the use of coal and **the energy obtained from coal has shown an increase of 136% rising from 16.1 million TOE in 1990 to 38 million TOE in 2012.**

...Turkey's power sector is based on more fossil fuel consumption...

In 2012, 63% of coal consumption took place in power plants. In terms of thermal value, the share of the coal used at thermal power plants has been 45%. In other words, low-quality coal has been provided to high carbon economy via power production. **While the greenhouse gas emissions of Turkey has increased 133.4% between 1990-2012, the emission produced by the combustion of coal at thermal power plants has increased 219%.** Hence, **1 of each 5 carbon dioxide gases emitted to the atmosphere in 2012 has been produced by the coal combusted at thermal power plants.**

... As Turkey involved into climate treaties, coal privileges had strengthened...

Turkey has ratified the UNFCCC in 2004 and Kyoto Protocol in 2009; however, surprisingly it has strengthened the privileges for coal, in those periods.

First, the production areas have been privatized, and then coal fired power plants have been transferred through privatization in order to create market for coal TPPs. The fact that the main fuel and lignite have high ash and humidity ratio and low calorific value, has opened the way to imported coal plants. The use of imported coal, which has low humidity and ash ratio but high calorific value, has increased. Production with imported coal has become higher than the production with domestic coal in power production and it has become a candidate to get ahead of domestic coal in terms of installed power with the realization of the continuing investments. In spite of all those developments, **Turkey has been consistent in providing an inefficient resource to economy by providing privileges for coal.**

... Coal produces emission rather than power....

The power produced by coal plants is presented with concepts such as availability or capacity factor. However, what is important in terms of climate change is the combusted fossil fuel rather than the technical specifications of the plant. When 13 plants combusting domestic coal are taken into consideration, it is seen that their theoretical design thermal efficiency is 37.5%, but they produce power corresponding to 32,5% gross thermal efficiency. After internal consumption loss, the produced power corresponds to 28-29% thermal efficiency. **When expressed in terms of climate change effect, 29 units of power obtained from 100 units of coal have been given to the grid, while the greenhouse gas emissions of 100 units of coal has been given to the atmosphere for that production.**

Subsidies provided for domestic coal, which causes several problems in terms of fossil fuel economy, has opened yet another new door to imported coal. The imported hard coal rapidly progressed through the this mechanism door opened by the existing coal privileges. The installed capacity of imported coal increased has increased its installed power from 3.9 GW in 2012 to 6 GW in 2014 and has approached the domestic coal plants, which have an installed power of 8.1 GW. **It is obvious that, recently built imported coal plants, which have a design thermal efficiency about around 42-44%, will provide a thermal efficiency under the design rate, by combusting 100 units of coal. Then they will reach a lower net thermal efficiency after internal consumption but will emit all of the greenhouse gas produced by 100 units of coal to the atmosphere.**

By providing low-calorific value lignite areas to economy, Turkey has been increasing the emissions on the one hand, while multiplying this increase with imported coal on the other hand. By combusting imported coal, which has a higher emission value in terms of unit coal amount, leaving more than 80% of global reserves under the ground is prevented. Those, the reserves mined in any other part of the world, are being financed in Turkey through power plants based on the imported coal. In other words, **there has also been carbon leakage from other countries through Turkey's financing.**

... The future of Turkey is based on coal...

The privileges developed by Turkey for production of coal and its usage at power plants brings the situation into an irreversible point in terms of climate change and reveal that the future will be worse than today. The installed coal fired power plants, which was 5.2 GW in 1990, has reached 12.5 GW in 2012 and 14.8 GW in 2014. With the addition of ones in the project portfolio, which are licensed or in construction stage, which have pre-license and in assessment stage, there have been a potential of 34,5 GW of new coal. **If Turkey commissions the plants included in the portfolio; carbon dioxide emissions from coal fired power plants is expected to reach 200 million tons from 21,5 million tons in 1990 and 68,7 million tons in 2012.**

... Coal financing model of Turkey...

One of the basic instruments to include private sector in the process for development of the coal market in Turkey has been involvement of the banks in the process. Within the framework of the global fight against climate change, a series of national and international funds have created to accelerate transition to a low carbon economy by reducing emissions and fighting deforestation. As a result of the global developments; financing of transition to a low carbon economy cause the international financiers to keep at distance to investments such as coal, and not provide loans for fossil fuel investments. This transformation in the global economy has been the greatest barrier in front of Turkey in enlarging its coal plant market. The policy documents of Turkey, which provide prioritizes for coal investments, and its performance in application, draw the attention and interest of credit institutions. The limitation applied by international institutions for coal financing has paved the way for domestic banks taking the lead. Until today, Turkish banks have provided 4.3 billion USD of credits for new investments or privatizations of existing plants and have started performing their roles in meeting the financing needs of the coal market. 8.5 billion dollars, which has been provided for the privatization of power plants having an installed power of 4.6 GW, the financing portfolio of 20-22 billion USD for 20 GW installed power that may be added to the existing capacity increase the motivation of the banks providing loans. Consequently, **this model created by Turkey has resulted in a new economy not financing emission reduction, but financing new coal; meaning more emissions, opposite to the global trend.**

... The banks are financing a high carbon economy, not the investments...

Even if Turkish banks finance investment by providing loans, they warrant an increase in the annual greenhouse gas emissions and release of carbon- which has to remain under the ground- to the atmosphere by ensuring the realization of the investments. Not only a power plant installed on a mine reserve will release carbon dioxide to the atmosphere continuously, but also it will warrant the potential carbon dioxide, which accelerates climate change by mining the reserve. Similarly, a power plant based on imported coal is financed for a reserve mined in another part of the world that increases the CO₂ concentration.. **Considering that Turkey is producing 2 times of coal and imports 5-6 times when compared to the amount in 1990, it is obvious that the developed privileges will worsen the situation.**

...To conclude....

The privileges provided by Turkey for the “coal market” and the loans developing accordingly reveal that Turkey will exhibit a significant increase in greenhouse gas emissions compared to the past. It seems that Turkey, beyond using its own coal reserves, will continue emitting the reserves of other countries to the atmosphere, which means “carbon leakage”.

Bearing in mind the scientific evidence the global greenhouse gas emissions should peak before 2020, it is obvious that Turkey will increase its emissions after 2020 with 43 potential power plants to be added to the existing 55 coal plants. In this case, other countries will have to decrease more emissions in order to keep the temperature rise under 2°C threshold.

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Abbreviations:

UNFCC	United Nations Frame Agreement on Climate Change
EIA	Environmental Impact Assessment
ETKB	Ministry of Energy and Natural Resources
EPDK	Energy Market Regulation Board (EMRA)
EÜAŞ	Electricity Generation Company
IPCC	Intergovernmental Panel on Climate Change
IEA	International Energy Agency
MİGEM	General Directorate of Mining
MTA	Mineral Research and Exploration Institute
TEİAŞ	Turkish Electricity Transmission Company
TKİ	Turkish Coal Enterprises Institution
TTK	Turkish Hard Coal Institution
CO ₂	Carbon dioxide
CH ₄	Methane
N ₂ O	Nitrous oxide
WG	Working Group-IPCC,

Units:

TOE	: ton of oil equivalent petroleum
MTOE	: million ton of oil equivalent
TJ	: Tera joule
kcal	: kilocalories (one thousand calories)
Mton	: million tons
kW	: kilowatt (one thousand watt)
MW	: megawatt (one thousand kW)
.GW	: giga-watt (one million kW)
kWh	: kilowatt-hour (one thousand watt-hour)
MWh	: megawatt-hour (one thousand kWh)
GWh	: giga-watt-hour (one million kWh, or one thousand MWh)
Gt	: giga-ton (one billion tons)

Introduction

This report has been prepared for explaining the role of coal in Turkey in terms of climate change. While coal has been a fuel that was discussed in terms of air pollution in the past, it has become more debated due to its negative impact on both the necessity to reduce greenhouse gas emissions for combatting climate change and "adapting" to climate change as the result of the damage caused by coal mining.

The reports that have been released in Turkey until today are prepared on the basis of the old "high carbon economic growth" narrative. As such, it is difficult even for the experts to understand its significance in a low carbon economy and its equivalent in terms of climate change. Therefore, this report can in fact be assessed as an introduction to the *high carbon arithmetic of Turkey*. In the report, the data has been explained in the relevant sections, and the policies regarding these data have been deeply assessed in the conclusions and report summary sections. Through this structure, the policies and details regarding these policies can be understood more easily. Since the data in the existing official reports is not consistent in terms of time series and since different reports present the data within the same period of time differently, a special study has been performed for this report, and;

- 1- Care has been paid to verify the data used in the report from a second reference.
- 2- Since it is difficult to ensure the consistency of data in terms of time series, some data has been analyzed within the limits allowed by their own internal consistency.
- 3- Priority has been given to the best available data and such data has been used in the calculation methodologies and analysis.

However, it should be taken into consideration that the data could have been changed in time and may not be updated.

Although subventions have a great part in the discussions on financing of coal, they are not included in this report. The reports on the subventions provided by Turkey for coal can be separately examined³.

In the report, the credit and finance data, which have rapidly developed especially in recent years, have been carefully examined in order to understand the high carbon economy model of Turkey in the future. Thus, an analysis on prospective financing mechanisms has also been performed. Although it seems that the consumer has financed the fossil fuel economy in Turkey, efforts have been shown to make the policy, which has been followed for financing the first investment at the point reached today, understandable.

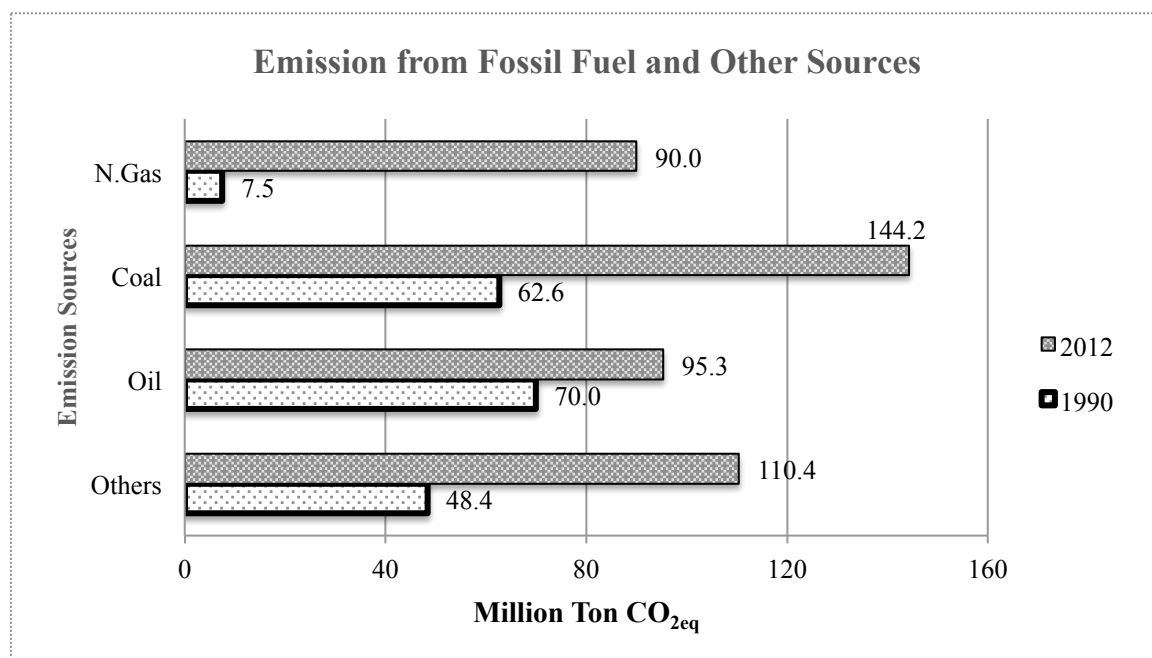
³ The subventions provided for coal are not included in the report. For more information, the following reports can be examined: Oil Change International (OCI). (2014). *Turkey's coal subsidies and public finance*, and The International Institute for Sustainable Development (IISD), (2015) *Subsidies to Coal and Renewable Energy in Turkey*.

