



“Assessment of the Present Situation and Gaps in Capacity, Technology and Policy & Regulatory Instruments in Coal Sector of SAARC Member States”



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Foreword

The foreseeable extensive use of Coal warranted a detailed study which could highlight the potential of coal in SAARC Member States in terms of encompassing gaps in capacity, technology and policy & regulatory Instruments. As a matter of fact, coal significantly contributed towards the socio-economic progress of United States, Australia and China. Today's developed nations not only relished *coal-based economy* but are also developing clean coal and coal conversion technologies. However, in SAARC Member States, coal could not become a major energy component in past except in India where coal has a long history of utilization and industrial application.

With time, there emerged a need to develop and formulate a set of guidelines for the Member States that could help in revising their energy policies and ensuring the justified role of coal in a diversified energy mix. However, this was only possible by assessing the actual resource potential, identifying the environmentally-compatible technology forefronts, directions to develop human resource potential and infrastructure, comparative analysis of existing and future energy policies, particularly with reference to coal and pinpointing the pathways for achieving coal-based regional collaboration. Additionally, this assessment study could, possibly, lay the foundations of a mechanism for achieving regional integration and energy sustainability.

Precisely, the report addresses status of coal reserves, utilization patterns, issues related to coal mining, coal supply chain management, coal-based power generation technologies, environmental effects, need of human resource potential, status of coal in foreseeable future around the globe, regulatory frameworks, and need of regional policy framework. However, the biggest challenge was assembling a set of formulations by gathering all this scattered information into one piece. Much of the information, presented in this report was scattered and lacked intra-regional cooperation on the subject, thus necessitating the preparation of an updated document. No doubt, there must have been some components that could have been included in the report, but at this point of time, this work can be propagated for achieving the true purpose of this assessment.

December'2017

Mohammad Naeem Malik
Director

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Author(s)

Executive Summary

According to *Copenhagen Accord (2009)*, the biggest challenge for the developing countries is poverty alleviation while addressing the rising challenge of climate change, equally. Industrial growth and energy security & sustainability drive Socio-economic development of any country. In SAARC region, unfortunately, not a single member country has been able to provide electricity to all households. According to *Electricity Access in 2009 (World Energy Outlook 2011, IEA)*, 68.5% of the total population in developing Asian countries has access to electricity, more precisely, 15.5% of Afghanistan, 41% of Bangladesh, 75% for India, 43.6% of Nepal, 62.4% of Pakistan, and 76.6% of Sri Lanka. As a whole, 493.4 million population is living without access to electricity in SAARC region.

Fossil fuels will remain the key source of primary energy as renewables are not yet a competitive replacement. Among fossil fuels, coal can be associated with a number of key attributes including abundance, accessibility, energy security, reliability, affordability and versatility, as a result of which coal would be continuing to play an important role in meeting global energy demands for more than 100 years. Currently, as per estimates of 2014, 40.8% of electricity is being supplied from coal based power generation (Key World Energy Statistics, 2016), thus being the largest single source for electricity generation. Additionally, considering the prospective role of coal in meeting energy demands, it has been estimated that an additional 3800 TWh of electricity will be generated through coal by 2035, which indicates 44% increase (The Global Value of Coal, 2012). The pivotal role of coal in industrial revolution has set an example of rapid societal progress of China, which can be evidenced as, “Coal has underpinned China’s massive and unprecedented growth in output, fueling an economic miracle that has helped to improve the standard of living” (Cleaner Coal in China, IEA 2009).

In SAARC region, most of the countries possess coal reserves and yet a large amount of reserves is untapped. Pakistan has 175 billion tonnes of untapped lignite reserves at Thar, which presents a unique opportunity for uplifting regional economy. As of now, only six blocks have been awarded to private companies for development. However, there is a need to expedite the development of Thar coal by allocating more

blocks for mining and power generation purposes. Pakistan should also shift its dependence from imported coal to Thar coal reserves that can be used in various energy recovery schemes including power generation. Bangladesh and Afghanistan have 3.3 billion tonnes and 66 million tonnes, respectively, which are largely unexploited. The tapping of these reserves may provide an opportunity for economic uplifting of the region through the generation of direct and indirect employment opportunities.

