The journey of Black Gold from Coal Mining to Power Plant at Thar Block II

During current pandemic situation Thar Team is effectively managing all coal mining and power plant operations ensuring essential power fed to the national grid.

Even in current pandemic situation Thar Team is effectively managing all coal mining and power plant operations ensuring essential power fed to the national grid. The coal supply is the backbone of power generation, it is essential to supply the coal as per the requirement and need of power plant.

Groundwater is present in three horizons named as: Dune Sand Aquifer (1st Aquifer), Coal Seam Roof Aquifer (2nd Aquifer) and Coal Seam Floor Aquifer (3rd Aquifer). Coal Seam Roof and Floor Aquifers are confined aquifers and Dune Sand Aquifer are phreatic aquifer. Due to the presence of aquifers beneath the earth, dewatering becomes a backbone of the project. Till date 27 peripheral dewatering wells and 06 in-pit wells are in operation with additional setup of surface drainage pumping station in mine which have the pumping capacity of 1800-1900 m3/hr. Sand which extracted from 2nd horizon is the topmost unit and mainly consist of Sand with minor silt.

The electricity crisis in Pakistan has been a major political agenda during the time period of 2005-2014 when the electricity shortfall reached its peak. A combination of factors including the declining state investment in power generation, failure to pay circular debt and rising electricity consumption on the back of a consumer-led economy promoted the peak demand, at 7,000 MWs in 2013.

Electricity crisis was a major distress for the Peoples Party Government that took power in 2008 and subsequently election manifesto of the Nawaz Sharif Government that was elected in 2013. Apart from prioritising energy in the CPEC package, the Sharif government – through coal, hydropower and renewable sources – managed to add 30% to the installed electricity capacity taking it to 29,573 MW in 2018 (from 22,812 in FY 2012-13). The government also increased the share of the government in Gross Fixed Capital Formation (GFCF) in electricity generation and distribution.

Need for Coal-Based Energy

According to the Pakistan Energy Yearbook 2015, coal contributed 7% of energy supplies of the country, by source. Pakistan

Continued on page 2
CPEC in Punjab, Sindh and Balochistan. 17 coalfields in Pakistan located near cement, fertilizer and power plants. There are railways, cement, fertilizer and power plants. In the future, Pakistan aims to increase coal power generation in total energy mix to at least 35% and reduce reliance on oil-based energy sources.

The government has developed policies and frameworks to enhance coal’s share to 19% by 2030 and to 50% by 2050. The Energy Security Action Plan has set a target of generating 20,000 MW power from coal by 2030. The major consumers of coal are the primary fossil fuel in Pakistan, where it is used in power plants and industry. These coal layers are interbedded with waste which has the thickness of >0.5 m. Lakhra is in Thar Block II Region start from 62 AMSL till -115 AMSL with interbedded claystone/carbonaceous clay. Average cumulative thickness of coal seam is about 25-30 m. Each coal seam possesses different quality parameters which are indicated fluctuation in paleo-environment. Due to variation in coal quality parameters, coal blending and sampling become a backbone of coal supply operations.

Coal blending helps to utilize the maximum resource from mine with keeping all quality parameters in range. Mine has achieved their design depth and successfully extracted the last coal seam from the designed pit shaft and currently in the phase of advancement toward west wall. SECMC follow the robust coal blending, sampling and testing regime to produce and supply on-spec coal to power plant. Mine geology also a main factor which is being covered by the coal Mining Teams as well.

The journey of black gold (coal) from Mine to Power Plant goes through by several screening processes such as:

- Seams thinning or thickening
- Variation in quality parameters
- Variation in coal seam roof and floor characteristics
- Handling of coal stockpile
- Transportation of coal to power plant
- Coal blending
- Coal quality assurance

Coal Seam Roof and Floor instability is the first stop from which the quality of coal has been controlled, identification and removal of waste material, inspection of over-digs and under-digs in major function of roof and floor demarcation process, this practice helps to utilize the maximum resource of coal and minimize the probability of dilution.

In situ sampling helps in the updation of Resource model and provide an edge during the planning of daily blends of coal. As Bara Formation consist of different layers of coal which have different quality parameters, so it is necessary to make a blend of coal seams on daily basis to fulfill the requirement of Power plant.

