CHAPTER 4

MITIGATION: EFFORTS, ACHIEVEMENTS, & NDCs

Pakistan seeks to contributing towards global mitigation efforts without compromising on its growth and development pathways. As highlighted in the Nationally Determined Contribution (NDC) submitted in 2016, Pakistan's top priority remains social development and poverty eradication. We recognize that large-scale investments in high emission sectors can also provide additional opportunities for mitigation potential. However, constraints in technology transfer and climate financing mechanisms have remained barriers.

Pakistan has surpassed mitigation contributions and has taken climate change beyond NDCs, and taken initiatives that have contributed to reduction of 8.7% emissions between 2016-2018.

4.1 POLICY INITIATIVES

i. **Energy Demand and Supply Management:** According to the Pakistan Economic Survey 2019–20, the country is facing demand-supply gap of 3000 Mega Watt (MW) that can best be fulfilled by improving energy-mix. For the demand side management, the Government of Pakistan (GoP) has approved National Electric Vehicles Policy 2020-25 (NEVP 2019) stipulating a target of 30% and 90% share in sale of passenger vehicles and heavy-duty trucks by 2030 and 2040. Also, National Energy Efficiency and Conservation Authority (NEECA) is developing Minimum Energy Performance Standards (MEPS) for electric motors, air conditioners, and LED lights. NEECA's Draft Strategic Plan (2020-2023) will reduce 3 Million Tonnes of Oil Equivalent (MTOE) from the country's primary energy supply contributing to 6.4 $MtCO_2e$ carbon emissions reduction. More importantly, however, the GoP endeavors to meet the demand with the Indicative Generation Capacity Expansion Plan (IGCEP 2021-30), National Electricity Policy (NEP) 2021, and Alternative and Renewable Energy Policy (ARE 2019), included together with hydropower, to prioritize transition to demand side management.

ii. **Engaging Private Sector:** The GoP has engaged the private sector for energy supply. For

example, a Result Based Financing (RBF) pilot project in Sindh and Punjab was initiated in 2019 in order to encourage private sector investment for off-grid solution based on the International Finance Corporation's (IFC) global standard products in off-grid communities. A four-year campaign has been launched to encourage private sector investment towards the lighting needs of consumers in the remote areas, including the addition of 1200 MW of wind.

iii. **Coal Consumption Trends:** In Pakistan, coal consumption has tripled over the last five years to 21.5 million tonnes/year to meet the growing demand from industry, and the start of coal power production from 2018. Whereas, coal import has increased upto five-fold in the last five years, primarily for industrial purposes - around 73%, of which the cement sector constitutes 65% of industrial coal consumption. The relatively high economic growth until 2018 led to increase in cement manufacturing and pushed cement production forecast to grow 10-15% annually over the next decade. This is an additional production of estimated 15-25 Million Tonnes (MT)/year by 2030. The share of power generation from coal was 24% in FY21 and is expected to increase to 31% by FY 25 due to committed plants, but will then decrease to 20.1% by FY30. The estimates are that the increase in coal consumption by power sector will only be 6 MT by 2030. Financially viable coal power exists only from lignite mining in Thar region of Sindh Province.

iv. **Energy Mix Projections:** Pakistan has an estimated hydropower potential of around 60,000 MW, out of which approximately 14% is currently exploited. Pakistan has an average theoretical solar photovoltaic (solar PV) potential of 5.341kWh/m²Global Horizontal Irradiation (GHI) requiring only 0.071% of Pakistan's total land area, mainly in the Balochistan province. If this potential is utilized, all of Pakistan's current energy needs can be met with solar power alone. Pakistan also has a significant untapped potential for wind power generation, mainly in the coastal areas of Sindh and Balochistan. The share of renewables in recent years has increased significantly from 0.25% in 2015 to 5% in 2019[8], and the potential for several-fold growth is tremendous.