1. Role of Coal in Turkey

While Turkey emitted 188.43 million tons of greenhouse gases to the atmosphere in 1990, this amount has increased to 439,87 million tons in 2012. Turkey has increased its emissions with 133,4% in 22 years. In such increase, fossil fuels such as coal, oil and natural gas, which are the sources for three of each 4 units of greenhouse gas emitted to the atmosphere, have been determinative.

The path for natural gas has been paved at the end of eighties, with the purpose of “increasing energy diversity” and reducing coal-sourced air pollution in the cities. The first natural gas agreement was signed with Russia in 1986, the first natural gas delivered to the country in 1987, and the first supply of natural gas to Ankara in 1988 have been the important milestones. Because of popularization of natural gas use, carbon dioxide emission based on natural gas has increased 1102% in 2012 compared to 1990.

One of the fundamental points of origin of these policies of 30 years ago was to use coal as a substitute for natural gas especially in the cities. With the effect of this policy, the total coal use showed almost no increase in the first years, but started to increase in the last decade. The greenhouse gas emissions caused by use of coal have increased 130% in 2012 compared to 1990. As a result of the increase in the amount of carbon dioxide emitted due to combustion of coal, oil and natural gas, Turkey has emitted 135,2% more greenhouse gas to the atmosphere compared to 1990. Today, the fossil fuel economy of Turkey has become stronger than the past and in 2012, the emission caused only by those three fuels has exceeded to the total emissions of 1990.



Graphic 1: Emission amounts of fossil fuels and other greenhouse gases for 1990 and 2012

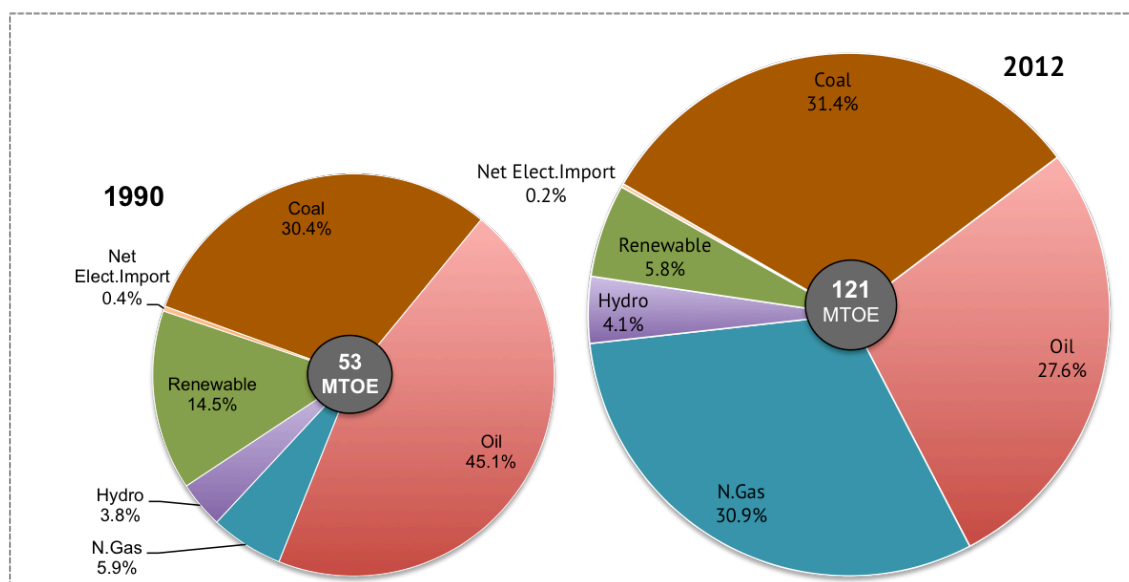
Comparison of carbon dioxide (*) and other emissions (in CO_{2eq}) that occurred as the result of combustion of fossil fuels in the greenhouse gas emissions of Turkey for the years 1990 and 2012. (Reference data, National Inventory Report for the years 1990 and 2012)

Place of Coal in the Power Sector

The sector that is determinative in the emissions of Turkey has been the power sector and one of the determinative fuels in this sector has been coal. In accordance with the data for the year 2012, 70% of the GHG emissions have been produced by the power sector. When coal is examined in terms of total emissions, it is revealed that the source of one of each 3 greenhouse gases emitted to the atmosphere is originating from combustion of coal⁴.

The energy balance in Turkey and the development of coal in it gives important hints:

- 1- **Turkey's energy supply has increased.** While 53 million TOE energy has been consumed in 1990, the energy consumption has increased in the following years and reached 121 TOE in 2012. *Turkey has increased its energy supply 128% between 1990 – 2012 and started to consume more energy.*
- 2- **The energy provided by fossil fuels has increased.** The power obtained from natural gas, oil and coal was 43.1 million TOE in 1990, and it has increased to 108,8 million TOE in 2012. In one sense, the power obtained by Turkey from fossil fuels has shown an increase of 152%, which exceeded the increase in the energy consumption, and has become determinative.
- 3- **The share of fossil fuels in power consumption has increased!** While the share of coal, oil and natural gas in power supply was 81.4% in 1990, this share has increased to 89,9% in 2012. Hence, Turkey has transited to an economy that uses more fossil fuel besides being an economy that uses more energy.
- 4- **Coal consumption has increased in spite of natural gas!** In nineties, natural gas use has been extended in cities in order to reduce the use of coal due to air pollution and to increase energy resource diversity. In spite of the national policy, the share of coal in energy, which was 30,4% in 1990, has increased to 31,4% in 2012. While 16,1 million TOE energy was being supplied from coal in 1990, 38 million TOE power has been supplied from coal in 2012. In spite of natural gas, coal consumption both kept its share and the power obtained from coal increased with 136%.



Graphic 2- Share of Fuels in General Power Balance tables for the years 1990 and 2012
(Reference: ETKB, General Power Balance Tables)

⁴ Reference Approach calculations have been taken into consideration; fossil oil mining produces CH₄ and combustion of fossil fuels produces CH₄ and N₂O and these are not included in carbon dioxide emitted as the result of combustion

Consumption in Sectors

The increasing Turkey's energy dependency, the rise in the share of fossil fuels in the increasing energy consumption and in their amounts increase the danger created by coal, which is one of the most important fuels at the point, in terms of climate change.

The coal is basically used for electricity production, in the industry and residential. 63% of 108 million tons of coal, which has been consumed in 2012, has been used in power production. As summarized in Table-1, the power sector is followed by the use in the residential with a share of 18%, industry with 17% and other sectors. The coals that are suitable for coking are sent to the coking factories and some part of them is used in power production during the process. The obtained coke is mainly used in iron&steel industry.

Table 1- Distribution of coal use and power obtained from coal to the sectors (2012)

	Million Ton	Share	Million TEP	Power Share
Power plants	68	63%	17,164	45%
Residential and Services	19,888	18%	10,087	27%
Industry and other sectors	18,636	17%	9.319	25%
Coke factories and loss	1,558	1%	1,408	4%
Grand total	108,082		37,978	

When the supplied coal amount and the power supplied by this coal amount are examined, it is observed that coal with a high calorific value is mainly used in the residential and industry sectors. While 63% of the amount is used at power plants, only 45% of the total power of coal supplied in 2012 has been used at the power plants (Table -1). In other words, high calorific coal has been combusted in the residential & service sectors and industry & other sectors.

Consequently: In spite of the extended use of natural gas and in spite of its share of 31% in energy in 2012, coal consumption has increased seriously. Coal is the leading fuel alone among the greenhouse gases emitted to the atmosphere. The share of coal in the total share of fossil fuels, which has increased to 89,9% in primary power supply, has increased to 31,4% and has been determinative in the power and climate policies. Likewise, coal, as being a the source of two out of five of the carbon dioxide emissions in Turkey, it is the the biggest source of CO₂ emissions. **In the era of climate change, we face coal as the most fundamental problem, for which a way should be found to ensure a reduction instead of an increase in its use in Turkey.**

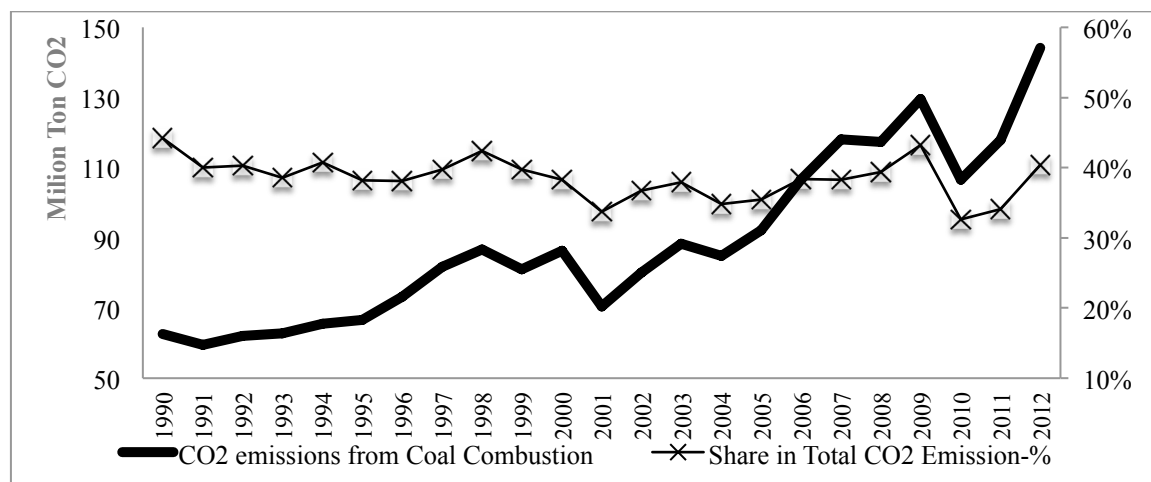
2. Coal Consumption and Emissions

The strong share of coal in power and the increase in its amount infers as an increase in the greenhouse gas emissions. In order to be able to better examine the condition of coal plants in Turkey in terms of climate change, the examination of carbon dioxide emission basing on the above mentioned sectors would allow a better rooted explanation. In this way, it would be possible to make an assessment with climate change perspective by determining the emission values calculated based on amount of coal used and the power produced by it.

The development in the use of coal in Turkey should be examined basing on three fundamental sectors, which are i) power production⁵, ii) residential/buildings and iii) industry⁶.