Mining practices in all SAARC region except India are obsolete, manual and labour intensive. These practices need to be mechanized for meeting increasing coal demands of the region. Coal India Limited (CIL), the largest coal producing company in the region, has not been able to ensure anticipated domestic coal production, thus requiring the import of 166.557 million tonnes of coal for the year 2013-14 (Coal Directory of India, 2013-14). The major reason for this inefficient productivity is the limited involvement of private sector in coal mining. Similarly, Pakistan's annual coal production is 3.4 million tonnes that is much below than its future plans for coal power generation through China-Pakistan Economic Corridor (CPEC). Mining practices are at the same stage where Britain left the country and obsoleted. Mining is the major bottleneck in the utilization of indigenous coal. Pakistan needs to develop its mining infrastructure along with supply chain. As a matter of policy, private investment in coal mining sector must be encouraged and facilitated through tax relaxation schemes, so that targeted coal productivity can be ensured. Alongside, legislations should be introduced across the region for improving residential, health and safety standards of miners in accordance with the international standards. Coal towns can be developed for the facilitation of mining workers in the vicinity of coal producing areas.

In addition to the development of coal mining industry, there is a dire need to improve coal supply chain infrastructure, as well. Rail networks need to be developed in SAARC countries, other than India, for the transportation of coal. The improvement in supply chain infrastructure will not only increase the availability and accessibility of coal but also boost transportation industry, creating numerous employment opportunities. Coal washing and upgradation facilities must be installed at mine

mouths so that the transportation cost of coal can be reduced in addition to the improvement of coal quality.

In SAARC region, power generation is the major use of coal, which will increase in near future owing to upcoming coal fired power projects in India, Pakistan and Bangladesh. Though, power generation will remain the predominant use of coal, however, other uses of coal also need to be explored, for instance, role of coal as chemical feedstock, use of coal in fertilizer production and provision of alternative fuel options through gasification. India has traditional low efficient and high emission producing coal power plants, which need to be upgraded with modern clean coal technologies. Within the region, India happens to be the largest contributor to coal-based pollutant emissions, as coal-based power generation capacity of India is 186,493 MW (as of October, 2016) and 90% of India's coal fired power generation plants are based on subcritical technology. As per Ministry of Environment, Forest and Climate Change (India), for existing coal fired power plants, the emission standards for particulate matter, SO_x and NO_x are in the ranges of 150 to 350 mg/Nm³, 200 to 600mg/Nm³ and 300 to 600mg/Nm³, respectively. Though, for new coal based power plants, emission standards have been revised but still those are not comparable to the standards of USA and European Union (EU).

This scenario not only necessitates the immediate upgradation of India's existing coal fired power plants but also requires future installation of supercritical based technology or higher in India. Another allied aspect is the regional synchronization of environmental standards for, effectively, controlling emissions of pollutants from coal based power generation. Now, time has come for taking the initiative of establishing SAARC Environment Control Standards at regional level in order to ensure the improvement in existing standards in the light of those, which are being practiced in European Union and USA. Moreover, in conjunction with increased use of coal, carbon capture and storage technologies would have to be integral component for coal based power generation in order to mitigate carbon dioxide emissions. Investments to achieve this objective can be pursued from Green Climate Fund (UNFCCC, 2010). Carbon trading credits schemes can be launched in SAARC countries. India contributes to 98% coal originated CO₂ emissions in the region. Since high-efficient and low-emission (HELE) technologies, such as Integrated Gasification Combined

Cycle (IGCC) require large initial capital cost, the role of private investors can be expedited. A number of incentives like tax relaxations etc. can be offered for attracting investors for the development of coal sector from coal mining to utilization.