There is a strong business case for meeting targets set in the Alternative and Renewable Energy Policy (ARE) 2019 for RE growth. The ARE 2019 mandates 30% solar, bagasse and wind by 2030. Yet, the most recent 'Indicative Generation Capacity Expansion Plan' stipulates that the energy mix should have 65% RE (hydropower, solar, wind and bagasse) by 2030, reversing the large dependence on imported fossil fuel. Given the system constraints, solar and wind will only begin to accelerate after 2030 in Pakistan. The new NEP 2021 includes principles of competitive bidding, environmentally responsible expanded generation through RE and more efficient use of generation.

Against this backdrop, achieving the least cost electricity mix in Pakistan would require an

[8] https://www.s-ge.com/en/article/export-knowhow/20213-c5-pakistan-renewable-energy. According to IGCEP, however, it is 3% in annual power generation. The Regasified liquefied natural gas (RLNG) based plants, though installed and available are envisaged to have a decreasing share in the energy mix from 2021 to 2030 i.e. from 18% to 2% in 2025 and then eventually falling nearly to 0% in 2030. Similar trend is there for imported coal-based plants whose contribution in the overall generation mix falls from 21% in 2021 to only 9% by the year 2030. Moreover, the share of solar and wind in the overall energy mix increases from about 3% in 2021 to 16% in 2030.

ambitious expansion of RE, reaching proposed production levels by 2030 in the base case scenario (4.02% peak demand growth). Hydropower development in Pakistan is critical for the energy transition as it can even out the volatility of high shares of solar and wind. It is estimated that 42% of total installed capacity in 2030 will be hydropower in the base case scenario. Large number of projects are focused on clean hydropower, where more than 12 GW are under construction. In theory, an even higher variable renewable energy share is possible, allowing Pakistan to be close to 100% no-carbon but at a highly unaffordable cost, as transitioning to the proposed energy mix will require investments in the grid, changes to operational procedures, and proper planning of Variable Renewable Energy (VRE) expansion with storage facilities.

4.2 MITIGATION ACTIONS

With respect to the Pak-NDC (2016) mitigation options, the following progress was made during Financial Year 2018-2021:

i. **Policy Environment:** Recognizing that the energy sector plays a critical role in achieving mitigation targets, the policies that guide Pakistan's initiatives include NEP 2021, Energy Efficiency & Conservation Strategic Plan by NEECA, ARE 2019, NEVP 2019, and IGCEP 2021-2030. These policies are coordinated and steered by regulators and specialized agencies including National Electric Power Regulatory Authority (NEPRA), Private Power & Infrastructure Board (PPIB), Alternative Energy Development Board (AEDB), Central Power Purchasing Agency Guarantees (CPPA-G), National Transmission & Dispatch Company (NTDC), Water & Power Development Authority (WAPDA), and Pakistan Atomic Energy Commission (PAEC). There are specialized agencies at the provincial level dealing with hydro and coal generation and transmission issues.

ii. **Wind Power Projects:** About 18 wind power projects of 926.76MW capacity were completed. Twelve wind power projects with a cumulative capacity of 610 MW achieved financial closing in November 2019 .

iii. **Bagasse energy:** Eight bagasse cogeneration projects of 259.1 MW capacity were completed.

iv. **Solar Power Projects:** Five solar projects are operational with installed capacity of 330 MW; four projects by Independent Power Producers (IPPs) with 41.80 MW capacity are expecting financial closure.

v. **Hydropower:** Small hydro are contributing 128 MW, while 877 MW are under implementation and 1500 MW are available for development. Medium to large hydro project of 9,827 MW are installed.

vi. **Net-Metering:** More than 2,300 new licenses were issued by NEPRA during July 2019-March 2020 under its Net Metering Regulations (2015); poised to grow at an accelerated pace, as of March 2020, more than 4,125 solar installations with

cumulative capacity exceeding 75 MW were approved[9].

vii. **International Finance Corporation (IFC) Lighting Pakistan:** A four-year campaign to encourage private sector investment towards the lighting needs of consumers in the remote villages in Pakistan. The program introduced IFC global standard products in off-grid villages.