Coal-Sourced Emissions

The increase in the power use by Turkey and the increase in the share of fossil fuels, and hence their amount in the power use resulted in a significant increase in coal based emissions. Coal consumption has not increased significantly and has not shown a development that is parallel to the increase in carbon dioxide emission until 2001. In 1990, 44% of carbon dioxide emissions of Turkey have been coal-based, and the lowest share has been obtained in 2001 with 33,7%. An increase has occurred in the supply of coal starting from 2001 and its share has increased to 43,2% among carbon dioxide emissions in 2009. Hence, while the coal-based emission was 62,6 million tons in 1990, it has increased to 70,5 million tons in 2001 and to 144.2 million tons in 2012.



Graphic 3: Carbon dioxide emission and share in total emission of coal combustion.

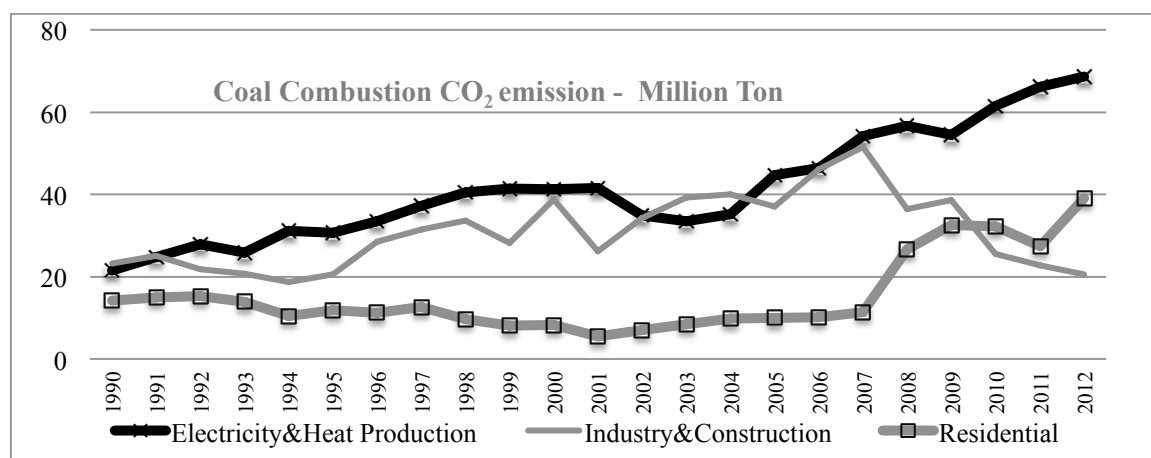
(Carbon dioxide emission is given on the left axis in million tons and the share of emission caused by combustion of coal in the total carbon dioxide emissions is given on the right axis. Reference data; National Inventory Report, 2014)

While the share of coal-based emissions returned to the values of nineties in the recent periods, it should be seen that an increase of 130% is a more important datum from climate change perspective. While the increase in coal consumption for the period 1990 – 2011 has been low, the increase has accelerated in the following years and the developments in the sub-sectors have been determinative in such increase.

⁵ Mentioned as Electricity and Heat Production in Greenhouse Gas Inventory.

⁶ Mentioned as industry – construction in the Greenhouse Gas Inventory.

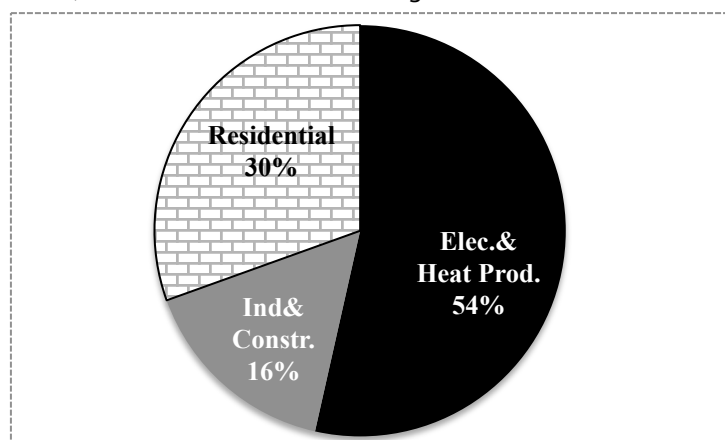
During this period, the increase in the amount of coal used in power production, and hence the increase in the emissions, have continued. As a result of such increase, the power plants emitted 219% more carbon dioxide to the atmosphere as of 2012 compared to the values of 1990. The industrial sector raced with the power plants in terms of coal use, and hence the emissions, until 2007. After 2007, the use of coal in the industry sector started to decrease⁷ and in 2012, the share of coal use reached the values of 1990s. The policy of extending the use of natural gas in order to decrease the use of coal in the buildings in cities has shown its effect and carbon dioxide emission has decrease to almost one third of its value in 1990. Between 2001-2007, the use of coal in the residential sector has recovered and increased and thereafter, has shown a significant jump. In 2012, carbon dioxide emission caused by use of coal in residential sector has increased 677% in comparison with 2001 and 177% in comparison with 1990.



Graphic 4- CO₂ emission from coal combustion

(It is the amount of carbon dioxide emitted to the atmosphere as the result of combustion of coal in the period between 1990-2012, the data is obtained from National Inventory Report, 2014.)

When examined in terms of emissions, the most important sectors causing the use of coal in Turkey in a more intensive way than the past are power production and the residential uses. In 2012, 54% of the emissions produced by coal use 2012 were caused by power production, 30% of them by buildings and the remaining was caused by use as fuel in the industry. In this case, the power sector is brought to the foreground by its impacts on the climate change and by the risks it creates, because it is the area using the greatest amount of coal on one hand, and it uses the coal having low calorific value on the other hand.



Graphic 5: Coal combustion related carbon dioxide emissions share of the sectors for 2012

⁷ The reduction in coal use in the industrial sector is caused by the items given under the heading "Other Industry" rather than big sectors such as iron – steel or cement, and is not included in the topic since it is not included in the report scope.

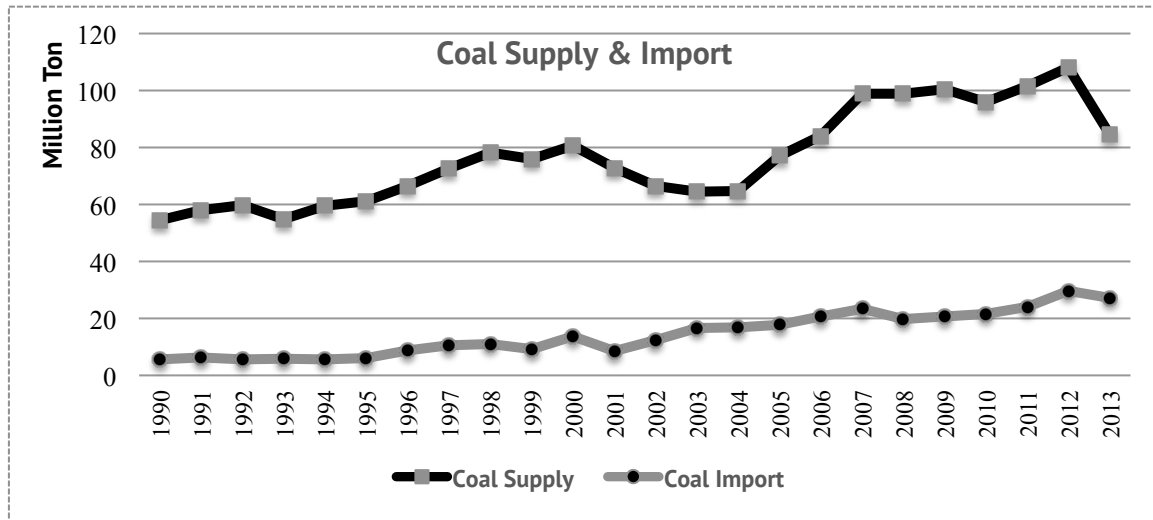
Methodology

The methodological reasons of the mentioned approach can be listed as follows:

- It is the carbon content and hence the energy value (TJ) and the sector of use that determines the impact of coal on climate change. The amount of greenhouse gas emitted to the atmosphere is found by multiplying the energy obtained as the result of combustion of coal and the emission factor that is applied for the method of obtaining energy (implied emission factor). *(For details on emission calculations, see; 2006 IPCC Guidelines for National Greenhouse Gas Inventories)*
- In this case, what is important in terms of climate change is not the amount of coal, but the emission amount of coal. While a unit amount of coal having low calorific value provides a low energy and hence low emission when combusted, coal with a high thermal value means more carbon dioxide emission. Therefore, while giving the amount of coal in the study, thermal value and emission equivalents have been used due to the climate change aspect.
- On the other hand, energy balance tables show the data in amount (ton) and energy (TOE). However, all of the tables in TOE could not be accessed as a times series. *(the energy balance tables used in the report are obtained from World Energy Council – Turkish National Committee archive and are included only on year 2013 balance table page of ETBK as of the date of writing the report.)*
- National greenhouse inventory is prepared based on energy balance tables and with the guidelines prepared by IPCC/ Intergovernmental Panel on Climate Change and with a statistical approach. Therefore, the inventory prepared by Turkey is the only reference with an internal consistency in terms of used coal, energy value and emission.

3. Coal Production and Supply

In 1990, 90% of coal supply was domestic production and 10% of it was imported coal. Primarily the imported coal was hard coal, which has higher calorific value, compared to lignite. In 2003, the share of imported coal has exceeded the 20% level for the first time and then reached high ratios as 27% in 2012 and 32% in 2013. While the share of imported coal was 5.6 million tons in total coal supply, which was 55.6 million ton in 1990 in total, the share of imported coal has become 29,6 million tons whereas total coal supply was 108,1 million tons in 2012. In other words, **Turkey started producing twice the amount of coal in 1990 and imported 5-6 times the amount of coal in 1990.**



Graphic 6: Annual imported coal and total coal supply
(Reference Data: Energy Balance Tables)

Lignite is determinative in coal production amount of Turkey. In 2012, a record has been broken in lignite production with 77,4 million tons⁸. Hard coal production varied between 1,9 to 2,8 million tons in the period between 1990-2013 and hard coal is the second fuel following lignite with a big difference. While there is a limited amount of asphaltite production, it has increased after 2003 and the production has reached 1 million ton level in recent years.

One of the most important organizations ensuring lignite production in Turkey is Turkish Coal Enterprises – TKİ. Ege, Çan, Garp, Bursa, Ilgın, Güney Ege and Yeniköy Lignite enterprises, which are affiliated to TKİ, have a saleable lignite production at 31,6 million ton level mined as of 2012. The share of TKİ in total lignite production was about 85% 20 years ago, and it has been reduced to about 38% as of 2013⁹.

The share of Elektrik Üretim A.Ş has increased with the transfer of mine sites from TKİ to the company and its share has increased to 42% as of 2013, exceeding the share of TKİ. The company has a saleable lignite production of 33,8 million tons in 2012 in Afşin-Elbistan, Elbistan-Çöllolar, Sivas-Kangal, Çayırhan, Koyunağılı and Seyitömer Lignite enterprises, which it owns. This capacity will increase more when 20 million tons, which is incomplete area production due to Elbistan Çöllolar accident that occurred in February 2011.

