



# **USE OF COAL IN THE ENERGY MIX OF PAKISTAN**

**2015 International Pittsburgh Coal Conference  
Pittsburgh, PA, USA  
October 5 – 8, 2015**

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# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

SIGN PETITION  
TO STOP OVERSEAS  
SHIPMENT OF COAL  
FROM NORTH WEST  
COAST

# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

## Use of coal in the 21st century

ECONOMIC ISSUES

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Coal has met the energy needs of humans for centuries. The decline of this fuel resource started in the mid 20th century when large reservoirs of oil and gas were discovered. Despite the environmental degradation by the combustion of coal, most large economies of the world are dependent on its use.

Countries like USA, China, India, Malaysia, Russia and Germany produce power by burning coal. The Kyoto Protocol has put a lid on the direct use of this fossil fuel. The entire civilised world, including Pakistan but excluding USA, are signatories to this agreement.

As US meets around 56 percent of its energy needs by direct combustion of coal, it refused to be dictated by the Kyoto Protocol. Instead the Obama administration launched a programme called "Futuregen" to control emissions from coal-fired plants. Oxygen is introduced at the top of the combustion chamber to convert carbon monoxide (CO) to carbon dioxide (CO<sub>2</sub>), which is then collected and stored in underground silos to be disposed later. There is negligible emission of gases that cause the green house effect. In USA, no new plant based on direct combustion of coal has been built in the 21st century.

In short, the environment has become important for the world and even the lone superpower has to respect it. So, the mistakes of the past cannot be repeated.

Against this backdrop, Pakistan is moving in the direction of large-scale use of coal. The Thar deposit in Sindh is one of the largest in the world (175 billion tons). Punjab too has around 600 million tons of coal, which can be used as an energy resource.

After the passage of the 18th Amendment, the provinces can generate their own power and exploit their own energy resources. In other words, the provincial governments are empowered and exercise control over their own natural resources.

As a country, we must develop a workable coal strategy. In the 19th century, it was acceptable to dig and then burn all

From an energy standpoint, Punjab is seriously handicapped as it lags behind in oil, gas and hydel energy resources as compared to other provinces. There are three main energy options for the province: solar, biogas and coal in the near future. Being an agrarian area, bio-fuels like jatropha, castor also have a potential for the future.

varieties of coal (lignite, semi-bituminous, bituminous, coking, etc). The practice continued unabated till the 20th century. But global warming and environmental issues came to the forefront. While the energy resources are becoming scarce, the environment has also become critical. Nevertheless, coal may be a cheap source of energy, but it cannot be burned directly in the 21st century, it has to be processed.

Further, the Salt Range alone has about 500 million tons of coal that can be exploited. Unfortunately, the linkages for its exploitation do not exist. The mining practices are outdated and inadequate. There are no stockpiles or coal supply chains.

As a result, imported coal is being used both for burning and gasification. Recently, a process has been developed in Germany for the upgradation of the Kalabagh iron ore, using indigenous coal at Makarwal. Due to the lack of supply chain, the process is now being shifted to imported coal.

After availability comes processing or usage. Engro Energy was the first company to initiate two 600MW plants based on direct combustion of the Thar coal. To ensure supply of the coal, the company formed a Joint Venture (JV) with the Sindh government called Sindh Coal Mining Company (SCMC). Groundbreaking was planned for June 2012. It was an ambitious project costing \$4 billion. Unfortunately, the funding could not be arranged and the deposit at Thar remains unexplored. In the 21st century, therefore, the exploitation of coal requires better planning and utilisation.

As a country, we must develop a workable coal strategy. In the 19th century, it was acceptable to dig and then burn all varieties of coal (lignite, semi-bituminous, bituminous, coking, etc). The practice continued unabated till the 20th century. But global warming and environmental issues came to the forefront. While the energy resources are becoming scarce, the environment has also become critical. Nevertheless, coal may be a cheap source of energy, but it cannot be burned directly in the 21st century, it has to be processed.

Above ground gasification (not underground) after mining is being done under Integrated Gasification Combined Cycle (IGCC). It is called "Clean Coal Technology". Once gasified, the synthetic natural gas (SNG) can be used for multiple purposes (diesel, fertiliser, power generation, etc). Being a relatively specialised technology, the cost of licensing is high, but can be negotiated and managed.

Adhocism in this sector of vital national importance will be disastrous. In case of oil and gas sectors, there are complete chains of exploitation extending from exploration all the way to the pump.