Considering the potential of coal in SAARC region, there is also a need to establish SAARC Coal Centre, which, in a broader perspective, could provide a platform for promoting the efficient coal utilization in the region. Particularly, this Centre can play role in terms of energy and resource hub for;

1. Developing mechanism for technology transfer within the region from countries with developed coal sector to the countries, which need to enhance the role of coal in energy mix
2. Development of human resource potential with special reference to the requirements of coal industry
3. Advancing research & development in coal sector for exploiting the use of coal for fertilizer production and as a chemical feedstock
4. Reassessment and Reevaluation of Coal Resources for actual estimation of reserves in SAARC region
5. Organizing workshops, training, seminars and conferences for promoting cleaner use of coal

Conclusively, the probable extensive use of coal in SAARC region will require addressing environmental concerns during mining and utilization of coal. 21st Century Clean Coal technologies have the potential of addressing all environmental concerns with increased plant efficiencies and reduced per unit cost. In short, energy poverty of the region can be eradicated by adopting clean coal based industrial growth, which would definitely lead to economic growth along with meeting climate challenge with the help of 21st century clean coal technologies.

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Purpose of the Study

The study presents baseline situation of coal sector, assesses the technology, policy & human resource capacity and put forward recommendations to promote the role of coal for sustainable development of SAARC region.

Objectives of the Study

The objectives of the study were as follows;

1. Assessment of the Present Scenario of Coal Sector in SAARC Member States
2. Identification of the Gaps in Policy Framework for Efficient Utilization of Coal Resources
3. Existing Practices of Extraction and Supply Chain Management of Coal Resources in SAARC Member States
4. Identification of Key Coal Utilization Sectors, End User Technologies and Environmental Mitigation of Coal for Each Member State
5. Role of Coal in Energy Security from SAARC Regional Perspective
6. Capacity Building and Technology Transfer Options and Opportunities

Scope of the Study

This study provides an extensive overview of coal sector in SAARC region with special reference to the current status of coal sector in the region, indication of gaps in production and demands, assessment of coal technologies in practice and, lastly, prospective role of coal in the social and economic progress of the region.

Limitations in the Study

Key limitations, faced during conducting the study, were as follows;

1. Present study was primarily conducted based upon published literature, however, limited data was available related to geological occurrence of coal in SAARC member states, particularly, for Afghanistan and Bangladesh posed difficulties.
2. In some countries of the region, coal production and consumption data might not have been well reported owing to limitations of the governing bodies. The actual production and consumption numbers might be higher than reported for Afghanistan, Nepal and Bangladesh.

Table of Contents

| | |
|----------------------------------------------------------------------------------------------------------------|-------------|
| Foreword | i |
| Acknowledgment | ii |
| Executive Summary | iii |
| Purpose of the Study | vii |
| Table of Contents | viii |
| List of Figures | xi |
| List of Tables | xiv |
| Abbreviations | xv |
| 1 Status of Coal Reserves in SAARC Region: Reserves, Production & Consumption | 1 |
| 1.1 Afghanistan | 2 |
| 1.2 Bangladesh | 3 |
| 1.3 Bhutan | 5 |
| 1.4 India | 6 |
| 1.5 Maldives | 15 |
| 1.6 Nepal | 15 |
| 1.7 Pakistan | 16 |
| 1.8 Sri Lanka | 20 |
| 2 Coal Utilization in SAARC Region: Mining Practices, Supply Chain Management and End User Technologies | 22 |
| 2.1 Coal Mining | 23 |
| 2.2 Coal Processing | 26 |
| 2.3 Coal Mining in SAARC Region | 40 |
| 2.3.1 Afghanistan | 40 |
| 2.3.2 Bangladesh | 44 |
| 2.3.3 Bhutan | 45 |
| 2.3.4 India | 46 |
| 2.3.5 Nepal | 48 |
| 2.3.6 Pakistan | 49 |
| 2.3.7 Sri Lanka | 51 |
| 2.4 Coal Supply Chain Management | 51 |
| 2.4.1 Efficient Coal Supply Chain Management and its Components | 51 |
| 2.4.1.1 Planning and Sourcing | 52 |
| 2.4.1.2 Logistics and Inventory Management | 53 |
| 2.4.1.3 Quality Management | 54 |
| 2.4.2 Status of Coal Supply Chain Management in SAARC Region | 55 |
| 2.5 End User Technologies | 57 |
| 2.5.1 Power Generation | 57 |
| 2.5.2 Cement Production | 67 |
| 2.5.3 Brick Kilns | 68 |
| 2.5.4 Steel Production | 69 |
| 2.5.5 Coal as Chemical Feedstock | 70 |
| 3 Environmental Impacts of Coal and Carbon Footprint of SAARC Region | 72 |
| 3.1 Impact of Coal Utilization | 73 |
| 3.1.1 Air-borne Emissions | 73 |
| 3.1.2 Solid Waste Generation | 77 |
| 3.1.3 Water Pollution | 79 |
| 3.2 21 st Century Clean Coal Technologies | 82 |
| 3.2.1 SO _x Control | 84 |
| 3.2.2 NO _x Control | 86 |
| 3.2.3 Carbon Capture and Storage | 89 |

