

# Reform Priorities for Pakistan's Energy Sector

# Perspectives in the Backdrop of Paris Agreement

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This brief draws from the extensive workshops on the subject led by the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) and the Sustainable Development Policy Institute (SDPI) under the project 'Evidence Based Policies for Sustainable Use of Energy Resources in Asia and the Pacific'. It also draws from an extended study by Dr. Jiang Kejun who was the Team Lead for this project and Ms. Qu Chenfei who supported the energy sector modelling.

## NOMENCLATURE

MoPDR	Ministry of Planning, Development and Reform
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
NDCs	Nationally Determined Contributions
CO <sub>2</sub>	Carbon Dioxide
GHGs	Greenhouse Gases
LEAP	Long-range Energy Alternatives Planning
IPAC	Integrated Policy Assessment Model for China
SDGs	Sustainable Development Goals
OGRA	Oil and Gas Regulatory Authority
AEDB	Alternative Energy Development Board
NEECA	National Energy Efficiency & Conservation Authority
PEPCO	Pakistan Electric Power Company
WAPDA	Water and Power Development Authority
IPDF	Infrastructure Project Development Facility
MOCC	Ministry of Climate Change

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#### 1 Objectives and Background

This study attempts to provide future energy transition pathways in Pakistan towards 2030, considering determinants such as population growth, economic development and technological progress within the context of CO2 mitigation targets. The methodological framework and all modelling results have been derived from an extended study on 'Power Sector Transition Towards Pakistan's Commitment in Paris Agreement' by Jiang & Chenfei, 2019. Simulations of future energy demand and supply in Pakistan have been conducted with a view to present key policy and technological optional to meet Pakistan's NDC's through an energy sector transition.

#### 1.1 Energy Challenges in Pakistan

Pakistan is a small open economy with Gross Domestic Product now touching USD 321 billion [1]. The agriculture sector makes up 18.9%, while industry and service sectors contribute 20.9% and 60.2%, respectively. The country has the 5<sup>th</sup> largest population (217,641,492) [2], 10<sup>th</sup> largest labor market in the world and ranks 67<sup>th</sup> amongst the global exporters [3]. However, 21% of the population lives under the poverty line [4], facing formidable challenges to meet their energy demands. At least 51 million people in Pakistan or nearly 27% of the population lives without access to electricity [5]. Electricity access varies between urban and rural areas with more than 90% electrified households in urban areas down to only 61% in remote rural area. Pakistan's energy sector is heavily reliant on imported fuels and constitutes a major share in the energy mix of Pakistan. In the energy mix, about 64% of energy comes from fossil fuels (mainly imported oil and gas), 27% hydro, 7% nuclear, while renewable only account for only 2% [6]. Coal is expected to play a relatively more prominent role in the future energy mix. Moreover, transmission losses also account for approximately 30% of total energy supply while exports and bunkers constitute 1.7%. Population growth and economic development has resulted in increased demand for affordable and reliable energy but the reliance on imported fossil fuels puts a heavy burden of the balance of payments while further contributing to climate change.

Expanding infrastructure and upgrading to clean technologies is vital to achieving SDG7 by 2030, which means that investing in solar, wind and thermal power is required to improve energy productivity and efficiency. Figure-1 shows the imports of different fossil fuels in the past years and the share of different energy sources in power generation mix of Pakistan highlighting the historical reliance on fossil fuels.



Figure 1 Imports of Different fuels in Energy mix of Pakistan and the Share of Different Energy Sources in Power Generation Mix of Pakistan [7]

Currently, Pakistan is an energy deficient country facing severe power shortages which is one of the major factors preventing the country from achieving its economic potential. According to recent estimates, Pakistan will run out of domestic natural gas within the next 15 years, owing to the huge gap (2.5 billion cubic feet) between demand and supply that costs around 2% of the country's national income. At the same time, energy demand is expected to increase 8-fold by 2030 and 20-fold by 2050 in Pakistan [8]. In addition, fragmented institutional and governance structure of the authoritative bodies, have separate terms and conditions to deal with energy issues in the country. There is an absence of a cohesive body to coordinate between the six relevant Ministries and 42 agencies working in the development of energy sector. Moreover, the regulatory authorities lack resource capacity to govern the entities, creating disharmony in energy prices [9]. This along with inconsistency on maintaining untargeted subsides and lack of accountability on power theft has led to face many challenges in Pakistan's energy sector. The major challenges include:

- Overreliance on oil imports and unbalanced energy mix shows lack of integrated policy and cohesion among relevant sectors and Ministries. The previously followed policies for Renewable policy, Power Policy, Petroleum policy etc.<sup>1</sup>, show lack of integration in numerous energy plans and inefficiencies in utilizing planning models being used around the world such as ENPEP, BALANCE, LEAP, MARKAL/TIMES [10], [11].
- Transmission and distribution losses Pakistan ranks 14 out of 131 countries in power losses. This
  can be attributed to technical inefficiencies as well as non-payment of bills, theft and governance
  related issues. It is estimated that "T&D loss of one percent incurs deficit of one billion over
  national treasury", and PESCO and SEPCO have reported transmission and distribution losses of
  34.8% and 27.5% respectively [12].
- The poor fuel efficiency of power plants has translated to a higher cost of generation than the notified cost by Government of Pakistan (GOP), leaving a gap which is then recovered through

<sup>&</sup>lt;sup>1</sup> See the appendix for Energy, power and climate policies.

subsidization.