Coal is extracted using air-sealed continuous miners. The underground water will evaporate with no impact on mine water. All the waste which has the thickness of >0.5 m is “CL” used for coal, “Interburden-IB” is used for interbedded claystone/ waste which has the thickness of >0.5 m and “parting” is used for those interbedded claystone which has thickness of <0.5 m.

In Lakhra in Thar Block II Region start from 62 AMSL till -115 AMSL with interbedded claystone/carbonaceous clay. Average cumulative thickness of coal seam is about 25-30 m. Each coal seam possesses different quality parameters which are indicated fluctuation in paleo-environment. Due to variation in coal quality parameters, coal blending and sampling become a backbone of coal supply operations.

Coal blending helps to utilize the maximum resource from mine with keeping all quality parameters in range. Mine has achieved their design depth and successfully extracted the last coal seam from the designed pit shaft and currently in the phase of advancement toward west wall. SECMC follow the robust coal blending, sampling and testing regime to produce and supply on-spec coal to power plant. Mine geology also a main factor which is being covered by the coal Mining Teams as well.

The journey of black gold (coal) from Mine to Power Plant goes through by several screening processes such as:

- Seams thinning or thickening
- Variation in quality parameters
- Variation in coal seam roof and floor characteristics
- Handling of coal stockpile
- Transportation of coal to power plant
- Coal blending
- Coal quality assurance

Coal Seam Roof and Floor instability is the first stop from which the quality of coal has been controlled, identification and removal of waste material, inspection of over-digs and under-digs in major function of roof and floor demarcation process, this practice helps to utilize the maximum resource of coal and minimize the probability of dilution.

In situ sampling helps in the updation of Resource model and provide an edge during the planning of daily blends of coal. As Bara Formation consist of different layers of coal which have different quality parameters, so it is necessary to make a blend of coal seams on daily basis to fulfill the requirement of Power plant.

Coal is extracted using air-sealed continuous miners. The underground water will evaporate with no impact on mine water. All the waste which has the thickness of >0.5 m is “CL” used for coal, “Interburden-IB” is used for interbedded claystone/ waste which has the thickness of >0.5 m and “parting” is used for those interbedded claystone which has thickness of <0.5 m.

In Lakhra in Thar Block II Region start from 62 AMSL till -115 AMSL with interbedded claystone/carbonaceous clay. Average cumulative thickness of coal seam is about 25-30 m. Each coal seam possesses different quality parameters which are indicated fluctuation in paleo-environment. Due to variation in coal quality parameters, coal blending and sampling become a backbone of coal supply operations.

Coal blending helps to utilize the maximum resource from mine with keeping all quality parameters in range. Mine has achieved their design depth and successfully extracted the last coal seam from the designed pit shaft and currently in the phase of advancement toward west wall. SECMC follow the robust coal blending, sampling and testing regime to produce and supply on-spec coal to power plant. Mine geology also a main factor which is being covered by the coal Mining Teams as well.

The journey of black gold (coal) from Mine to Power Plant goes through by several screening processes such as:

- Seams thinning or thickening
- Variation in quality parameters
- Variation in coal seam roof and floor characteristics
- Handling of coal stockpile
- Transportation of coal to power plant
- Coal blending
- Coal quality assurance

Coal Seam Roof and Floor instability is the first stop from which the quality of coal has been controlled, identification and removal of waste material, inspection of over-digs and under-digs in major function of roof and floor demarcation process, this practice helps to utilize the maximum resource of coal and minimize the probability of dilution.

In situ sampling helps in the updation of Resource model and provide an edge during the planning of daily blends of coal. As Bara Formation consist of different layers of coal which have different quality parameters, so it is necessary to make a blend of coal seams on daily basis to fulfill the requirement of Power plant.

Coal is extracted using air-sealed continuous miners. The underground water will evaporate with no impact on mine water. All the waste which has the thickness of >0.5 m is “CL” used for coal, “Interburden-IB” is used for interbedded claystone/ waste which has the thickness of >0.5 m and “parting” is used for those interbedded claystone which has thickness of <0.5 m.