| | | |
|------------------|---------------------------------------------------------------------------------------------|------------|
| 3.2.4 | Co-Combustion | 92 |
| 3.3 | CO ₂ Emissions Profile in SAARC Region | 94 |
| 3.4 | Carbon Trading | 98 |
| 4 | Coal Policies, Regulations and Institutional Setups of SAARC Member States | 100 |
| 4.1 | Role of Coal in Future Energy Plans and Policies of SAARC Member States | 101 |
| 4.1.1 | Afghanistan | 101 |
| 4.1.2 | Bangladesh | 101 |
| 4.1.3 | Bhutan | 102 |
| 4.1.4 | India | 103 |
| 4.1.5 | Maldives | 105 |
| 4.1.6 | Nepal | 105 |
| 4.1.7 | Pakistan | 106 |
| 4.1.8 | Sri Lanka | 107 |
| 4.2 | Role of Public-Private Partnership in the Development of Coal Sector in SAARC Member States | 108 |
| 4.4 | National Institutional Setup | 110 |
| 4.4.1 | Coal related Key Ministries/Departments | 110 |
| 5 | Human Resource Issues | 114 |
| 5.1 | Health & Safety Issues | 115 |
| 5.1.1 | Coal Mining | 115 |
| 5.1.2 | Coal Utilization | 118 |
| 5.2 | Education & Training | 122 |
| 6 | Coal around the Globe | 126 |
| 6.1 | Coal in United States | 127 |
| 6.2 | Coal in Australia | 128 |
| 6.3 | Coal in China | 129 |
| 7 | Gap Analysis | 133 |
| 7.1 | Country-Wise Projected Share of Coal in 2035 | 135 |
| 7.1.1 | Afghanistan | 135 |
| 7.1.2 | Bangladesh | 136 |
| 7.1.3 | Bhutan | 137 |
| 7.1.4 | India | 137 |
| 7.1.5 | Maldives | 138 |
| 7.1.6 | Nepal | 139 |
| 7.1.7 | Pakistan | 140 |
| 7.1.8 | Sri Lanka | 141 |
| 7.2 | Production Technologies | 141 |
| 7.3 | End User Technologies | 142 |
| 7.4 | Policies & Regulatory Instruments | 143 |
| 7.5 | Human Resource Development | 145 |
| 8 | Regional Coal Policy Framework | 147 |
| 8.1 | Regional Coal Trade Potential | 148 |
| 8.2 | Capacity Building Measures | 152 |
| 8.3 | Regional Carbon Footprints of Coal Utilization | 152 |
| | Recommendations & Conclusions | 154 |
| | Bibliography | 161 |
| Annexures | | |
| Annexure I | Detail Profile of Indian Coal Quality | 175 |
| Annexure II | Provincial Distribution of Coal in Pakistan | 182 |

| | | |
|--------------|-----------------------------------------------------------------------------------------------------|-----|
| Annexure III | Structural Organization of Ministry of Coal and Responsibilities of Coal India Limited (CIL) | 183 |
| Annexure IV | Detailed Contact Information of All Relevant Key Ministries and Departments | 186 |
| Annexure V | Pedagogy Comparison between Chemical Engineering Graduates from a Model and SAARC Country Institute | 189 |