viii. **Off-Grid Electrification Pilot Project:** The AEDB undertook a RBF pilot project in Sindh and Punjab to encourage private sector investment for off-grid solar solutions in remote villages. The IFC program was completed in 2019 with 7.5 million people served in Sindh, Punjab and GB. The Internationale Zusammenarbeit (German International Development Agency – GIZ) undertook a small-scale RBF project serving limited number of villages in Punjab and Sind. Based on the initial success, Sindh has started a partial RBF program for electrifying 200,000 households. This project is expected to lead to a full-fledged program in 2021. The microgrids are being considered for electrification of remote communities. NEPRA will notify enabling regulations for these.

ix. **Sustainable Energy For All (SEforAll) National Action Plan 2019:** AEDB was mandated to achieve renewable energy targets whereas the energy efficiency targets were mandated to NEECA. This plan targets to – double renewable energy share -and double to energy efficiency rate by 2030. Policy also targets cooking fuel practices in Pakistan with a plan to introduce alternate sources for cooking to a total of 14.03 million households by 2025.

x. **National Electric Vehicles:** Policy for two and three wheelers as well as heavy vehicles will target a 30% shift in sale of EVs by 2030. Pakistan follows the European (Euro) emissions standards, and while the recent switch to Euro 5 still has a limited share of the market, it is expected to have long-term benefits in terms of urban air quality and lowering vehicular emissions from combustion.

xi. **Bus Rapid Transit (BRT):** System has been introduced in five cities—Islamabad, Lahore, Peshawar, and Multan, while a bus rapid transit zero emission metro-line was initiated in 2018 for the city of Karachi. Presently under implementation, the project which will also turn cow-dung to methane as a fuel for the metro-line is under implementation. The 30 km metroline would be the world's first bio-methane hybrid bus fleet where 100% of the fuel demand would be met by biogas. The project will last for an estimated 20 years piloting emission free public transport services. A 40 km Karachi Circular Railway is under development to provide mass transportation while reducing emissions in the city.

[9] Net-metering rules allow DISCOs to balance the units consumed by consumer, from the grid, against the excess unit sold to them. With more than 2,300 new licenses issued during July 2019-March 2020, these installations stand at cumulative installed capacity of 47.6 MW in 2019. This contribution thus far accounts for only 0.12% of total energy mix. As of May 2021, there were 11121 commissioned systems.

In terms of emissions, with 21% increase since 2015, six key sectors and the policy actions taken by Pakistan can be summarized in the following table:

Table: 4.1: Mitigation Policy Action in Six Sectors

GHG Emission	Policy Initiatives	Plans and Targets
Energy		
Biggest source of GHG emissions in Pakistan with 218.9 MT CO_2 eq. in 2018	ARE Policy (2019)	The policy sets the specific target of at least 20% RE generation by 2025 and at least 30% by 2030
	NEECA Draft Strategic Plan (2020-2023)	Sectoral actions account for 6.4 MtCO_2e emissions reduction by 2030
Transportation		
Major energy demand sector contributing to GHG emissions of 51.3 MT CO_2 eq. in 2018	NEVP 2019 for two and three wheelers as well as heavy vehicles	The policy sets the specific target of at least 20% RE generation by 2025 and at least 30% by 2030
	Switch to Euro 5 (in process) Improve Air quality	Goal is to lower vehicular emissions from combustion and improving urban air quality Improve air quality standards as well as monitoring in provincial capital and other major cities
Agriculture		
Second highest emitting sector with 198.59 MT CO_2 eq. in 2018	Punjab Smog Policy (2017)	Complete ban on open burning of rice stubble, solid waste and other hazardous materials Disposal of crop residue in an environmentally friendly manner
	Climate Change Policy Azad Jammu & Kashmir AJ&K (2017)	Climate Change Action Plan (2019–2030)
Industrial Processes		
Third largest emitting sector which releases 25.76 MT CO_2 eq. in 2018	Pakistan's National Action Plan on Sustainable Development Goal-12 (SDG-12) (2017)	Mitigation measures to encourage adoption of clean production technologies, implementation of eco-standard, incentivize carbon trading between industries to limit the production of GHGs Promote bottom up actions by private sector, and develop plans for emissions reductions form major sectors particularly cement and textile