⁸ The lignite production in 2013 has been 57.5 million tons. In TKİ's 2013 Coal Sector Report, the reason of this figure is shown as the requirement to stop production in the mine due to the landslides that occurred in February 2011 in Çöllolar Open Cast Coal Mine and the inability to make sufficient investments in the sector.

⁹ 2013 Coal Sector Report, TKİ, page: 21.

The production by the private sector can be classified as follows:

- 1- Areas, where coal production is performed only by the private sector: In the areas in Balıkesir, Edirne, Karaman Ermenek, Konya Beyşehir, Manisa and Tekirdağ, 4.5 million tons of lignite has been mined in 2011. The annual production by private sector between 1990-2012 has been at 4-8 million ton level. In accordance with MİGM data, the private sector owns 380 lignite areas¹⁰.
- 2- The areas transferred to the private sector through privatization in recent years: Sivas-Kangal basin and Seyitömer basin coals have been transferred to the private sector in 2013 and the mine sites supplying coal to Kemerköy, Yeniköy and Yatağan thermal power plants have been transferred to the private sector in 2014. Thanks to the privatizations performed until 2013, the share of private sector has risen to 20% level as of 2013¹¹.
- 3- There are coal areas, where private sector mines through service purchase or royalty, although the ownership belongs to the public. These are lignite areas such as Soma, Milas, Bolu-Göynük, Tekirdağ-Saray, Çorum-Dodurga and the asphaltite areas in Silopi¹². In accordance with the activity report of TKİ for 2013, 66,5% of 13 million tons run of mine coal obtained in Ege and Garp Lignite enterprise areas through underground mining, has been mined against royalty, 31% of it has been mined with service purchase and 2,5% has been mined with the own resources of the enterprise.¹³.

When examined in terms of production, after years, for which the production was determined by TKİ, the areas have been transferred to EÜAŞ starting in 1989 and thereafter, the production has changed hands first through service purchase and royalty, and then through privatization in recent years. This model has been developed later and the areas are provided for operation with the condition of construction of thermal power plants. The explanation included in the coal report of TKİ for 2012 is given hereunder:

“Bolu-Göynük Area has been awarded to a private firm by TKİ through royalty tender, with the condition of constructing a thermal power plant. The firm has commenced the design works and obtained electricity production license for the power plant having 2x134 MW power, and the works for the establishment of the power plant are continuing. The project related with power production from the coal reserve in Eskişehir – Mihaliçcik is being performed by a private firm within the scope of the same model. The works for the establishment of 2x145 MW power plant are continuing.”

When examined in terms of hard coal, Amasra, Armutçuk, Kozlu, Üzülmüş, Karadon reserves in and around Zonguldak are owned by Turkish Hard Coal Enterprise-TKİ. TKİ performs coal production through service purchase or royalty. Almost half of the production is sold to Çatalağzı Thermal plant and the remaining amount is sold mainly to Kardemir and Erdemir Iron steel factories and to various places. When we examine the data for 2012, 4,6% of the hard coal needs for 2012 is supplied from TTK area, 2,6% of it is supplied from royalty areas, corresponding to a total of 7,2% supplied from the basin¹⁴. The remaining amount is

¹⁰ The production data of those areas could not be accessed.

¹¹ Coal Sector Report for 2013, TKİ, page:21.

¹² Coal Sector Report for 2012, TKİ, page:45-46.

¹³ Activity Report of TKİ for 2013, page:38.

¹⁴ Activity Report of TKİ for 2013, page:35.

provided from countries such as South Africa, Australia, USA, China and Canada, and mainly Russia.

Lignite production and imported coal are determinative for the coal supplied in Turkey. The coal supply process in the entire country can be summarized as follows:

- 1- Before 1990, almost 90% of the coal production of the sector was provided by TKİ and TTK and the remaining part was provided by the private sector. One of every 3 hard coal combusted in that period was provided by domestic production.
- 2- After 1990, some of the lignite areas providing coal for thermal plants have been transferred to EÜAŞ. Hence, the lignite reserves have become the property of the power plants privatized in recent years.
- 3- TKİ and TTK have developed the service purchase method in the following years and have transferred the works of mining coal from the areas owned by them to the private sector.
- 4- In 1990, the last paragraph of article 32 of the Regulation on the Application of Mining Law has been amended as the first step to royalty¹⁵. The basis for hard coal has been provided with the law amendment made in 2004¹⁶. Lignite production had a similar problem and the barriers in front of royalty have been removed with the regulation made in 2005¹⁷. After that date, the share of private sector has started to increase more through royalty.

When this data is assessed, it is seen that 70% of lignite and hard coal supply in Turkey is provided through import or production by the private sector¹⁸. It is also seen that this ratio will reach 80% when calculated for lignite and hard coal-sourced energy (toe).

¹⁵ Kilim E.E, Subcontracting and Privatization Method in Mining Sector: Royalty, Public Management World, January-May 2005, page21, 12-16.

¹⁶ Royalty has been added to the scope of the "Mining Law" within the frame of the provisions of the "Law on Amendment of the Mining Law and Some Laws" numbered 5177, which has entered into force being published in the Official Journal dated 05.06.2004 and numbered 25483.

¹⁷ Mining Law Application Regulation dated February 3, 2005, Provisional Article 2.

¹⁸ This includes production by the private sector in its own licensed area, and *production by public through royalty or service purchase from the private sector.*

4. Coal Power Plants in Turkey

In 2014, a capacity of 2.212,89 MW has been commissioned and the installed power, which was 12.234 MW in 2012, has shown an increase of 18% reaching 14.447 MW. As of 2014, Turkey has 55 coal plants¹⁹.

Under the decision taken by EPDK (Energy Markets Regulation Board), the auto-producer licenses have been converted into production licenses on May 1st 2014, and by this way, a set of power plants under 50 MW has been added to this list. Those added power plants mainly belong to sugar factories and other industries, and their total installed power is 295 MW. The total installed power of the remaining 22 power plants having an installed power in excess of 50 MW is 14.152 MW (Table-2).

Table 2- Power plants with an installed power in excess of 50 MW.

	Power Plant Name	Fuel type	Province of power plant	Installed Power (MWe)	Capacity in operation (MWe)
1	Çatalağzı- ZETEs I and II (*)	Imported Coal	Zonguldak	2.590	1.390
2	Afşin-Elbistan-A	Lignite	K.maraş	1.355	1.355
3	İSKEN - Sugözü Power Plant	Imported Coal	Hatay	1210	1210
4	İÇDAŞ	Imported Coal	Çanakkale	1.200	1200
5	Atlas Thermal Power Plant	Imported Coal	Hatay	1.200	1200
6	Afşin - Elbistan B	Lignite	K.maraş	1.080	1.080
7	Soma T.S. (*)	Lignite	Manisa	1.034	1.034
8	Yatağan Thermal Power Plant (*)	Lignite	Muğla	630	630
9	Kemerköy Thermal Power Plant (*)	Lignite	Muğla	630	630
10	Çayırhan Thermal Power Plant	Lignite	Ankara	620	620
11	Seyitömer TES (*)	Lignite	Kütahya	600	600
12	Kangal TES (*)	Lignite	Sivas	457	457
13	Yeniköy (*)	Lignite	Muğla	420	420
14	İçdaş Biga Thermal Power Plant	Imported coal	Çanakkale	405	405
15	Tunçbilek (*)	Lignite	Kütahya	365	365
16	İzdemir Enerji	Imported coal	İzmir	350	350
17	Çan	Lignite	Çanakkale	320	320
18	Çatalağzı (*)	Hard coal	Zonguldak	300	300
19	Orhaneli (*)	Lignite	Bursa	210	210
20	Çolakoglu-2 Thermal Power Plant	Imported coal	Kocaeli	190	190
21	Silopi Thermal Power Plant	Asphaltite	Şırnak	405	135
22	Polat-1 Thermal Power Plant	Lignite	Kütahya	51	51

The ones marked with (*) indicate the facilities, for which a privatization decree is taken or for which the privatization has been completed.

¹⁹ Based on EPDK license tables and new plants added from EIGM Energy Investment tables. Full list is provided in Annex-1

When 22 power plants with higher than 50 MW installed powers given in Table-2 are summarized:

- 1- 7 of the existing plants are operated with imported hard coal and produce a total installed capacity of 5945 MW.
- 2- One of the remaining 15 power plants is operated with hard coal, one is operated with asphaltite, 13 are operated with lignite, and the installed capacity of those domestic coal plants in operation is 8.207 MW.
- 3- When examined on fuel basis, the power plants, one of which is combusting domestic coal, and the remaining of which are combusting imported hard coal, constitute 44% of total coal plant power, the ones using lignite constitute 55% of total coal plant power and the only power plant, which uses asphaltite represents 1% of total coal plant power.
- 4- Although the installed power of thermal power plants using lignite has a share of 55% in total coal power plants, it has produced less electricity than the hard coal plants, most of which uses imported coal, in 2013.

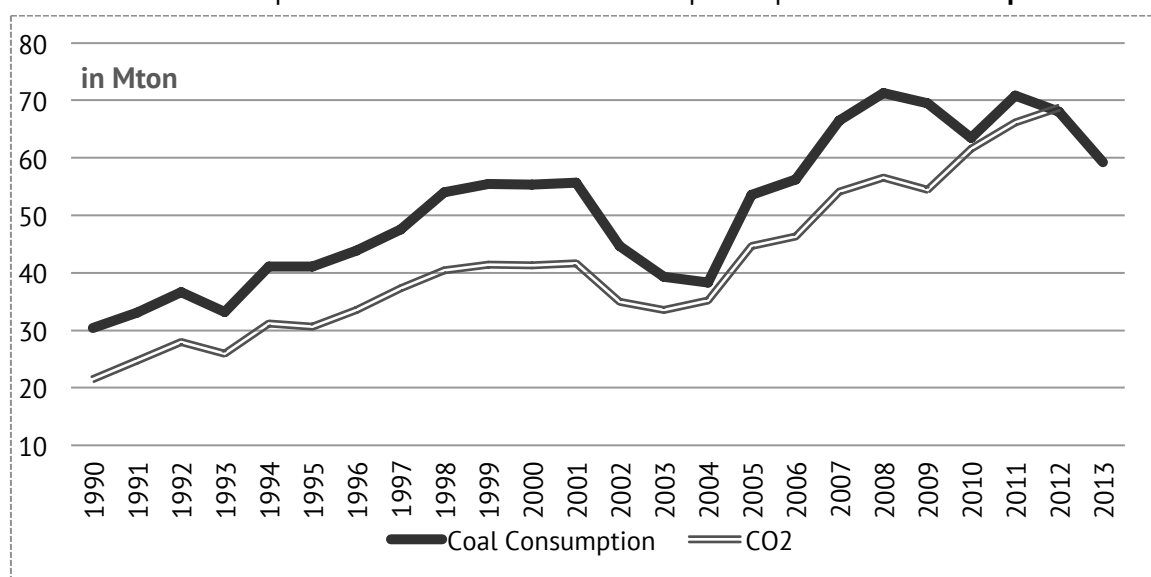
In accordance with the energy balance tables, the power plants in operation in 2013 have combusted 11 million 777 thousand tons of hard coal, 47 million 120 thousand tons of lignite and 329 thousand tons of asphaltite. 26,6% of electricity production has been provided by combusting 59,2 million tons of coal in total.