List of Figures

| | | |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1.1 | Coal Production in Afghanistan (Million Tonnes) | 3 |
| 1.2 | Coal Consumption in Afghanistan (Million Tonnes) | 3 |
| 1.3 | Coal Production in Bangladesh (Million Tonnes) | 4 |
| 1.4 | Coal Consumption in Bangladesh (Million Tonnes) | 4 |
| 1.5 | Coal Production in Bhutan (Million Tonnes) | 5 |
| 1.6 | Coal Consumption in Bhutan (Thousand Tonnes) | 6 |
| 1.7 | Resource Estimation of Coal in India (Million Tonnes) | 6 |
| 1.8 | Quality Wise Reserves Estimation of Indian Coals (Million Tonnes) | 8 |
| 1.9 | State Wise Distribution of Indian Coal Reserves (Million Tonnes) | 8 |
| 1.10 | State Wise Distribution of Indian Lignite Reserves (Million Tonnes) Logarithmic Scale | 9 |
| 1.11 | Coal and Lignite Production from Year 2004-05 to Year 2013-14 (Million Tonnes) | 10 |
| 1.12 | Sectoral Share of Coal in Indian Industries (2013-14, %) | 11 |
| 1.13 | Industry Wise Consumption of Raw Coal in India (Million Tonnes) * Others include Sponge Iron, Colliery Consumption, Jute, Bricks, and Coal for Soft Coke, Fertilizers and other Industries Consumption | 11 |
| 1.14 | Total Production Growth (%) from 2003-04 to 2013-14 | 12 |
| 1.15 | Raw Coal Production Growth (%) from 2003-04 to 2013-14 | 12 |
| 1.16 | Trends in Lignite, Coking and Non-Coking Coal Production from 2003-04 to 2013-14 (Million Tonnes) | 13 |
| 1.17 | Country Wise and Quality Wise Coal Import by India during 2013-14 (Million Tonnes) | 14 |
| 1.18 | Import of Coal, Coke and Lignite by India during 2013-14 (Million Tonnes) | 14 |
| 1.19 | Coal Export (2.188 Million Tonnes) from India to Different Countries during 2013-14 (%) | 14 |
| 1.20 | Coal Production in Nepal (Million Tonnes) | 15 |
| 1.21 | Coal Consumption in Nepal (Thousand Tonnes) | 16 |
| 1.22 | Provincial Distribution of Coal Reserves in Pakistan (Logarithmic Scale, Million Tonnes) | 17 |
| 1.23 | Resource Estimation of Pakistani Coals (%) | 17 |
| 1.24 | Coal Production (Province Wise) in Pakistan for the Year 2013-14 (Million Tonnes) | 18 |
| 1.25 | Coal Consumption by Sector in Pakistan during 2013-14 (%) | 19 |
| 1.26 | Coal Imports by Sri Lanka from Year 2010 to 2014 (Thousand Tonnes) | 20 |
| 1.27 | Coal Consumption in Sri Lanka (Thousand Tonnes) | 21 |
| 2.1 | Schematics of Coal Mining | 23 |
| 2.2 | Surface Mining | 24 |
| 2.3 | Underground Mining | 25 |
| 2.4 | Technological Advancements in Mining | 25 |
| 2.5 | Overview of Coal Processing | 26 |
| 2.6 | Overview of Techniques with respect to Particle Size for Coal a) Sizing, b) Cleaning c) Dewatering | 27 |
| 2.7 | Vibrating Screens | 29 |
| 2.8 | High Frequency Screens | 30 |
| 2.9 | Sieve Bends | 31 |
| 2.10 | Classifying Cyclones | 32 |
| 2.11 | Dense Medium Vessels | 33 |