LULUCF		
Fourth GHG emitting sector calculated to be 24.86 MT CO_2 eq. in 2018	National Forest Policy (2018) Land Degradation Neutrality (LDN)	Conserve existing forests, increase tree cover through community participation, and meet international obligations related to forests Identify policy priorities for protecting soil quality for nutrition and micronutrients and piloting approaches on LDN in various ecosystems.
Waste		
Ranked lowest emitting sector in Pakistan that contributes 21.72 MT CO_2 eq. to total GHG emissions in 2018. Methane is the major component with a share of 19.2 MT CO_2 eq.	Clean Green Pakistan Index (CGPI–2019) Banning of single-use plastics	Strengthening municipal service delivery by the local governments. Includes a composite index of five pillars i.e. water, sanitation, hygiene, solid waste management and plantation Encourage turning animal waste (cow-dung) to methane for use as fuel for rural household and urban transportation projects as in Karachi BRT. Promote reuse and source reduction of waste

4.3 CONTRIBUTION TO MITIGATION

While reviewing mitigation options and devising any low-carbon growth strategies, the following overarching sectoral considerations need to be adequately addressed

1. **Energy Demand:** While Pakistan's supply and demand gap has considerably narrowed since 2016, more than 40 million people still remain without access to electricity. Access to energy and generation capacity influences the future investment and licensing of hydropower projects. Off-grid and RE resources have emerged as the least cost preferred option to overcome the energy access challenge.
2. **Carbon Lock-in:** Several coal power plants have become operational since 2016, including the 1,320 MW Sahiwal Coal Power Project. The share of coal power in Pakistan's energy mix is small, and as under-construction hydropower projects become operational this ratio will further improve.
3. **Just Transition:** The introduction of EVs has provided an opportunity to switch fuels for two and three wheelers as well as light commercial transportation in order to ensure continuity of their livelihoods and a just transition for them and their communities. Since the fossil fuel industry is a major employer of local communities[10], any plans for phasing out fossils from the economy require sectoral planning, based on technical studies.

[10] In 2018, the Fuels sector grew by approximately 52,000 jobs, or nearly 5% for a total of 1,122,764 jobs. Oil and natural gas employers added the most new jobs, nearly 51,000, employing 603,000 and 271,000 respectively. Including hydropower

The following table outlines the key sectors along with the overarching objective and supporting actions as contributions towards mitigation.

Table-4.2: Overarching Mitigation Objectives & Supporting Initiatives

Objective	Supporting Actions	Lead Organization	Potential Indicators	Goals
To ensure efficient, affordable and renewable energy supply	Increase in grid efficiency and transmission infrastructure	NTDC	Annual improvement in energy efficiency	Increase energy efficiency with combined sectoral targets to achieve a total of 1.5% annual improvement in energy efficiency
	Mechanisms for grid flexibility and greater integration of VRE	NTDC	Number of RE options explored	At least 20% RE generation[11] by 2025 and at least 60% by 2030
	Improvement in coal efficiency and exploration of green coal technologies	Ministry of Energy (MoE) – Power Division	Number of green coal technologies identified	
	Large scale and distributed grid connected solar, wind and hydroelectricity	AEDB	Ratio of energy mix	

[11] Including hydropower

	Support the deployment of ARE technologies: 1. Promoting innovation and technology transfer to ensure availability of renewable technology at reduced costs (including offshore) 2. Onshore large-scale wind and solar projects	AEDB	Number of low-cost renewable options explored Percentage increase in RE generation	
	Exploration and development of storage technologies to tackle RE intermittency	AEDB	Number of options proposed for RE intermittency	
	Utilizing other alternative energy sources for generating electricity	AEDB	Percentage of electricity generation from alternate sources	Transition from biomass to electricity in 15% of households by 2050
	Research and development programs for carbon capture and sequestration	Ministry of Climate Change (MoCC), GCISC	Number of research reports developed for policy uptake	
Improve mechanisms and procedures to provide for effective conservation and efficient use of energy	Efficient irrigation motors/pumps (electric), fans, boilers/furnaces, stoves, water heaters and LEDs, etc.	NEECA	Annual improvement in energy efficiency	Increase energy efficiency with combined sectoral targets to achieve a total of 1.5% annual improvement in energy efficiency