Table 3- Share of coal used in electricity production in 2013 and the amount of obtained electricity.

	Hard coal	Lignite	Asphaltite
Coal consumption –thousand Tons	11.777	47.120	329
Electricity production -GWh	32.792	30.262	732
Share in production	13,7%	12,6%	0,3%

Coal Consumption and Emission

For electricity production, 30,4 million tons of coal has been combusted in 1990, 68 million tons in 2012 and 59,2 million tons in 2013 at the existing thermal power plants. While the coal consumption has been almost doubled in 22 years, the amount of carbon dioxide emitted to the atmosphere due to coal combustion at power plants **has been tripled**.



Graphic 7: Coal consumption and CO₂ emission to the atmosphere in electricity production.

In Graphic-7, it is seen that the emission increase in Turkey is not parallel with the coal consumption increase, and that especially in recent years, million-ton carbon dioxide amount has caught the million-ton coal. This is mainly caused by imported coal. *Imported coal, which has more thermal energy/calorific value, and hence that contains more carbon, causes more emission to the atmosphere although being combusted in less amounts.* Thus, fuel is used in different ratios depending on the coal types in obtaining unit electricity in electricity production. When we examine the coal combusted at thermal plants and the obtained energy in the last 5 years; it will be seen that 384 gr hard coal is combusted to obtain one kilowatt hour electricity, 1 kg 573 gr lignite is combusted for the same amount at lignite power plants and 465 gr coal is combusted at the power plant using asphaltite. The amount of coal combusted at coal plants in the last 5 years per kilowatt hour is given hereunder²⁰.

Table 4- Amount of coal necessary to obtain 1 KWh electricity at thermal power plants

Coal consumption - Kw/gr	2009	2010	2011	2012	2013
Hard coal	394	418	381	365	359
Lignite	1609	1542	1551	1607	1557
Asphaltite	424	475	488	476	449

(Data sources: Energy Balance Tables and Renewable Energy General Directorate data)

Arithmetic of Coal Plants

In the production performed by coal plants, the fundamental criteria are capacity factor, availability capacity²¹ and thermal efficiency.

The **capacity factor** of a power plant is the ratio of installed power of the production obtained in one year to the theoretical production. There may be a difference between the value given in the design and the actual data. For 13 power plants having 7161 MW capacity in coal production of Turkey²² the reasons for the difference between theoretical production and actual production between the years 2010-2012 are given in Table-5.

As can be seen from Table-5, the power plant can not use all of its capacity due to internal reasons such as maintenance and due to external reasons such as demand. Except planned out-of-service periods of coal thermal power plants, there may be unplanned out-of-service periods. What is important here is the inability to supply all of the produced electricity to the grid. The produced electricity is used at many points in the plant. When 13 power plants, for which inventory has been prepared in accordance with the Court of Account reports, are examined, it is seen that more than 12% of gross production is used in internal consumption and only less than 88% can be provided to the grid²³.

Imported coal power plants have a higher thermal value than the existing thermal power plants in Turkey due to a series of differences from the quality of coal to the production technology. However, even if the capacity factor is an important parameter for thermal power plant production, it is the thermal efficiency of the power plant that really matters.

²⁰ The design specific fuel consumption of coal plants, which belonged to EÜAŞ before 2012, is given in Annex-2.

²¹ TEİAŞ uses the definition "Active Power Capacity (MW) of the production group that can be provided to ESI" for "available capacity". ESI is the abbreviation for Electric Supply Industry.

²² The list of those plants is given in Annex-2.

²³ Since efficiency is higher at the power plants using fuels other than lignite, the ratio will be lower. Examples could not be given due to the lack of clarity of data of other existing power plants in Turkey.

Table 5- Production performance of thermal power plants included in Annex-2 List

Loss Source	2010	2011	2012
Theoretical Electricity Production	%100	%100	%100
Group A Electricity Losses			
<i>Reasons such as planned and forced out-of-service periods, repair and maintenance based out-of-service periods and load decreases</i>	-39%	-37%	-35%
Group B Electricity Losses			
<i>Reasons such as load bus central demand, fuel amount and quality, insufficient water and frequency control, ash and slag system, atmospheric conditions, environment and network failures.</i>	-13%	-10%	-19%
Gross Electricity Production after Losses	49%	53%	46%
Internal Consumption	5%	6%	6%
Net Electricity Production	%43	%47	%40

The data is obtained from EÜAŞ 2011 and 2012 reports prepared by the Court of Account.

When the thermal efficiencies of the power plants given in Annex-2 are examined, the activity data for calculating the energy consumed for electricity production and hence for calculating the emission will be found. Although the design thermal efficiencies of those thermal power plants are 37,5% in average²⁴, their gross thermal efficiencies are between 32,6%-32,2%²⁵. When the gross and net thermal efficiencies are examined originating from the table given herein above, although the thermal value of electricity obtained by combusting coal equivalent to 100 calories is 37,5 in design, it decreases to 32,5 calories in gross production, and to 29 calories when internal consumption loss is added. **In other words, only 29 calories-equivalent of 100 calories of combusted coal is transmitted to the grid and 71 calories of it is emitted to the air, consumed for internal losses and plant consumption.**

Table 6- Gross and net thermal efficiencies of thermal plants given in Annex-2 list

	2010	2011	2012
Total thermal value of combusted coal	100	100	100
Thermal equivalent of produced electricity	32,6	32,5	32,2
Thermal equivalent after internal consumption loss	28,7	29	28
Net thermal efficiency / ratio of thermal value to production	29	29	28

(The energy of combusted coal is accepted to be 100 kcal)

Consequently, the heat of the coal combusted at thermal power plants and the thermal efficiency of the power plant are important. While the thermal value of the combusted coal determines the emission, its net thermal efficiency determines the amount of power provided to the grid. Even if the same amount of lignite, which has a low thermal value, and the imported coal are combusted in the same amounts; the first has lower energy and a proportional emission, while the second will cause a higher greenhouse gas emission.

²⁴ In Environmental Impact Assessment reports, the thermal efficiencies of imported coal – based thermal power plants are given at 42-44% level.

²⁵ Data on the actual gross thermal efficiencies of imported coal – based thermal plants could not be accessed.

5. Potential Coal plants

As of the end of 2014, a series of new power plants have obtained license, or at the stage of preliminary license or their connection, applications have been received in addition to existing the thermal power plants having an installed power of 14.447 MW. The potential coal power plants can be briefly divided into 4 groups:

- 1- The plants, for which connection application has been made. It defines the power plants, which have made a connection application to TEİAŞ or the distribution company for the establishment of the power plant. In accordance with TEİAŞ reports, there are applications for thermal power plants operated with coal having a total power of 13.585 MW, for which opinions are given for connection²⁶. The capacity provided by TEİAŞ does not include the power plants, which have obtained license, or which are under construction.
- 2- Power plants, the preliminary license applications of which are being assessed. It defines the power plant projects, for which connection opinion is obtained; necessary preliminary license application operations have been performed, and assessed by EPDK. As of the beginning of 2015, 14 power plants having a total capacity of 4603 MW are at the stage of assessment and are given in Annex-3.
- 3- The power plants, which have obtained preliminary license: Before making license applications, works and transactions such as ownership right of use, resource right of use for domestic coal plants, Environmental Impact Assessment report for investment etc have to be completed. As of the beginning of 2015, 7 power plants are at the stage of assessment with a total capacity of 6875 MW and are given in Annex-3.
- 4- Projects that have obtained license and that are under construction: They are the plants, which obtained the right for construction upon obtaining license as the result of the license application after completing the preliminary license transactions. In accordance with EPDK progress reports, there are 22 projects having an installed power of 8458 MW and a capacity of 8273 MW is under construction. The list of the plants is given in Annex-4. The average annual production of 22 plants is estimated to be 71 thousand GWh²⁷ and it will be seen that this is above 68 thousand GWh produced by the coal plants in 2012.

In 2012, the coal plants, which have an installed power of 12,5 GW, have increased with 2,3 GW added until the end of 2014; with the addition of the licensed plants and the plants under construction, if the other candidate 44 ²⁸ plants are constructed, Turkey seems to have a potential to reach a coal plant installed power of 34,7 GW.

²⁶ The data has been compiled from Production Facilities Regional Capacity Report 2019-2024 prepared by TEİAŞ and there is no such information obtained from distribution companies, the privatization of which is new.

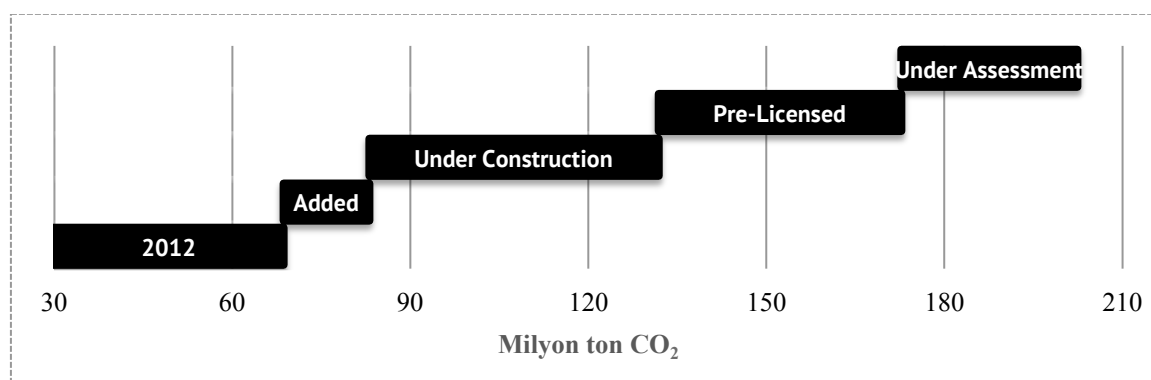
²⁷ In accordance with the license application lists of EPDK.

²⁸ The plants, which have been announced, but which are not officially approved, are not included in the number of plants given herein.

Table 7- Installed power projection created by the existing and candidate coal plants²⁹.

Existing Capacity - 2012	Added capacity	Under construction	Pre- licensed	Under Assessment	Potential sum
12,5 GW	2,3 GW	8,5 GW	6,9 GW	4,6 GW	34,7 GW

In 2012, the existing coal plants sourced emission has been 68.7 million tons. It can be envisaged that the plants added until 2014 and all of the candidate plants given in Table-7 will be realized and that new ones will be established instead of the ones that are not realized, in which case the capacity will remain in the given values. In this case, while the carbon dioxide emission produced as a consequence of coal use in the coal plants, has been 69 million tons in 2012; taking into consideration the newly added plants and the plants that are on their way in terms of the official process, it is envisaged that an emission of 200 million tons will be reached. That is, **with the completion of all plants, Turkey will be emitting 200 million tons of carbon dioxide to the atmosphere every year.**

Graphic 8: CO₂ to be produced by the plants that exist in 2012, added until 2014 and candidate plants³⁰.

²⁹ 13,5GW capacity connection application made to TEİAŞ can be deemed the top limit under the existing conditions. Connection application is not sufficient for the application of the project and approval is necessary, therefore, the total figure of 11,5 GW, which has been finalized upon preliminary license and assessment application, has been taken into consideration.