In Lakhra in Thar Block II Region start from 62 AMSL till -115 AMSL with interbedded claystone/carbonaceous clay. Average cumulative thickness of coal seam is about 25-30 m. Each coal seam possesses different quality parameters which are indicated fluctuation in paleo-environment. Due to variation in coal quality parameters, coal blending and sampling become a backbone of coal supply operations.

Coal blending helps to utilize the maximum resource from mine with keeping all quality parameters in range. Mine has achieved their design depth and successfully extracted the last coal seam from the designed pit shaft and currently in the phase of advancement toward west wall. SECMC follow the robust coal blending, sampling and testing regime to produce and supply on-spec coal to power plant. Mine geology also a main factor which is being covered by the coal Mining Teams as well.

The journey of black gold (coal) from Mine to Power Plant goes through by several screening processes such as:

- Seams thinning or thickening
- Variation in quality parameters
- Variation in coal seam roof and floor characteristics
- Handling of coal stockpile
- Transportation of coal to power plant
- Coal blending
- Coal quality assurance

Coal Seam Roof and Floor instability is the first stop from which the quality of coal has been controlled, identification and removal of waste material, inspection of over-digs and under-digs in major function of roof and floor demarcation process, this practice helps to utilize the maximum resource of coal and minimize the probability of dilution.

In situ sampling helps in the updation of Resource model and provide an edge during the planning of daily blends of coal. As Bara Formation consist of different layers of coal which have different quality parameters, so it is necessary to make a blend of coal seams on daily basis to fulfill the requirement of Power plant.
Environmental Indexing of Sustainable Lignite Deposits at Thar Coal Field

Pakistan’s lignite coal deposit was discovered by Geological Survey of Pakistan in the 1990s and it spreads over more than 9,000 km² area comprises around 175 billion tons enough to meet the country’s fuel requirements for centuries.

Lignite, generally yellow to dark brown or rarely black coal that formed from peat at shallow depths and temperatures lower than 100 °C (212 °F). It is the first product of coalification and is intermediate between peat and subbituminous coal according to the standard coal classification used in the United States and Canada.

It has been estimated that nearly half of the world’s total proven coal reserves are made up of lignite and subbituminous coal, but lignite has not been exploited to any great extent, because it is inferior to higher-rank coals (e.g., bituminous coal) in calorific value, ease of handling, and storage stability.

In areas where other fuels are scarce, the production of brown coal far exceeds that of bituminous coal. Most lignite’s are geologically young, generally having formed during the Mesozoic and Cenozoic geological age (approx. 250 million years ago to the present).

Pakistan has emerged as one of the leading countries of the world after the discovery of huge lignite coal resources in Thar, Sindh, Pakistan has the seventh largest coal resources in Thar, Sindh. Pakistan’s lignite coal deposit was discovered by Geological Survey of Pakistan in the 1990s and it spreads over more than 9,000 km² area comprises around 175 billion tons enough to meet the country’s fuel requirements for centuries.

Lignite Deposits at Thar Coal Field

Survey of Pakistan in 1990s and it spreads over more than 9,000 km² area comprises of around 175 billion tons enough to meet the country’s fuel requirements for centuries. The economic lignite deposit of Pakistan is restricted to Paleocene and Eocene age (approx. 70 million years old) rock sequences.

Lignite coal mining in Pakistan has always been considered as an environmental threat due to various myths which aren’t based upon any technical rationale. One of the most common myth is that utilization of Thar coal is that it has high sulfur and ash (combusted product of coal) contents.

Sulfur in coal is fundamentally originates from either organic (pollen) or inorganic (pyrite) sources. Sulfur and Ash are the two most globally known potential environmental risk ingredients in coal-fired power plants.

However, as the power generation technology is getting advanced, sulfur and ash production from coal combustion can be effectively controlled and even reduced to the standard acceptable limits making it to an environmentally friendly component.

Thar coal in comparison with international lignite coal

In order to provide with a technical explanation against all the coal quality myths being considered for Thar coal deposit, Environmental Indexing based on the reported concentrations of sulfur and ash parameters have been done for Thar Coal in comparison with globally renowned lignite coal deposits.

Coming down to the facts, the sulfur and ash values for nearly topmost large scale globally recognized lignite coal deposits have been compared with Thar coal and are summarized below. Before proceeding any further, author wish to express that the data accumulation, compilation as well as QA/QC has then done by a competent Team of Resource Geologists with diverse experiences and skills.