Green Building codes and certification for new and refurbished buildings, including revolving guarantee mechanism for energy efficient appliances	NEECA	Energy efficient building codes notified Number of buildings certified Revolving guarantee mechanism operationalized	At least 20% RE generation[12] by 2025 and at least 60% by 2030
Mandatory energy audits of large energy consuming industries and companies	NEECA	Number of energy audits conducted	
Explore and adopt cap and trade schemes and carbon levies to manage industrial emission efficiency	MoCC	Reduction in industrial emissions	
Promotion of Energy Standards and Labeling (ESL)	NEECA	Audit reports on enforcement of standards	

[12] Including hydropower

	Tax exemptions for hybrid and EVs	Ministry of Industry (MoI)	Number of vehicles purchased	30% shift to electric passenger vehicles and 50% shift to electric two/three wheelers and buses by 2030 90% shift to electric passenger vehicles and 90% shift to electric two/three wheelers and buses by 2040
	Establishing recharging network for EV adoption	MoI with MoE	Number of charging stations	
	Transition to Euro 5	MoE (Petroleum Division)	Reduction in air pollution	
Promote climate smart inputs and management practices in agriculture and livestock management	Improve irrigation practices and water management	Provincial agriculture department	Reduction in drop per crop	
	Climate resilient agriculture/ agroforestry practices	Ministry of National Health Services, Regulation & Coordination (MoNHSR&C)	Number of farmers trained on farming techniques	
	Introduce climate resilient seed varieties	MoNHSR&C & Provincial Departments of Agriculture (DoAs)	Number of crop varieties developed and piloted	
	Promotion, storage and management of green manure	MoNHSR&C & DoAs	Area of land using green manure	
Promote energy efficient practices in industries	Ensure the provision of gaseous fuels at cheaper rates		Reduction in prices for energy efficient fuels	

	Introduce and practice Polluter Pays Principle (PPP)		Number of industries audited	
	Introduce Refrigeration and Air Conditioning (RAC) standards, and labels	NEECA	Standards and labels notified	
	Switching to zig-zag Brick kiln technology to mitigate SLCP	Provincial departments	Number of units switched approx. 10,000	
	N_2O abatement from nitric acid plants at comparatively low cost that accounted for 5.1% of the total Industrial emissions in 2015	• Nitric and fertilizer productions plants • Provincials EPAs & regulatory agencies, National Fertilizer Corporation, and academic institutes.	Number of plants converted to low emitting technology and selling their credits in the open market	Reduction of 0.9% of the total Industrial emissions for 2030 after the strong growth in this sector
Promote conservation and sustainable management of area under cover	Mass afforestation through the involvement of government agencies, provinces, local governments and non-state actors	MoCC and provincial forest department	Area afforested or number of new plants planted	1 million ha afforested
	Conservation and management of existing forests by controlling deforestation, protecting forest reserves, and controlling other anthropogenic disturbances	Same as above	Increase in forest cover	
	Conservation and restoration of mangroves, peatland ecosystems, and coastal & marine ecosystems to reduce emissions and revive natural carbon sink	Provincial forest department	Increase in restored area as carbon sink	

	Maintaining forest inventories and increasing capacity for monitoring and modeling carbon changes	MoCC, GCISC and provincial forest department	Annual forest inventory reports	
	Encouraging private investments in farm forestry	MoCC and provincial forest department	Number of private investments	
	Develop a comprehensive management system for protected areas including coastal wetlands	MoCC	Number of management plans generated	
	Establishment of a transboundary ecological corridor	MoCC	Number of ecological corridors established	
Promote 3Rs and improve waste management practices	Enacting by-laws on land use (landfills, sewage treatment plants and power plants, waste-to-energy schemes and recycling)	Provincial department	Number of laws enacted	
	Infrastructural development for waste collection, transfer stations and treatment facilities	Same as above	Number of operational waste treatment facilities	
	Promoting a culture of recycling and reuse	Same as above and Environmental Protection Agency (EPA)	Reduction in waste generation	
	Installation of hospital and other on-site waste incineration devices	Provincial department	Number of onsite waste management facilities	
	Material Flow Analysis to generate the evidence on plastic waste management	MoCC	Number of studies conducted	