³⁰ Since emission calculations are not included in EIA reports, the thermal efficiency average obtained from EIA reports that could be accessed, and the coefficients from National Inventory Report for 2014 have been used in the calculations for the candidate plants. Grid need or operation-sourced production changes are not envisaged in the calculations.

6. Coal Plant Market

Although it seems difficult for Turkey increase 12.5 MW installed coal in 2012 to 34,7 MW as it was indicated in government plans, there are progresses on this path with the plants under construction and the candidate plants. Electrical Energy Market and Security of Supply Strategy Document dated 2009 defines the existing explicit policies on coal:

- Proven lignite deposits and hard coal resources will be put to use for electricity generation activities by 2023 (article.8.2)
- Domestic and renewable energy have priority for meeting the electrical energy need and taking into consideration the developments and security of supply in using those resources, ***plants based on qualified imported coal will be used*** (Article 8.6).

In order to implement the policy decisions, the coal plant market risks have to be defined, and supporting policies that are necessary for mitigating those risks have to be determined. Thus, Turkey, with government policies, has accelerated the process of developing the coal plant market; this acceleration has started before the release of Electrical Energy Market and Security of Supply Strategy Document and after the release of document the acceleration continued.

Risks in the Coal Market

There are some risks in the development of coal market in Turkey. The risks defined in the report prepared by TKİ are listed hereunder:

- The low quality of lignite reserves to a great extent
- Existing reserves do not have the appropriate qualities for beneficiation
- Low energy density due to high ash and humidity content
- Very limited activity of private sector firms in research and development area
- Limited interest in the research and development area among the public institutions acting in the sector
- Existing coals have much higher carbon dioxide emission compared to other energy sources per unit thermal value
- Existing coals have a big negative impact on the environment due to their high sulfur content

Since the risks have to be mitigated in order to develop the market, Turkey is carrying out its program including two basic targets and a series of sub-actions related with those targets:

- 1) Allocating the lignite areas, which are owned by public and for which investments can not be made, to the private sector for their use
- 2) Developing strategies on opening the coal industry in Turkey to international markets.

In order to allocate the areas to the private sector, the investment risks have to be mitigated and the path to easy financing has to be opened with low risks.

Mitigation of Risk

Various privileges are provided through the mitigation of risks for the development of the coal sector. For the target of expanding the coal market, it is necessary to first ensure cost reductions that will mitigate the credit risks, facilitations that will expand the market and to make the lignite sector, which has limitations, more attractive.

Investment Preparation Support: For this purpose, the works to prepare the coal reserves, which can be converted into thermal plants in the future, for investment, are performed:

- Preliminary surveys and examinations,
- Reserve drillings,
- Hydrologic survey
- Geologic survey
- Determination of exploitable reserve.

Allocating Coal Areas to the Private Sector: Transferring the coal areas, where production is performed by TKİ, has ensured the development of market and TTK, to the private sector through sub-contracts, royalty or production permits.

Privatization of the Public Coal Plants to the Private Sector: In order to strengthen the existing investments of the private sector and to expand the market, the plants have been sold to the private sector, models have been created for the use of the existing reserves and actions have been defined at policy level.

The coal reserves and coal plants, which are under the control of the public, have rapidly privatized and have been transferred to the private sector in recent years. It is necessary to see the transformation, to which coal and electricity obtained from coal have been subject, in order to analyze the new structure of the market.

- 1- In addition to the royalty model in coal production, the transfer of areas through royalty for electricity production has been started³¹:

*"The completion and commissioning of the investments in the coal areas, which have been tendered to and contracted with the private sector with royalty model for electrical energy production, shall be ensured."*³²

- 2- ETKB has included the model of electricity production through royalty in its own strategy plans and has added the development of more projects to its targets:

"Opening all coal areas, where the public has license, to investments will be ensured with appropriate models (intergovernmental agreements/ public – private partnership etc for lignite areas with big – scaled reserves)." ³³

- 3- ETKB has integrated its targets on domestic coal production with measurable, reportable and verifiable targets:

"A2. Target: The electrical energy produced from domestic coal shall be increased to an annual level of 60 billion kWh at the end of the period. " ³⁴

- 4- Ministry of Economy has strengthened its subvention system by making regulations on coal. It has been ensured that the investments on coal mining for lignite, asphaltite etc. can benefit of the following subsidies:

- Value Added Tax Exception

³¹ These refers to Bolu Göynük and Yunus Emre Coal Power Plants.

³² ETKB 2015-2019 Strategy Plan p:43

³³ ETKB 2015-2019 Strategy Plan p:43

³⁴ ETKB 2015-2019 Strategy Plan p:121

- Customs Tax Exemption:
 - Insurance Premium Employer Share Subsidy,
 - Income Tax Withholding Subsidy,
 - Insurance Premium Subsidy:
 - Credit interest subsidy:
 - Investment place assignment
- 5- After 2012, the coal plants belonging to the public have been transferred from EÜAŞ (Government Electricity Production Company) to the private sector through privatization. As of 2015, public plants having an installed power of 4602 MW have been privatized. Hence, Çan, Soma A and Afşin-Elbistan A and B plants have been left to EÜAŞ.

Table 8- Coal plants that are privatized by Privatization Directorate

	Installed power	Sales Price Million \$
Yatağan Thermal power plant	630	1091
Çatalağzı	300	350
Kemerköy, Yeniköy	1050	2671
Seyitömer	600	2248
Kangal	457	985
Soma B	990	685
Orhaneli and Tunçbilek	575	521
Total:	4.602 MW	8.551 M\$

Expansion of Market with imported coal: Besides the direct methods of mitigating the risks for, indirect methods are also used. Due to the low efficiency of lignite and limited asphaltite and hard coal reserves, the imported coal will have an expansion impact on the coal – sourced energy production market. Thus, the imported coal plants, which had an installed power of 1651 MW until 2008, have now exceeded 6 thousand MW installed power.

Transformation of Coal Market

Turkey, which has ratified UN Framework Convention of Climate Change in 2004, has ratified Kyoto Protocol in 2009. However, neither the Convention nor the Protocol slowed down the coal policies of Turkey, on the contrary, Turkey has continued its high-carbon development with a higher rate than the past. Electricity production from coal has become a serious market with the models developed after 2004.

Although the path to electricity production from domestic coal has been paved, the low quality of coal made the plants with import fuel more attractive. In accordance with 2013 data of MTA, 69% of 13,3 billion tons of lignite reserve has a thermal value of 2000 kcal/kg, 25% has a thermal value of 2000 – 3000 kcal/kg, and the remaining part is above a thermal value of 3000 kcal/kg. When the high ash ratio varying between 18-52% and the high humidity ratio varying between 19-40% are added to those values, imported coal becomes more attractive in terms of investment and operation. Imported coal from South Africa, Colombia, Venezuela, Russia and Australia with an ash ratio of 10%, humidity ratio of 10% and a thermal value of 6000 kcal/kg adds import carbon to the carbon budget of Turkey.

Due to the realization of Turkey's targets on coal, imported coal, whose cost and technology are more appropriate for the investor has exhibited a fast development. **With the coal policy of Turkey that supports imported coal, Turkey become a carbon importing country.**

7. Financing of Coal

In electricity production, the financing of coal can be defined as the financing of investment and financing at the stage of operation:

Investment financing: It is financing the investment with the credit obtained by taking into consideration the subsidy politically provided by the state to the coal plants. The financed plant thus warrants the use of coal as long as permitted by the reserve and/or for the life of the plant. *Financing of investment also provides financing for the greenhouse gas emissions produced by coal that is consumed for the life of the reserve or for the economic life.*

Financing at the operation stage: It is the period financed with the sales of the electricity produced by the commissioned plant, and is in fact paid by the end user. In terms of climate change, the electricity financed at the stage of operation *finances the greenhouse gas emission to the atmosphere in that year.*

Hence, while each financed coal plant is financing the potential emissions, the financing of each operated coal plant with the end user invoices is written in the annual emission account. In other words, in terms of climate change, not the investment, but the greenhouse gas emission is financed.

In the past, Turkey financed its coal plant investments with public resources or foreign credits/ investments (such as Sugözü Thermal Power Plant). As the market is opened to the private sector more, it has become more important to find resources other than the state. However, the fact that the international financing institutions or investment companies do not finance new coal plants or finance them only in rare circumstances, has increased the financing role of domestic banks.

The private banks have noticed this situation in Turkey and started serious financing works in recent years. A financing portfolio of 8.5 billion dollars for the privatized plants of 4,6 GW and a financing of 20-22³⁵ billion dollars for 20 GW that may be added to 14,8 GW capacity is in the line of assessment for the future periods.

The domestic banks have started providing substantial amounts of credits as a result of the decrease in the number of international financing alternatives, and after the market has become effective for the private sector. When we examine the provided credits, it is seen that the main contractor firm of Yunus Emre Thermal Power Plant has provided export credit from its own country, and that Turkish banks had roles for the other plants (Table-9). Turkish banks have provided 4.3 billion dollars financing for 4,7 GW installed power³⁶.

Table 9- Coal plant projects, for which financing is provided

		Installed Power	Credit	Financer
Aksa Göynük TPP	Lignite	270 MW	240 Million \$	İş Bankası, Garanti
Zetes-3 TPP	Import	1320 MW	800 Million \$	İş, Garanti
Seyitömer TPP	Lignite/ privatization	600 MW	1671 Million \$	İş, Garanti, Ziraat, Vakıf, Halk, Deniz
Aliağa TPP	Import	350 MW	280 Million \$	Garanti
Silopi TPP	Asphaltite	270 MW	286 Million \$	Garanti
Atlas TPP	Import	600 MW	262 Million \$	Garanti
Cenal TPP	Import	1320 MW	765 Million \$	Deniz, Halkbank, Finans ve Ziraat
Yunus Emre TPP	Lignite	300 MW	450 Million \$	Çek Export Bank

³⁵ When 1-1,1 million dollars is envisaged in the budget for 1 MW installed power.

³⁶ According to the finalized and publicized data.

When examined in terms of climate change, it will be seen that the financing of privatized plants and plants to be newly constructed is spent for financing high carbon economy, hence, not for decarbonizing the economy, but for making them more carbon-intensive.

When the report of the projects given in Table-9 is examined in terms of climate change, the greenhouse gases will be noticed as well as the financed plant and coal amounts.

Aksa Göynük Thermal Power Plant has an installed power of 270 MW, and its foundation has been laid in 2012 in order to obtain 38 million tons of lignite reserve through royalty. With the realization of the investment, an annual amount of 1,9 million tons of CO₂ will be emitted to the atmosphere and it will be seen that a total emission potential of 45 million tons will be financed with a 240 million dollar-credit. When the ratio of the emission potential to the credit is examined, it will be noticed that 5 dollars credit is provided for 1 ton carbon dioxide emission.

Aksa Göynük Thermal Plant		
Fuel	Installed Power	Reserve
Lignite	270 MW	38 million ton
Investment M\$	Credit	Financer
320	240 Million Dollars	İş Bank and Garanti Bank
Financed	Financing provided for 1 ton	
Annual Emission	Reserve Emission	CO ₂
1,9 Million Ton	45 Million Ton	5 \$/ton CO ₂

Report 1- Climate report of the financing for Aksa Göynük Thermal Plant (these are the values obtained considering a lower thermal value of 2757 kcal/kg, and a capacity factor of 50%.)