| | | |
|------|---------------------------------------------------------------------------------------------------------|-----|
| 2.12 | Dense Medium Cyclones | 34 |
| 2.13 | Spirals | 35 |
| 2.14 | Conventional Froth Flotation Unit | 36 |
| 2.15 | Vibratory Centrifugal Dryer | 37 |
| 2.16 | Screen Bowl Centrifuge | 38 |
| 2.17 | Disc Vacuum Filter (On Left Side) and Thermal Dryer (On Right Side) | 39 |
| 2.18 | Conventional Thickener (On Left Side) and Active Slurry Impoundment (On Right Side) | 40 |
| 2.19 | State-Wise Share of Open Cast and Underground Mining in India (Quantity in Million Tonnes) | 46 |
| 2.20 | Share of Open Cast and Underground Mining in India from 2003-04 to 2013-14 (Quantity in Million Tonnes) | 47 |
| 2.21 | Trend of Cost against Power Plant Location with respect to Coal Transportation | 53 |
| 2.22 | Schematic Producer-Buyer Coal Export Cycle | 55 |
| 2.23 | Contribution of Coal Transportation of Modes for 2013-14 (Quantity in Million Tonnes) | 56 |
| 2.24 | Mode wise Internal Dispatches of Coal for year 2013-14 (Quantity in Million Tonnes) | 56 |
| 2.25 | Schematic Diagram of Electricity Generation from Coal | 58 |
| 2.26 | Schematic Diagram Chain Grate Boiler | 59 |
| 2.27 | Schematic Diagram of Pulverized Coal Combustion System | 60 |
| 2.28 | Schematic Diagram of Bubbling Fluidized Bed Combustion | 63 |
| 2.29 | Schematic Diagram of Circulating Fluidized Bed Combustion | 64 |
| 2.30 | Schematic Diagram of Pressurized Fluidized Bed Combustion | 64 |
| 2.31 | Integrated Gasification Combined Cycle | 65 |
| 2.32 | State-Wise Existing Supercritical Coal based Power Generation Capacity in India (MW) | 66 |
| 2.33 | Sectoral Consumption of Coal in India for Year 2013-14 | 66 |
| 2.34 | Sectoral Consumption of Coal in Pakistan for year 2013-14 (Total Consumption = 6.55 Million Tonnes) | 67 |
| 2.35 | Sectoral Consumption of Coal for Steel Industry in India for year 2013-14 (Figs. in Million Tonnes) | 70 |
| 3.1 | Typical Wet FGD System | 85 |
| 3.2 | Selective Catalytic Reduction | 87 |
| 3.3 | Selective Non-Catalytic Reduction | 88 |
| 3.4 | Amine Solution based CO ₂ Separation and Regeneration | 90 |
| 3.5 | Chemical Looping Technology | 91 |
| 3.6 | CO ₂ as Chemical Feedstock | 92 |
| 3.7 | CO ₂ Emissions in SAARC Region for 2012 (Million Tonnes) | 94 |
| 3.8 | Trends of CO ₂ Emissions in Afghanistan for 2008-2012 (Million Tonnes) | 95 |
| 3.9 | Trends of CO ₂ Emissions in Bangladesh for 2008-2012 (Million Tonnes) | 95 |
| 3.10 | Trends of CO ₂ Emissions in Bhutan for 2008-2012 (Million Tonnes) | 95 |
| 3.11 | Trends of CO ₂ Emissions in India for 2008-2012 (Million Tonnes) | 96 |
| 3.12 | Trends of CO ₂ Emissions in Nepal for 2008-2012 (Million Tonnes) | 96 |
| 3.13 | Trends of CO ₂ Emissions in Pakistan for 2008-2012 (Million Tonnes) | 96 |
| 3.14 | Trends of CO ₂ Emissions in Sri Lanka for 2008-2012 (Million Tonnes) | 97 |
| 4.1 | Probable Power Generation of Bangladesh Primary Fuel Sources by 2030 | 102 |
| 4.2 | Projected Coal Production in India | 103 |
| 4.3 | Projected Energy Plan of Pakistan (2022) | 106 |