- The rise in electricity price by the Independent Power Producers (IPPs) can be attributed to
  agreements to raise the price of power to favor oil in Pakistan's energy mix. Due to absence of
  international bidding procedures, untargeted timings of plants commissioning, their location and
  inappropriate choice of FO for IPPs power plant. The location of IPPs being far from load centers
  and northern areas of Pakistan laid severe strain on country's physical infrastructure, including the
  electricity transmission system.
- Pakistan adopted the incremental block tariff (IBT) strategy i.e. providing subsidies on electricity tariff to increase the poor consumer's capacity, but this does create an imbalance between the price paid per unit and per unit cost of supply [13]. Consequently, the Government ends up paying subsidies for electric power consumer resulting in a circular debt. [12].
- In 2013, government subsidies for electricity reached 1.3 billion USD. However, this did not recover the costs of generation, transmission and distribution. This creates a budget gap that curtails public investment in primary infrastructure, essential for economic development of the country. Lack of economic coordination between provinces and the lucrative exploration and production (E&P) policy that does not even consider renewables only attracts a weak pitch from the investor side. The concerns mainly revolve around the role of the State in energy governance reforms, higher capital cost of alternative resources like hydro, regulations on controlling export, prices and supply quotas, and lack of favorable environment for clean energy projects. This poor creditworthiness of electric utilities, with inefficient ways and policies to recover transmission and distribution losses, allocation of subsidies, lack or incompetency of technical staff, and inefficiency in collecting taxes have lingered on the energy crisis in Pakistan.

#### **1.2** Pakistan in the Paris Agreement

Although Pakistan's Greenhouse Gas (GHG) emissions are one of the lowest in the world it ranks among the top 10 countries most affected by climate change according to the long-term Climate Risk Index (CRI). The country suffers from extreme climatic events such as recurrent floods, desertification, glacial melt, and droughts that have resulted in irreversible damages to human societies and the economy. As per the updated GHG Inventory, the total emission of GHGs in Pakistan in the year 2012 were estimated at 369 GtCO<sub>2</sub>eq, which equals to about 0.8% of the global GHG emissions. On a per capita basis, Pakistan with 2.06 Gt per capita GHG emissions stands at 135<sup>th</sup> place in the world ranking of the countries. The major contributing sectors of GHG are the energy industries, emissions from biomass, land use changes and forestry, industrial processes, transport, burning of crops, and poor waste disposal systems. Given the future economic growth and associated growth in the energy sector, the peak of emissions in Pakistan is expected to take place much beyond the year 2030. Table-1 provides the emissions by sectors in Pakistan's INDC.

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Sectors	1994	2015	2030
Energy	85.8	185.97	898
Industrial Processes	13.29	21.58	130

Table 1 Sector Wise Projection of Emissions (MT CO2-equivalent) [14]

Agriculture	71.63	174.56	457
Land use and forestry	6.52	10.39	29
Waste	4.45	12.29	89
Total	181.7	405.07	1603

Source: Pakistan's Intended Nationally Determined Contribution (Pak-INDC)

Hence, the country is in the midst of a serious energy crisis accompanied with unprecedented impacts of climate change (CC), jeopardizing the whole economy of Pakistan. In the Internationally Determined Contributions (INDC), it is assumed that the GHG emissions of Pakistan in 2030 will be 1603 MT CO<sub>2</sub>equivalent, from 405 MtCO<sub>2</sub>-equivalent in 2015. Among this 405 Mt CO<sub>2</sub>-equivalent, energy sector constitutes approximately 186 Mt. Industrial, Transport, Residential, Commercial, Power plants, and Agriculture sector provides 41.2%, 20.2%, 13.4%, 2.6%, 15.2%, and 7% of share respectively. Pakistan being a signatory to the Paris Agreement has identified an ambitious and realistic mitigation target which provides an opportunity to showcase Pakistan's mitigation actions and adaptation priorities for climate change. The country's Nationally Determined Contributions (NDC) has set targets for mitigation in "Energy supply side: 37% GHG emissions reduction from BAU in 2030, equal to 35 Mt CO<sub>2</sub> GHG reduction in 2030; Demand side: 22% GHG emission reduction from BAU in 2030, equal to 50 Mt CO<sub>2</sub> GHG reduction in 2030". To meet the projected demand, the country needs substantial energy efficient technologies along with an increase in the share of renewable energy in utilities. The country is poised to shift towards an increased reliance upon its indigenous coal reserves to fuel its development in the 2010-2050-time frame<sup>2</sup> which would significantly increase the projected GHG emissions. There are technologies that can capture CO2 emissions at the source of generation and have been assessed in the model by decreasing energy emissions per unit of consumption. Still, a rapid increase in coal use will increase in resultant GHG emissions. Pakistan will need huge financing to adapt and mitigate the impacts of climate change. International financing institutions and agencies such as the Green Climate fund (GCF) and Global Environment Facility (GEF) can help address this gap by channeling funds through impactful and bankable projects. A study estimates that mitigation to climate change require USD 8 Billion with a potential of reducing emissions by 18% and 40% with a possible shift to cleaner energy technologies. The adaptation cost was estimated to be between US \$ 6 billion to US \$ 14 billion per year in 2010-2050 timeframe to avoid bearing significant residual damage costs caused by climate change (ibid).

In nursuit of this Dakistan has nladged to make considerable efforts to fight climate change recognized

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