600 MW **Seyitömer Thermal Power Plant** has been privatized for 2 billion 248 million dollars including the immovable assets and 200 million tons of coal reserve. With the transaction, which has been approved on 15.03.2013, the production will be ensured with a profitability to meet the privatization price economically for the 4 units commissioned between 1973 and 1989. The continuity of the plant, which is about to complete its economic life, will be ensured, and it will be seen that annually 4 million tons CO₂ and when the entire reserve is spent, an emission potential of 146 million tons will be financed with a credit of 1 billion 641 million dollars. With the financing, 11 dollars credit will be provided for 1 ton potential greenhouse gas emission.

Seyitömer Thermal		
Fuel	Installed Power	Reserve
Lignite	600 MW	200 million ton
Privatization Price	Credit	Financer
2 billion 248 Million \$	1 billion 641 Million \$	İş Bankası, Garanti, Ziraat, Halk, Deniz ve Vakıf Bank
Financed	Financing provided for 1 ton CO ₂	
Annual Emission	Reserve Emission	
4 Million Ton	146 Million Ton	11 \$/ton CO ₂

Report 2- Climate report of the financing for the privatization of Seyitömer Thermal Power Plant (these are the values obtained considering a lower thermal value of 1700 kcal/kg, and an annual coal use of 6 million tons)

Zetes-III thermal plant, which as 1320 MW power will be operated with coal and a credit of 800 million dollars of its investment cost has been provided by 2 banks indicated in the Table. The positive EIA report has been obtained, however the local population has brought the process to trial. Due to lack of sufficient reserve, the plant will be using imported coal and will emit an annual amount of 8,7 million tons carbon dioxide to the atmosphere; for an economic life of only 20 years, 174 million tons emission will be produced, and in this case the banks will provide 4,6 dollars credit for each ton of CO₂.

ZETES-III Thermal Power Plant		
Fuel	Installed Power	Reserve
Imported coal	1320 MW	Import
Investment M\$	Credit	Financer
1 Billion 50 Million \$	800 Million dollars	İş Bankası and Garanti
Financed		Financing provided for 1 ton CO ₂
Annual emission	Reserve emission	
8,7 Million Ton	174 Million Ton	4,6 \$/ton CO ₂

Report 3- Financing climate report of Zetes-III thermal power plant project
(considering a thermal efficiency: 43,84%, annual operation period of 8 thousand hours, lower thermal value of fuel: 5400 kcal/kg and an economic life of 20 years)

Consequently, the agreements on climate change and the competition for low carbon economy, developments for spending the resources not on fossil fuels but on climate-friendly projects/ investments, and pricing the existing³⁷ carbon with taxes or limited – trade mechanisms in 40 countries and 20 regions worldwide have been proceeding. However, **Turkey, has been creating a model, where loans are provided for more carbon dioxide emission through financing coal.**

³⁷ For more details see: State of Trends of Carbon Pricing, Worldbank Group, May 2014.

8. Conclusion

Turkish economy is using more energy due to higher fossil fuel use compared to 1990. While the energy consumed in 1990 was 53 million TEP, 121 million TOE energy has been consumed in 2012. The increase in the fossil fuel consumption has been more than the increase in energy consumption. Between 1990-2012, the energy consumption has increased 128% while the increase in fossil fuel consumption has been 152%. In this case, **the fundamental policy of Turkey has been increasing the energy production and consumption by increasing the fossil fuel production and consumption.**

Natural gas has penetrated the market at the end of eighties and has become a new source of energy. While it was expected that the addition of natural gas to energy diversity would substitute coal to some extent, this has affected coal consumption in the first years. However, Turkey has substantially increased its coal consumption with the policies developed in the period corresponding to the time of ratifying UN Framework Convention on Climate Change in 2004 and to Kyoto Protocol in 2009. The energy obtained from coal has increased to 38 million TOE in 2012 from 16,1 million TOE in 1990, corresponding to an increase of 136%. **Because of fossil fuel-based economy model of Turkey, coal has strengthened its throne.**

Coal consumption decreased in industry after 2007, however its use increased in electricity production after 2004, and in residential areas after 2007. 63% of coal consumption has taken place at power plants in 2012. The policy of Turkey for providing low-quality coal to the economy over power production has given its results and only 45% of coal – sourced energy has been used at the power plants in 2012. In spite of the share of coal amount used in total energy, low-quality coal has been combusted at the plants. Climate change had his share of the policies increasing the use of coal. **The greenhouse gas emissions of Turkey increased 133,4% between 1990 – 2012, while the increase in the greenhouse gas emission produced by the coal combusted at thermal power plants has been 219%.**

Coal is one of the fossil fuels used by the thermal power plants, but it is also a source of emission, which has great significance in terms of climate change. **In 2012, 2 of each 5 carbon dioxide gases emitted by Turkey to the atmosphere have been produced by the coal combustion.**

The privileges provided by Turkey for coal consist of providing an inefficient source for the economy. The efforts for developing domestic lignite, which has a high ash and humidity ratio and a low calorific value, have necessitated the provision of privileges for a market transformation. The privileges, which have been developed more in the policy documents have been further accelerated in 2009 and found responses in application. In order to create markets for coal power plants, first the production areas have been opened to the private sector, and then the power plants have been transferred through privatization. The problems encountered in lignite production, which is the main fuel, have paved the path for imported coal plants in recent years. Imported hard coal, which has low humidity and ash content and high calorific value, has found more areas of use and passed in front of the domestic coal first in electricity production. With the realization of the existing investments, it has become a candidate to pass in front of the domestic coal in terms of installed power as well.

The failure in considering coal in terms of carbon economy has resulted in the failure of not questioning it as a fuel. In fact, although the coal plants are presented as positive investments with concepts such as produced electricity, available capacity or capacity factor, their gross and net thermal efficiencies show that they are fundamentally inefficient sources. **When 13 plants combusting domestic coal are examined, it is seen that in spite of a**

theoretical design thermal efficiency of 37,5%, they have produced 32,5% gross thermal efficiency and after internal consumption loss, they have produced energy corresponding to a thermal efficiency of 28-29%. Speaking in terms of climate change, 29 units of energy obtained from 100 units of coal are provided to the grid, while the emission of 100 units of coal has been given to the atmosphere against the production.

Although the adventure of Turkey for producing electricity from coal has now reached a period of 70 years, the problems related with electricity production using low calorific value – lignite having a high pollutant level has never been solved. Import hard coal, which rapidly passed through the door opened by the existing coal privileges, has increased its installed power to 6.1 GW in 2014 from 3,9 GW in 2012, approaching the domestic coal plants, which have an installed power of 8,1 GW. It is another fact that new imported coal plants will not change the existing picture in terms of carbon economy. **It is obvious that new imported coal plants, which have a design thermal efficiency of 42-44%, will provide a thermal efficiency under the design value by combusting 100 units of coal and will reach a lower net thermal efficiency after internal consumption, but will emit all of the greenhouse gas produced from 100 units of coal to the atmosphere.**

The privileges developed by Turkey for the production of coal and its use at the power plants carry the situation to an irreversible point in terms of climate change and reveal that the future will be worse than today. The installed coal plant power, which was 5.2 GW in 1990, has become 12.5 GW in 2012 and 14.8 GW in 2014. With the addition of the ones, which are included in the portfolio, which are licensed, and in construction stage, which have preliminary license and in assessment stage, there is a potential of 34,5 GW. **If Turkey commissions the plants included in the portfolio, the coal – sourced carbon dioxide emission, which was 21,5 million tons in 1990, 68,7 million tons in 2012, is expected to reach 200 million tons.**

One of the most fundamental tools in order to involve the private sector in the process for the development of coal and coal-combusting plants market has been the inclusion of banks providing financing, in the process. The distance of international financing organizations to investments such as coal and their decision not to provide loans for them hinder the development of the market. The policy documents of Turkey, which provide warranty for coal investments, have ensured the inclusion of national banks in the process. Turkish banks, which have provided 4,3 billion dollars credit for new investments or existing privatizations until today, have started taking the role of meeting the financing needs of the market. **A financing portfolio consisting of 8,5 billion dollars for 4,6 GW plants that are privatized and a financing of 20-22 Billion dollars for a possible 20 GW capacity that may be added to the existing 14,8 GW capacity creates a situation that gives an edge to the appetite of the banks providing credit.**

While mechanisms financing projects that reduce carbon are being developed at the global level, a structure that will finance carbon increase is being developed recently in Turkey. Although the Banks consider that they finance the investment with the credits they provide, in fact they warrant the release of the supported annual emission and reserve emission to the atmosphere. A plant that is established on a mine reserve will not only emit carbon dioxide to the atmosphere every year, but also will warrant the emission of potential carbon dioxide accelerating the climate change with the mining of the reserve. Similarly, a plant based on imported coal is financed for a reserve mined in any other part of the world to change the climate. **The “coal market warranty” created by Turkey is a surplus carbon effort ensuring the addition of more reserves to the existing emissions, that is a high carbon market work that ensures a faster integration of national and global reserves to the existing reserves.**

ANNEXES

Annex-1: Existing Coal Plants as of the End of 2014

	Plant name	Fuel type	Province of plant	Installed power (MWe)	Capacity in operation (MWe)
1	Çatalağzı- ZETEs I and II	Imported Coal (*)	Zonguldak	2.590	1.390
2	Afşin-Elbistan-A	Lignite	Kahramanmaraş	1.355	1.355
3	İSKEN - Sugözü Power Plant	Imported Coal	Hatay	1210	1210
4	İÇDAŞ	Imported Coal	Çanakkale	1.200	1200
5	Atlas Thermal Plant	Imported Coal	Hatay	1.200	1200
6	Afşin - Elbistan B	Lignite	Kahramanmaraş	1.080	1.080
7	Soma T.S.	Lignite	Manisa	1.034	1.034
8	Yatağan Thermal Plant	Lignite	Muğla	630	630
9	Kemerköy Thermal Plant	Lignite	Muğla	630	630
10	Çayırhan Thermal Plant	Lignite	Ankara	620	620
11	Seyitömer TES	Lignite	Kütahya	600	600
12	Kangal TES	Lignite	Sivas	457	457
13	Yeniköy	Lignite	Muğla	420	420
14	İçdaş Biga Thermal Plant	Imported Coal	Çanakkale	405	405
15	Tunçbilek	Lignite	Kütahya	365	365
16	İzdemir Enerji	Imported Coal	İzmir	350	350
17	Çan	Lignite	Çanakkale	320	320
18	Çatalağzı	Hard Coal	Zonguldak	300	300
19	Orhaneli	Lignite	Bursa	210	210
20	Çolakoğlu-2 Thermal Plant	Imported Coal (*)	Kocaeli	190	190
21	Silopi Thermal Plant	Asfaltit	Şırnak	405	135
22	Polat-1 Thermal Plant	Lignite	Kütahya	51	51
23	Beyazırma ETİ-SODA Kojen.	Lignite	Ankara	24	24
24	Kardemir Demir Çelik	Lignite	Karabük	87,5	22,5
25	Konya Şeker Sanayi	Lignite	Konya	23,75	22
26	Türkiye Şeker Fab.A.Ş.	Other	Konya	14,4	14,4
27	Türkiye Şeker Fab.A.Ş.	Lignite + fuel oil	Tokat	14,24	14,24
28	Eti Alüminyum A.Ş.	Lignite + fuel oil	Konya	12,93	12,93
29	Türkiye Şeker Fab.A.Ş.	Lignite + fuel oil	Afyonkarahisar	12,8	12,8
30	Türkiye Şeker Fab.A.Ş.	Lignite + fuel oil	Burdur	10,96	10,96
31	Eti Maden İşletmeleri	Lignite	Balıkesir	10,66	10,66
32	Türkiye Şeker Fab.A.Ş.	Lignite	Sakarya	10,4	10,4
33	K.maraş Kağıt San.A.Ş.	Imported Coal	Kahramanmaraş	15,7	9,7
34	Türkiye Şeker Fab.A.Ş.	Lignite + fuel oil	Niğde	9,6	9,6
35	Türkiye Şeker Fab.A.Ş.	Lignite + fuel oil	Balıkesir	9,6	9,6
36	Türkiye Şeker Fab.A.Ş.	Lignite	Konya	9,6	9,6
37	Türkiye Şeker Fab.A.Ş.	Lignite + fuel oil	Kahramanmaraş	9,6	9,6
38	Çimsa Atıkısı Plant	Lignite	Mersin	9,56	9,56
39	Amasya Şeker Fab.A.Ş.	Lignite	Amasya	7,76	7,76