| | | |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 4.4 | Total Installed Power Generation Capacity of India, Share of State & Central Governments and Private Sector in Coal based Power Generation | 109 |
| 5.1 | Workers Demand in Coal and Lignite Mining by 2025-India | 122 |
| 5.2 | List of existing vocational courses for coal mining industry (Ministry of Labour, Government of India) | 123 |
| 5.3 | Proposed Model for Integrated Literacy Vocational Programs | 124 |
| 5.3 | Decrease in number of workers in Coal India Limited | 125 |
| 6.1 | Status of Coal in US | 130 |
| 6.2 | Status of Coal in Australia | 131 |
| 6.3 | Status of Coal in China | 132 |
| 7.1 | Coal Reserves, Production and Consumption Status in SAARC Region | 134 |
| 7.2 | Projected Coal Share in Primary Energy Demand of Afghanistan (Mtoe) | 135 |
| 7.3 | Projected Coal Share in Primary Energy Demand of Bangladesh (Mtoe) | 136 |
| 7.4 | Projected Coal Share in Primary Energy Demand of Bhutan (Mtoe) | 137 |
| 7.5 | Projected Coal Share in Primary Energy Demand of India (Mtoe) | 138 |
| 7.6 | Projected Coal Share in Primary Energy Demand of Maldives (Mtoe) | 139 |
| 7.7 | Projected Coal Share in Primary Energy Demand of Nepal (Mtoe) | 139 |
| 7.8 | Projected Coal Share in Primary Energy Demand of Pakistan (Mtoe) | 140 |
| 7.9 | Projected Coal Share in Primary Energy Demand of Sri Lanka (Mtoe) | 141 |
| 8.1 | Regional Coal Trade Potential | 151 |
| 8.2 | Regional Carbon Footprint and Trends for CO ₂ Emissions (From 2008 – 2012) | 152 |

List of Tables

| | | |
|-----|---------------------------------------------------------------------------------------------------|-----|
| 1.1 | Coal bearing Deposits in Afghanistan | 2 |
| 1.2 | Coal Production in India for Year 2013-14 (Million Tonnes) | 10 |
| 1.3 | Ongoing/Proposed Projects for Thar Coal Development (Thar Coal Energy Board, Government of Sindh) | 18 |
| 1.4 | Upcoming Coal Fired Projects under CPEC Programme | 20 |
| 2.1 | Comparison of Open Pit Mining and Underground Mining Approaches in Bangladesh | 45 |
| 2.2 | Losses Involved in Coal Supply Chain Management Framework | 52 |
| 2.3 | Features for Current Available Technologies for Coal based Power Generation | 61 |
| 3.1 | Main Sources for Effluent Generation in PC Power Generation | 80 |
| 4.1 | Relevant Key Ministries/Organizations Operative in SAARC Member Countries | 111 |
| 5.1 | Health and Safety Hazards to Brick Kiln Workers | 120 |
| 5.2 | Type of Accidents on Five Brick Kilns | 121 |
| 7.1 | Comparison between Conventional BTK and VSBK | 143 |
| 7.2 | Current Energy Policies in SAARC Region | 144 |
| 8.1 | All Coal Flows in SAARC Region (Million Tonnes) | 149 |

Abbreviations

| | |
|-----------------------------------|-----------------------------------------------|
| % | Percentage |
| °C | Centigrade |
| Afs | Afghani |
| AICTE | All India Council for Technical Education |
| atm | Atmospheric |
| BP | British Petroleum |
| BTK | Bull's Trench Kiln |
| CaCO ₃ | Calcium Carbonate |
| CaO | Calcium Oxide |
| CaSO ₄ | Calcium Sulphate |
| CCS | Carbon Capture & Storage |
| CCT | Clean Coal Technologies |
| CFBC | Circulating Fluidized Bed Combustion |
| CHP | Combined Heat and Power |
| CIL | Coal India Limited |
| CO | Carbon Monoxide |
| CO(NH ₂) ₂ | Urea |
| CO ₂ | Carbon Dioxide |
| COD | Chemical Oxygen Demand |
| COS | Carbonyl Sulphide |
| CPEC | China-Pakistan Economic Corridor |
| Dept. | Department |
| DMC | Dense Medium Cyclone |
| DMV | Dense Medium Vessel |
| EIA | Energy Information Administration |
| EP/ESP | Electrostatic Precipitator |
| ESIR | <i>Environmental and Social Impact Report</i> |
| EU | European Union |
| FBC | Fluidized Bed Combustion |
| FeS ₂ | Pyrite |
| FeSO ₄ | Ferrous Sulphate |
| FGD | Flue Gas Desulphurization |
| FIFO | First in, First Out |
| FYP | Five Year Plan |
| g | Gram |
| GCV | Gross Calorific Value |
| GDP | Gross Domestic Product |
| GSB | Geological Survey of Bangladesh |
| GSP | Geological Survey of Pakistan |
| Gt | Gigatonnes |
| GW | Gigawatt |
| GWe | Gigawatt Electrical |
| GWh | Gigawatt-hour |
| H ₂ O | Water |