From the data collected and shown in graphs, it can be observed that the sulfur and ash concentrations of Thar coal deposit are very less i.e. 1.0% and 7.4% respectively and included among the good quality lignite coals of the world which are well known for their inherent environmentally friendly characteristics.

Further, Thar coal sulfur and ash values are also very identical to the lignite deposits of USA and Russia which are the top 02 lignite producing giants of the world. Moreover, Thar coal also proven to be much better than the lignite deposits of Poland, India, Indonezia and Turkey.

This shall now be concluded with the fact that Thar coal can be effectively utilized to its full capacity as it has very negligible proportion of sulfur and ash which can barely affect local or regional environment. In addition, Spontaneous Combustion and Acid Rock Drainage (ARD) are also treated as major environmental hazards regarding coal mining and power generation.

Both hazards are predominantly triggered by the concentrations of sulfur present in coal. Engro Coal Mining Company at its Lignite Coal Mine in Thar Coal Block II has placed all potential controls to eliminate these environmental hazards associated with coal mining.

Spontaneous combustion of coal is the process of self-heating resulting eventually in its ignition caused by the oxidation of coal (primarily sulfur bearing pyritic coal) when it is exposed to the atmosphere. It usually occurs at coal stockyards where coal is being storage for longer time periods.

Spontaneous combustion at Thar coal mine is being controlled by reducing the coal storage time at coal stockyard and by limiting the exposure of coal seams at mining pit to a minimum possible. Acid Rock Drainage (ARD) also known as Acid Mine Drainage (AMD) describes the formation of acid when sulfide bearing mine wastes (principally pyrite) are exposed to oxidizing conditions, typically in the presence of water, due to groundwater, rain and runoff.

Dumping area has the highest potential risk of acid rock drainage where acid prone material is being dumped and exposed to sunlight for oxidation which can result in acid generation and drainage to underground.

However, Storage areas like coal stockyard, ROM pad etc. has very least ARD risk since coal or pyrite bearing wastes are being stored at such areas for lesser time period thus eliminating the process of oxidation.

Likewise, Spontaneous Combustion, Acid Rock Drainage is also being effectively controlled during mining operations at Thar coal mine by dumping the Potentially Acid Forming (PAF) rocks sequentially with Acid Neutralizing Material (Dune Sand) in the form of alternate layers and sealing both the materials completely with the non-permeable clay from bottom, top and sides to eliminate seepage. Apart from this, another major environmental concern associated with the combustion of coal is the emission of toxic contaminants such as Sulfur Oxides (SOx) and Nitrogen Oxides (NOx) which affects human and environmental health.

Engro Powergen Thar Limited is running 2 * 330 MW coal fired power plant at Thar Coal Block II from indigenous Thar lignite coal which has equipped with advanced technology based Circulating Fluidized Bed (CFB) boiler which is rated as an environmentally friendly boiler for power generation.

CFB doesn’t require any back-end equipment for sulfur and nitrogen emission controls. It uses limestone as a catalyst which controls the release of SOx and NOx during coal combustion to a minimum and within the specified NGC/IC guidelines.

Various national and international auditors have also acknowledged the fact that coal production and power generation at Thar Coal Block II is being done in accordance with standard HSE guidelines and has adapted the best practices for environmental compliance.
The Gorano Reservoir Issue

Thar Coal: indigenous lucrative power generation source

T

The Gorano Reservoir Issue

Thar Coal Project: A Brief Overview

The presence of coal in Tharparkar desert of Sindh was a common knowledge among the local population much before the actual test drilling for the coal was carried out in 1988. The Sindhi Arid Zone Development Authority (SAZDA), in collaboration with the British Overseas Development Administration (ODA), had drilled wells for water near village Khario Ghausan Shah. They found large-scale coal deposits underneath.

These findings prompted the Geological Survey of Pakistan (GSP) and the United States Geologic Survey of Pakistan (USGS), to carry out coal exploration in Thar Desert under the Coal Resources Evaluation and Appraisal Programme (Coal REAP) of the USAID between January 1992 and May 1994. This resulted in the establishment of a large-scale coal deposits across vast areas of Tharparkar district.