40	Türkiye Şeker Fab.A.Ş.	Lignite + fuel oil	Kastamonu	7,32	7,32
41	Kütahya Şeker Fab.A.Ş.	Lignite	Kütahya	7,128	7,13
42	Petlas Otoprodüktör Tesisi	Lignite	Kırşehir	6	6
43	Türkiye Şeker Fab.A.Ş.	Lignite + fuel oil	Yozgat	6	6
44	Türkiye Şeker Fab.A.Ş.	Lignite + fuel oil	Kırşehir	6	6
45	Aynes Gıda A.Ş.	Lignite	Denizli	5,5	5,5
46	Türkiye Şeker Fab.A.Ş.	Lignite + fuel oil	Kırklareli	5,4	5,4
47	Türkiye Şeker Fab.A.Ş.	Lignite + fuel oil	Erzurum	5,4	5,4
48	Küçüker Termik Kojen. Tesisi	Lignite	Denizli	5	5
49	Türkiye Şeker Fab.A.Ş.	Lignite + fuel oil	Samsun	4,75	4,75
50	Türkiye Şeker Fab.A.Ş.	Lignite + fuel oil	Erzincan	4	4
51	Türkiye Şeker Fab.A.Ş.	Lignite + fuel oil	Uşak	3,72	3,72
52	Türkiye Şeker Fab.A.Ş.	Lignite	Afyonkarahisar	3,385	3,38
53	Çankırı Tuz Fabrikası Kojen.	Lignite	Çankırı	1,64	1,64
54	Göknur A.Ş. TES	Lignite	Niğde	1,55	1,55
55	Bolluk Tesisi (Kojenerasyon)	Lignite	Konya	1,448	1,45
TOTAL:				14.447	

Notes:

- 1- EPDK License lists have been taken as reference.
- 2- Checked with the reports of other institutions and companies, basing on the list taken as reference.
- 3- The list has been prepared taking into consideration the reports until December 31st 2014 and may include incomplete and wrong information due to the incomppliance between the references.
- 4- The list includes the ones that are commissioned until December 31st 2014.
- 5- The plant names have been replaced with the name of the plant owner for easier understanding.
- 6- Auto-producer licenses had been converted into production licenses as of May 1st 2014 under the resolution of EPDK. Small coal plants have been added to the list, according to this resolution.
- 7- The fuel type of plants marked with (*) is different in EPDK and TKİ reports.

Annex-2: Status of Coal Power Plants that EÜAŞ had owned before 2012

Plant name	Current Owner	Installed power	Unit no.	Commissioning date	Total unit efficiency (%)*	Fuel consumption gr/kWh*	Type of fuel
ÇATALAĞZI	(Demir Madencilik)	300	1	19.10.1990	35,3	786	Hard coal
			2	05.07.1992	35,3		
TUNÇBILEK	(Çelikler)	365	3	18.08.1965	29,53	1.342	Lignite
			4	19.12.1977	38,19	1.038	
			5	10.10.1978	38,19	1.038	
SEYİTÖMER	(Çelikler)	600	1	18.07.1973	37,06	1.326	Lignite
			2	07.03.1974	37,06	1.326	
			3	03.11.1977	36,77	1.336	
			4	16.02.1989	36,98	1.453	
AFŞİN-ELBİSTAN-A	EÜAŞ	1355	1	07.07.1984	37,15	2.205	Lignite
			2	03.05.1985	37,15	2.205	
			3	25.01.1986	37,15	2.205	
			4	21.11.1987	37,15	2.205	
AFŞİN-ELBİSTAN-B	EÜAŞ	1440	1	03.03.2006	38,82	2.110	Lignite
			2	18.09.2006	38,82	2.110	
			3	23.06.2006	38,82	2.110	
			4	14.11.2006	38,82	2.110	
KANGAL	(Konya Şeker-Siyahbeyaz)	457	1	06.03.1991	37,3	1.774	Lignite
			2	05.06.1991	37,3	1.774	
			3	26.10.2000	35,19	1.880	
ORHANELİ	(Çelikler)	210	1	23.03.1992	35,6	1.028	
ÇAN	EÜAŞ	320	1	15.07.2006	42	788	Lignite
			2	15.07.2006	42		
SOMA-B	(Konya Şeker)	990	1	29.09.1981	36	995	Lignite
			2	02.08.1982	36	995	
			3	26.05.1985	36	995	
			4	20.02.1985	36	995	
			5	02.08.1991	35,5	1.563	
			6	25.03.1992	35,5	1.563	
SOMA-A	EÜAŞ	44	1	26.06.1957	29,2	886	Lignite
			2	20.12.1958	29,2		
KEMERKÖY	(İC İctaş)	630	1	16.12.1993	38,16	1.288	Lignite
			2	31.05.1995	38,16		
			3	27.01.1995	38,16		
YENİKÖY	(İC İctaş)	420	1	10.11.1986	38,6	1.273	Lignite
			2	03.04.1987	38,6		
YATAĞAN	(Elsan)	630	1	20.10.1982	37,75	1.085	Lignite
			2	15.06.1983	37,75		
			3	18.12.1984	37,75		

Notes:

- Columns marked with (*) show the design values.
- The owners of plants shown in parenthesis are the companies, who purchased the plants from EÜAŞ as the result of privatization. Soma-B Thermal Plant has been excluded from privatization later.
- The data have been compiled from EÜAŞ 2012 report of Court of Accounts and from the page of Privatization Directorate.

Annex-3: List of coal plants which have obtained pre-license or been under consideration.

Projects that obtained pre-license				
	Plant name	Fuel type	Plant province	Installed power (MWe)
1	Diler Elbistan Thermal plant	Domestic Coal	Kahramanmaraş	400
2	Gürmin Enerji Amasya TES	Domestic Coal	Amasya	300
3	Atakaş Thermal Plant	Imported Coal	Hatay	660
4	Çelikler Domaniç TES	Domestic Coal	Kütahya	300
5	Tosyalı İskenderun Thermal Plant	Imported Coal	Hatay	1200
6	Hunutlu Thermal Plant	Imported Coal	Adana	1200
7	Çankırı-Orta Thermal Plant	Domestic Coal	Çankırı	150
8	Çelikler Keles Thermal Plant	Domestic Coal	Bursa	270
9	ÇAN-2 Thermal Plant	Domestic Coal	Çanakkale	330
10	Kirazlıdere-2 Thermal Plant	Imported Coal	Çanakkale	660
11	Sanko Gölbaşı Thermal Plant	Domestic Coal	Adıyaman	150
12	Karaburun II Thermal Plant	Imported Coal	Çanakkale	660
13	Karaburun Thermal Plant	Imported Coal	Çanakkale	135
14	Soma Kolin TES	Domestic Coal	Manisa	460
Grand Total:				6.875 MW

Projects for which preliminary license application has been assessed				
	Plant name	Fuel Type	Plant Province	Installed Power (MWe)
1	Burak 2 Thermal Plant	Domestic Coal	Çanakkale	49
2	Güreci Thermal Plant	Imported Coal	Çanakkale	1320
3	Petkim New Vapor Production Plant	Imported Coal	İzmir	294
4	Akdeniz Thermal Plant	Imported Coal	Adana	600,1
5	Bandırma III	Imported Coal	Bandırma	800
6	MEDA Thermal Plant	Imported Coal	Tekirdağ	770
7	Ağan TES	Imported Coal	Çanakkale	770
Grand Total:				4.603 MW

Annex-4: List of coal plants that are licensed and under construction

	Plant Name	Fuel/ Source Type	Place of Plant	License Installed Power (MWe)	Capacity under construction (MWe)
1	Amasra Thermal Plant	Hard Coal	Bartın	1100	1100
2	Ayas Power Plant	Imported Coal	Adana	625,5	625,5
3	Cenal Termik-TES (1)	Imported Coal	Çanakkale	1320	1320
4	Kirazlıdere TES(1)	Imported Coal	Çanakkale	600	600
5	Hakan Coal plant	Imported Coal	Adana	100	100
6	Kahramanmaraş Kağıt San.	Imported Coal	K.maraş	15,7	15,7
7	Kipaş Kağıt San. İşl. A.Ş.	Imported Coal	K.maraş	25	25
8	Selena Coal Plant (1)	Imported Coal	Hatay	900	900
9	Çatalağzı (2)	Imported Coal	Zonguldak	2590	1200
15	Şirnak Thermal Plant	Asphaltite	Şirnak	270	270
16	Silopi Thermal Plant	Asphaltite	Şirnak	405	270
17	Silopi Power Plant	Asphaltite	Şirnak	135	135
10	Çayırhan Sodium Sulfate Plants Kojen Project	Coal	Ankara	2,66	2,66
11	Kardemir-Karabük Iron Steel	Coal	Karabük	87,5	65
12	Konya Şeker-Çumra	Coal	Konya	23,75	1,75
13	Çankırı Tuz Fab. Koj. Plant	Coal	Çankırı	1,64	1,64
14	Turyağ Thermal Plant	Coal	Balıkesir	1,592	1,592
18	Yunus Emre Thermal Plant	Domestic Coal	Eskişehir	290	290
19	Bolu-Göynük Power Plant	Domestic Coal	Bolu	270	270
20	Tufanbeyli Thermal Plant	Domestic Coal	Adana	450	450
21	Ilgın Thermal Plant	Domestic Coal	Konya	500	500
22	Etyemez TES	Domestic Coal	Sivas	135	135
G. Total:				9.848 MW	8.279 MW

Notes:

- 1- Courts have granted motions for stay of executions of the projects.
- 2- Çatalağzı Thermal Plant has been using imported coal since available hard coal reserve is not sufficient, and 1320 MW of it is licensed and performing production.
- 3- There are projects in the list, for which litigation processes are continuing.

High Carbon Arithmetic of Turkey