Coal continues to be a dirty business followed by primitive processing. This has to change in the 21st century. From mining to clean fuel, the linkages have to be established and it is not a small undertaking. The sector has to be moved from the 19th to the 21st century that is a big jump.

All experts in the field agree that the linkages are non-existent. The issue has been raised in several international coal conferences, but remains unresolved.

As coal is the future energy resource of Pakistan, we must take the lead and develop a unified plan to exploit and then convert this natural resource into a clean fuel worthy of being used in the 21st century.

■ The writer is the ex-chairman of Pakistan Science Foundation.

# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

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- Coal Deposits of Pakistan
- Coal Authorities in Pakistan
- Development Facilities
- Way Forward
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# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

## Abstract

- In the fifties natural gas was discovered in the Sui fields in Baluchistan area of Pakistan. Since then gas has been the main source of energy in the country. A comprehensive state of the art gas pipeline distribution network around 20,000 kilometers in length has been developed.

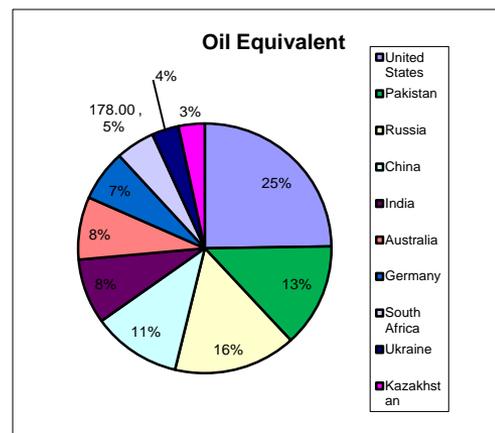
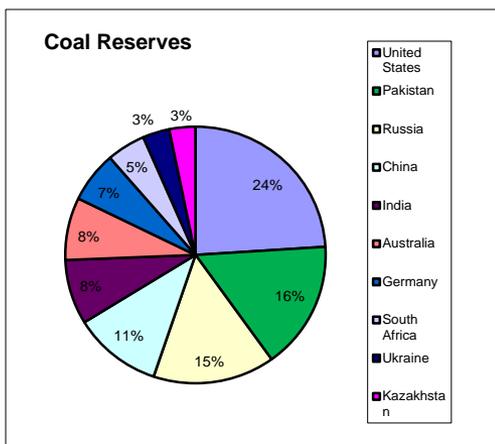
**Due to misuse and mismanagement a huge gap between demand and supply has been created resulting in shortages.**

- Pakistan has huge resources of coal that remain untapped with less than 1% contribution in the energy mix. Thar 175 billion tons of lignite being the largest, other significant deposits include Lakhra (1.33 billion tons) Shahraq (90 million tons) Chamalang (100 million tons) Salt range (600 million tons).
- In order to meet its energy needs Pakistan has to rely on its indigenous coal deposits. Use of coal in the 21<sup>st</sup> century is highly regulated due to environmental considerations. For optimum utilization of gas pipeline network, production of synthetic natural gas from coal seems to be the logical option. State of the art technology like IGCC (Integrated gasification combined cycle) is being planned for Thar coal deposit. Mining followed by above ground gasification is the way forward for coal rich and gas starved nation.

# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

## COUNTRIES WITH THE LARGEST COAL RESERVES

Figure I



Country	Coal Reserves Billion Tones	Coal Reserves (%)	Oil Equivalent Billion Barrels
United States	274.00	24.0	887.00
Pakistan	184.00	16.1	480.00
Russia	173.00	15.1	560.00
China	126.00	11.0	407.00
India	93.00	8.1	301.00
Australia	90.00	7.9	291.00
Germany	73.00	6.4	236.00
South Africa	55.00	4.8	178.00
Ukraine	38.00	3.3	123.00
Kazakhstan	37.00	3.2	120.00

# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

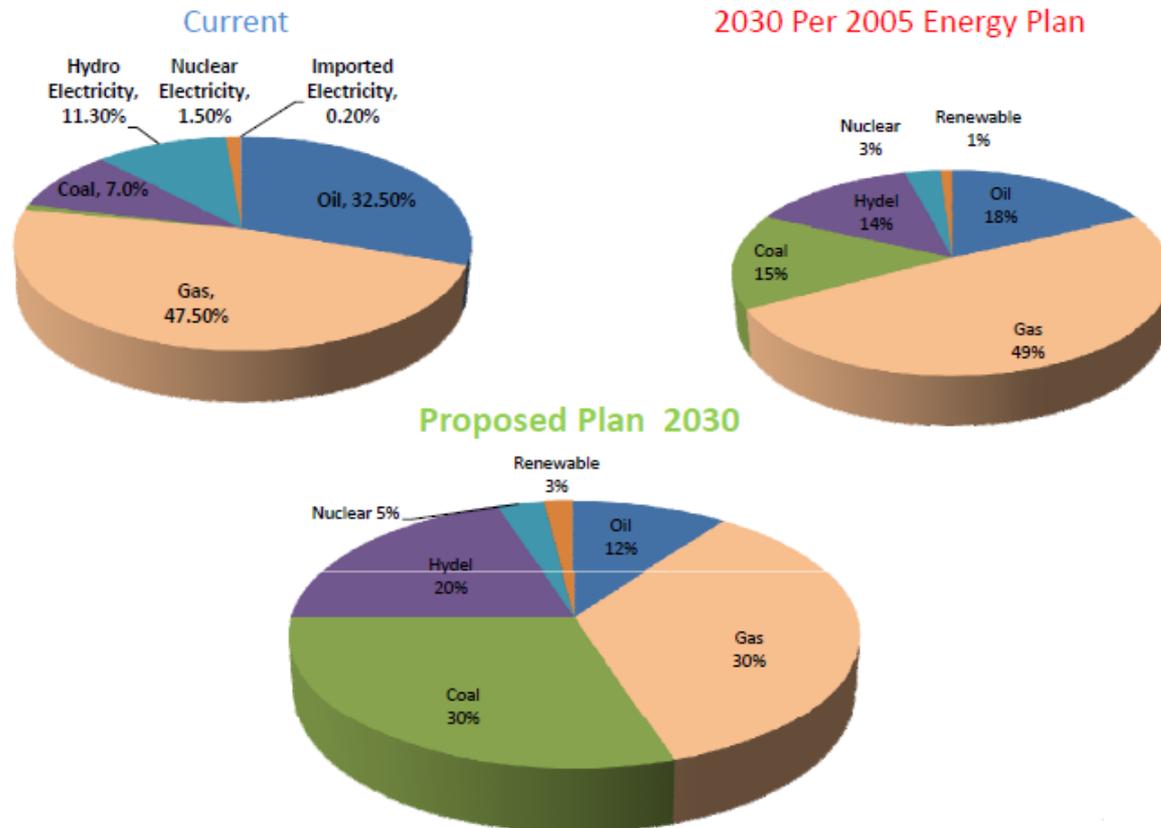
## Coals of Pakistan

No.	LOCATION	SIZE - TONS	CV Btu/lb	COMPOSITION				
				MOISTURE %	ASH %	VOLATILE MATTER %	FIXED CARBON %	SULPHUR %
1	THAR	175 B	8000	43.24	5.5	23.42	20.5	1.12
2	SONDHA	7.112 B	8000	27.90	15.0	28.00	25.2	1-2.82
3	LAKHRA	1.33 B	6000	28.90	18.0	27.9	25	4.7 to 7.0
4	SHARIGH	900 M	9600	6.12	20.1	20	35	3 to 9
5	CHAMALANG	100 M	13000	3.67	5.1	38.05	34.12	5.98
6	SALT RANGE	600 M	9472	4.07	44.21	28.35	25.24	6.63

# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

ENERGY MIX OF PAKISTAN  
FIGURE 2

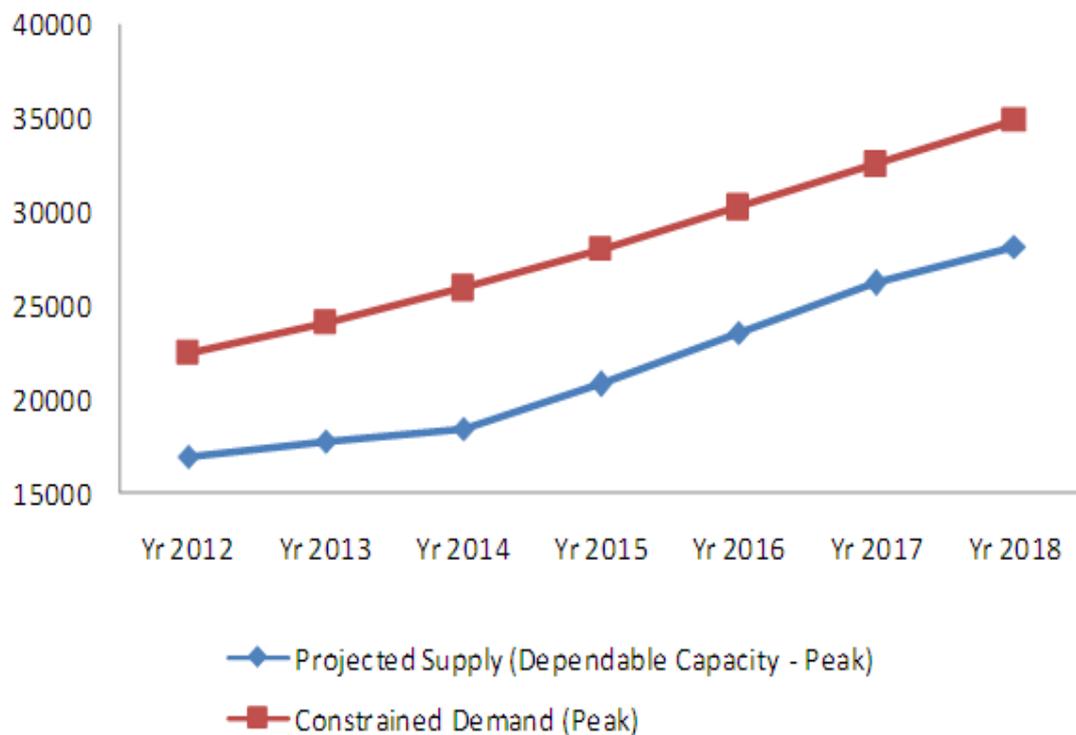
## PRIMARY ENERGY MIX



# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

## POWER AND GAS SHORTAGES IN PAKISTAN

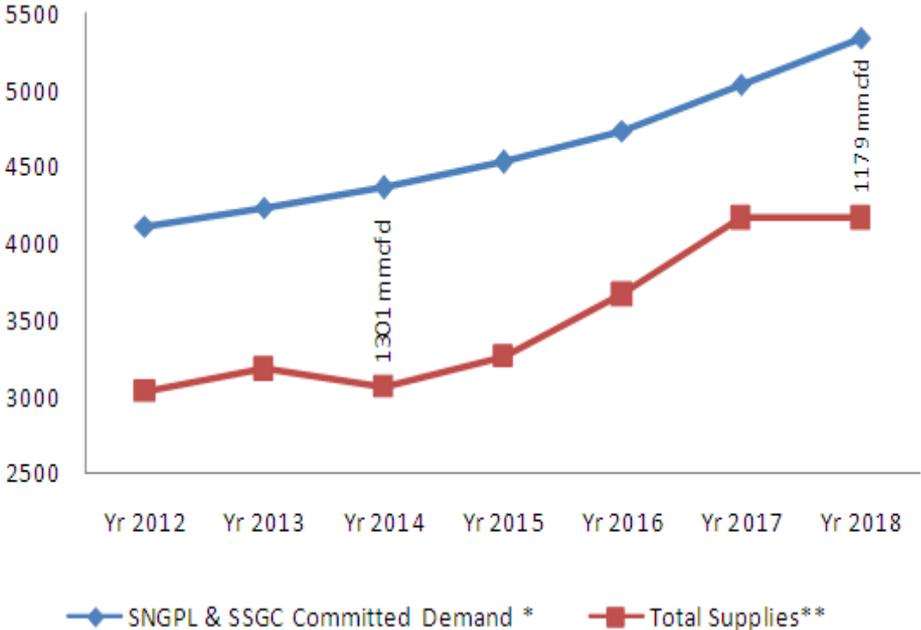
- Figure 3: - Electric Power Projected Dependable Supply vs. Constrained Demand



# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

## POWER AND GAS SHORTAGES IN PAKISTAN

- Figure 4: - Natural Gas Committed Demand (Constrained) vs. Projected Supplies in SSGC, SNGPL Pipeline network.



# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

## COAL AUTHORITIES IN PAKISTAN

- Sindh Coal Authority (Karachi)
- Thar Coal And Energy Board (Karachi)
- Punjab Mining Company (Lahore)
- Federal Ministry Of Petroleum And Natural Resources (Islamabad)
- Provincial Ministry Of Mines And Minerals (Lahore-Punjab)
- Provincial Ministry Of Mines And Minerals (Karachi-Sindh)
- Provincial Ministry Of Mines And Minerals (Quetta-Baluchistan)
- Provincial Ministry Of Mines And Minerals (Peshawar-KPK)

# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

## DEVELOPMENT FACILITIES

- Centre For Coal Technology (Punjab University)
- Centre For Fuel Technology (PCSIR – Karachi)
- NIBGE (PAEC – Faisalabad)

# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

## CENTRE FOR COAL TECHNOLOGY (UNIVERSITY OF PUNJAB)

- Technical Manpower
- Coal Gasification (CURRENTLY = M.Sc, M.Phil)  
(FUTURE = Ph.D Coal Tech, Environmental Pollution)
- Coal Cleaning
- Coal Fired Power Generation
- Domestic Utilization Of Coal
- Coal Substitution Of Furnace Oil / Natural Gas
- Transfer Of Technology
- Skill Sharing By Integrating Results On Indigenous Coal

# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

## FUEL RESEARCH CENTRE (PCSIR – KARACHI)

- Analytical, Testing, Consultancy Services
- Development And Commercialization Of Coal Briquette
- Development Of Humic Acid
- Detection Of Trace Elements In Coal
- Environmental Pollution Monitoring
- Coal Combustion And Conversion Studies  
(Desulphurization, Carbonization, Gasification, Fluidised Bed Combustion)

# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

## SNG vs LNG

(National Taiwan University)

- **SNG**

1. Air Separation Unit (ASU)
2. Gasification
3. Syngas Treatment (water gas – shift reaction, cooling, acid gas removal)
4. Methanation Reaction
5. Electricity Production
6. Energy Conversion Efficiency 60.38%

**Cost \$10.837 (USD / GJ)**

- **LNG**

1. Liquification
2. Transportation
3. Gasification

**Cost \$ 14-17 (USD / GJ)**

# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

## NATURAL GAS TRANSMISSION AND DISTRIBUTION NETWORK)

### SUI GAS FIELD:

- Commercial drilling started in July 1955  
Amongst largest in the world estimated reserves 12 Tcf
- Current reserves 2 Tcf
- Current gas shortage 1300 mm cfd  
(Household, Fertilizer, Power, Industry, Transport)
- Over 20,000 km pipeline network with state of the art cathodic protection system

# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

CONTRIBUTION OF COAL IN THE ECONOMIC DEVELOPMENT OF:

USA

CHINA

INDIA

EUROPE

PAKISTAN ? WAY FORWARD?

# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

## COAL / ENERGY PROJECTS IN CPEC

A total of 51 MoU's were signed in diverse sectors between China and Pakistan during the visit of Chinese president to Pakistan on 20 April 2015.

- Major coal-related projects under the corridor umbrella are:
- Financing cooperation agreement between the EXIM Bank of China and Port Qasim Electric Power Company (Private) Limited on Port Qasim EPC power station
- Gwadar Port- Completed, handed over to China for 40 years starting 2015
- Agreement on Port Qasim EPC power station between Power China and GoP.
- Terms and conditions in favour of Sindh Engro Coal Mining Company for Thar Block II 3.8Mt/a mining project, Sindh, Pakistan, arranged by China Development Bank Corporation
- Terms and conditions in favour of Engro Powergen Thar (Private) Limited, Sindh, Pakistan for Thar Block II 2x330MW Coal Fired Power Project, (Thar Engro power station) arranged by China Development Bank Corporation.
- Facility agreement for the Sahiwal power station between Industrial and Commercial Bank of China Limited, Huaneng Shandong Electricity Limited and Shandong Ruyi Group
- Cooperation agreement on Hubco power station between CPIH and Hubco Power Company.
- Facilitation agreement on Salt Range coal-fired power project between CMEC and Punjab government.

# USE OF COAL IN THE ENERGY MIX OF PAKISTAN

## Conclusions:

- With reserves close to 200 billion tons Pakistan can emerge as a major player in the coal industry
- Coal will play a dominant role in the energy mix of Pakistan reaching up to 30% by 2030
- International collaboration will ensure proper utilization of coal as mandated by 21<sup>st</sup> century usage challenges
- Being a late entrant Pakistan can benefit from the clean coal technologies available today
- China Pakistan economic corridor (CPEC) promises to bring the much needed economic growth in the region
- America Pakistan economic corridor (APEC) should also be considered

## COAL REFINERY?