The second government of the former Prime Minister Benazir Bhutto, under the Energy Policy, 1994, awarded a Hong Kong-based power company Hongkong United Power Company a contract to explore and develop mines and install a coal-fired power plant of 1.32MW near Islamkot, Tharparkar. The company had committed a total investment of US$ 2 billion in the project.

However, after Benazir’s removal from the PM office, her successor, former Prime Minister Nawaz Sharif scrapped all her energy projects including the one in Tharpark district. Successive governments have made several attempts to attract foreign as well as local investment in Thar coal. They remained unsuccessful due to several reasons including unfavorable policies.

The data released by the Sindhi Coal Authority suggests around 175 billion tons of coal reserves available in Tharparkar districts, spread over in an area of 9,100 square km in three talukas: Islamkot, Chachro and Nagarparkar.

As suggested by experts, coal in the surveyed blocks is sufficient for the establishment of as many as six coal fired power plants of 1,000 MW each, with 40 years of continuous production for 30-50 years duration.

The Tharparkar coal field is di- vided into 13 blocks. In the first phase, mining and power projects were worked out in Block II, in which 1.57-billion-ton coal is es- timated to be available for power generation.

Technical details of Thar Coal

Thar coalfield is located at a distance of 395 km from Karachi. It covers an identified area of 9,100 sq km. Total reserves stand at 175 billion tons (highest in Pakistan) at a depth of 150-200 m. Cumulative coal seam thickness is 24 m. So far, 12 blocks have been planned after detailed drilling, covering an area of 1,192 sq km. Each block is estimated to carry reserves of over 2 billion tonnes.

Thar’s lignite coal has a mois- ture content of 46.6%, fixed carbon at 16.7%, volatile matter at 23.4%, ash at 6.2% and Sulphur at 0.9 to 1.2%. The calorific value of bitu/m is 5,744. It is ranked at Lignite B to Lignite A.

Other lignite coal producing countries are: Germany (168 million tonnes), Greece (64 mt), Turkey (64 mt), Poland (60 mt) and Czech Republic (51 mt).

Coal mining methodology in Thar

Coal mining is carried out through two methods of opera- tions: underground and surface mining. Mining of the blocks in Thar are opting for surface mining/opencast mining method. Block II has opted for Bucket Wheel Excavators, Blocks I and VI are stated to be using for T&S and Block V will be using UDC (Underground Gasification), which was taken up as an experiment.

Opencast mining is a surface mining technique that consists of three different methods: strip mining, open-pit mining, and mountain top blasting. These are mostly used below for readers’ understanding:

• Strip mining involves removing the overburden (earth, sand, rock, and other material) in strips to enable excavation of the coal seams. This is done through using large machines, removing strips of overlying soil and rock and then excavating coal deposits;

• Open-pit mining which is another form of surface mining, involves blasting and mineral removing, "digging deeper into the earth causing a cra- ter-like result";

• Mountaintop removal involves blasting of mountain top in order to reach coal seams deep inside the earth.

All mining activity generates waste. For the ongoing Thar Coal project in Block II, the only block that is operational, the ESA men- tioned that waste management through dumping of mine overburden in the eastern corner of Block II.

Environmental impact of coal extraction

The environmental impact of surface/strip mining is the de- struction of ecosystem through stripping away of trees, plants and topsoil. Surface mining is known to destroy mountain tops, landscapes, forests and wildlife habitats. It promotes soil salination and barren land. The landscape changes can disrupt river channels, resulting in floods.

The drought situation in Thar is considered to be more environmental friendly, as it chemically transforms fossil fuel rather than burning it and also cuts down for coal transportation. However, it is extremely water intensive and is considered to emit twice as much carbon as a coal plant.32 According to news reports, vil- lages in the vicinity of the UGC project in Block V, Thar had to shut down their water wells and RO Plants because these were emerging gases.

Report on Thar Coal Project and Local Community – Documenting Views and Experiences of Stakeholders by National Commission for Human Rights (NCHR)

Thar Coal: indigenous lucrative power generation source

The Gorano Reservoir Issue

August 03 — 09, 2020

04 — Technology Times.Pk