| | |
|---------------------------------|--------------------------------------------------------------|
| H ₂ S | Hydrogen Sulphide |
| Hele | High Efficiency-Low Emission |
| HgS | Mercuric Sulphide |
| HHV | High Heating Value |
| HUBCO | Hub Power Company Limited |
| IEA | International Energy Agency |
| IGCC | Integrated Gasification Combined Cycle |
| IISCO | Indian Iron and Steel Company |
| IPP | Independent Power Producer |
| JORC | Joint Ore Reserves Committee |
| KBC | <i>Khoshak Brothers Company</i> |
| Kg | Kilogram |
| KPK | Khyber Pakhtunkhwa |
| KW | Kilo Watt |
| KWh | Kilo Watt-Hour |
| LHV | Low Heating Value |
| LNB | Low NO _x Burners |
| LNG | Liquefied Natural Gas |
| M/P&E | Ministry of Power and Energy |
| MCO ₃ | Metal Carbonate |
| MEA | Monethanolamine |
| mg | Milligram |
| MJ | Mega Joule |
| mm | Millimeter |
| MO | Metal Oxide |
| MoMP | <i>Ministry of the Mines & Petroleum</i> |
| MPa | Mega Pascal |
| MSD | Musculoskeletal |
| Mt | Million Tonnes |
| Mtoe | Million Tons of Oil Equivalent |
| MW | Mega Watt |
| N ₂ | Nitrogen |
| N ₂ O | Dinitrogen Oxide |
| Na ₂ SO ₄ | Sodium Sulphate |
| NCE | North Coal Enterprise |
| NH ₃ | Ammonia |
| Nm ³ | Normal Meter cubed per Hour |
| NO | Nitrogen Oxide |
| NO ₂ | Nitrogen Dioxide |
| NO _x | Nitrogen Oxides |
| NTEVTA | National Technical Education & Vocational Training Authority |
| O ₂ | Oxygen |
| PAC | Powdered Activated Carbon |
| PC/PCC | Pulverized Coal Combustion |
| PCC | Pulverized Coal Combustion |
| PFBC | Pressurized Fluidized Bed Combustion |

| | |
|-----------------|-------------------------------------------------------|
| pH | Potential of Hydrogen |
| PLC | Public Limited Company |
| PLC | Programmable Logic Controller |
| PM | Particulate Matter |
| R & D | Research & Development |
| R/P | Reserve/Production |
| RES | Renewable Energy Sources |
| RINL | Rashtriya Ispat Nigam Limited |
| ROM | Run of Mine |
| SAARC | South Asian Association for Regional Cooperation |
| SCC | SAARC Coal Centre |
| SCCL | Singareni Collieries Company Limited |
| SCR | Selective Catalytic Reduction |
| SDA | Semi-Dry Absorption |
| SG | Specific Gravity |
| SNCR | Selective Non-Catalytic Reduction |
| SO ₂ | Sulphur Dioxide |
| SO ₃ | Sulphur Trioxide |
| SO _x | Sulphur Oxides |
| SSRL | Sino-Sindh Resource Private Limited |
| Syngas | Synthesis Gas |
| TEVTA | Technical Education & Vocational Training Authority |
| TISCO | Tata Iron and Steel Company |
| TWh | Terawatt-Hour |
| UNEP | United Nations Environment Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USA | United States of America |
| USD | US Dollar |
| USGS | United States Geological Survey |
| VSBK | Vertical Shaft Brick Kiln |
| VSP | Vizag Steel Plant |
| W/A | Weighing/Analysis |
| µm | Micromilimer |