Mitigating Air Pollution:

Lessons from Beijing for Policy Reform in Pakistan

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Introduction:

While there is a history of severe air pollution in both Beijing and Pakistan's major cities, the causes and circumstances are different. Historically, Beijing's pollution was caused by a thriving industrial base, significant traffic expansion, and considerable coal use, particularly for winter heating. As per the Sustainable Mobility Report, in 2013, severe haze episodes were frequent and Beijing's average $PM_{2.5}$ was approximately 101 µg/m³. In 2013, the Chinese government acknowledged smog as a national emergency and publicly launched an "Air Pollution Prevention Action Plan" (the "war on pollution"). A Review by Air Pollution Control mentions that the subsequent policies established specific reduction goals and addressed all areas of pollution (e.g., 60 µg/m³ annual $PM_{2.5}$ by 2017. Furthermore, in under 20 years, Beijing's SO_2 concentration dropped from over 90% to less than 10 µg/m³ by 2017. On the other hand, as economic activity and car ownership have increased, Pakistan's urban pollution has increased as well. These days, Karachi and Lahore are two of the most polluted cities in the world.

The Air Quality Life Index ranks Pakistan as the "fourth most polluted" nation in the world, with a national average $PM_{2.5}$ that is significantly higher than the WHO recommendation. Approximately 98% of Pakistanis live over the national average (15 µg/m³).Because of agricultural residue burning and sluggish weather, pollution and $PM_{2.5}$ levels in Lahore frequently increase during the winter. In Karachi, pollutants are trapped by a combination of terrain and vehicular and industrial emissions.

Pakistan is currently responding with fragmented policy. According to the World Bank, the government has changed fuel quality to Euro-V standards, released a National Electric Vehicle Policy, and started Punjab's Clean Air Program, which aims to reduce PM_2 by about 35% over a ten-year period. Nevertheless, there is lax enforcement of waste management, industrial emissions limitations, and vehicle inspections. Moreover, there is a dire need to bring long-term and effective

outcomes for the compensation of workers.

To sum up, Pakistan's efforts to date lack this integration and scale, while Beijing's clean-air program was methodical and resource-intensive. After analysing Beijing's tactics and results, this essay looks at how comparable methods may be modified for Pakistan's institutional and economic environment.

China's Multi-pronged Approach in Beijing

Industrial Regulation and Pollution Control

According to the Ministry of Ecology and Environment, The People's Republic of China, Beijing vigorously reduced pollution from industry. Nearly 2,000 polluting businesses were shut down or moved as part of the 2013–2017 Clean Air Action Plan, greatly exceeding the 1,200 target. These manufacturers mostly produced chemicals, steel, cement, and other heavy pollutants. Moreover, it also mentions that six of the eight cement facilities were shut down by the city, reducing its capacity to 3.1 million tons. Between 2016 and 2018, more than 10,000 businesses that were operating unlawfully were closed or changed. Additionally, thousands of factories were relocated from metropolitan areas by local authorities (for instance, 1,173 enterprises are planned to relocate in Daxing District). Strict emissions upgrades for the remaining businesses were implemented in conjunction with these closures. For example, brick kilns across the country were mandated to implement zigzag (high-efficiency) designs or face closures during the winter.

As a result, industrial emissions drastically decreased. Through subsidies that cover two-thirds of conversion expenses and fuel switching to natural gas or electricity, the portion of Beijing's $PM_{2.5}$ that comes from local coal combustion (households and small boilers) has been drastically reduced. The majority of rural and urban families were "coal-free" by 2017. Regional pollution controls were also implemented by China's national strategy, which established a "2+26" city plan (Beijing, Tianjin, and Hebei plus 26 nearby cities) to coordinate fuel requirements, emission limits, and cooperative efforts across provincial boundaries.

Vehicle Emission Controls and Transportation Reform

Reuters reports that incentives and regulations were used to target on-road automobiles. Beijing was the first to limit the total quantity of cars through auctions and license-plate lotteries. In order to maintain the fleet below 6 million, new car registrations were reduced from 300,000 in 2010 to roughly 150,000 annually between 2014 and 2017. According to International Council on Clean Transportation, Electric vehicles (EVs) became more appealing as a result of the plate shortage; it was aimed to give EV buyers were given priority due to special quotas (20,000 NEV plates in 2014, increasing to 30,000 by 2015). In 2013, more than 2,000 EVs were added to public fleets; by 2015, 8,507 were to be added, and by 2017, 200,000 new-energy vehicles were the ultimate aim. By 2017, over 3% of Beijing's automobile fleet consisted of "new energy vehicles," primarily battery electric automobiles. A report by an electronic source Scientific American says that 300,000 cars with high pollution levels were aimed to be discarded in 2017.

In addition, Beijing implemented more stringent emissions regulations: it implemented "China VI" (akin to Euro 6) for car exhaust and fuel quality and accepted Euro 5/V standards before the country was ready. Heavy-duty diesel vehicles with high emissions were either removed or converted; they accounted for around 85% of vehicle NO_x and PM emissions, but only about 10% of cars. Bus fleets were redesigned with CNG and electric buses, and new subway and BRT lines were constructed as part of the city's significant public transportation expansion. Simultaneously, urban planning reforms that limited road and parking construction and densified neighborhoods surrounding transit 'decoupled' vehicle usage from income growth. Low Emission Zones that prohibited older vehicles in core districts and odd-even driving limits during smog alerts were two examples of transport demands.

Coal Reduction and Cleaner Energy:

The most prominent action that was taken by the Beijing was the rapid reduction of coal burning. From roughly 22 million tons in 2013 to less than 7 million tons in 2017, the city drastically

reduced its coal use.

In order to meet demand, Beijing imported extra electricity from nearby provinces and shut down or moved major coal-fired power plants. As villages became coal-free, 1.93 million tons of coal were used less frequently in Daxing District between 2013 and 2017, replacing urban boilers and stoves. Beijing prohibited coal heating in all homes and small businesses during the winter and encouraged the use of gas or electric heating instead.researchgate.net. By 2017, the majority of families had stopped using coal, resulting in extremely low levels of SO_2 emissions. As per the research by Journal of Environmental Science and Ecotechnology, outside of Beijing, China's "2+26" region initiative provided winter heating fuel upgrades and subsidised rural coal-to-gas conversions in northern regions.

China expanded renewable energy abroad at the same time in order to supply Beijing's system. Beijing benefited from national clean power expansion and even afforestation (which lessened the problem of dust storms), despite its own weak solar and wind capacity. Beijing also made investments to increase the efficiency of district heating. Cutting coal was crucial overall since it eliminated the biggest local source of PM_2 and greatly decreased SO_2.

Enforcement and Governance

China revised its environmental law in 2015, stiffening the penalties. As per the data provided by the The State Council, The People's Republic of China, by 2018, nationwide environmental fines have increased from over $0.5 billion in 2014 to over $2.1 billion. Beijing clamped down on infractions through its local authorities and specialised "eco-inspectors," closing 651 businesses for non-compliance in 2017 alone. The city mandated that all projects complete stringent environmental impact evaluations and gave environmental tribunals more authority. As reported by Dawn, burning garbage and fugitive dust were punished (Islamabad 2024 news reported that Pakistan's Capital EPA was begging to stop burning garbage bins to reduce $PM_{2.5}$). By making air quality data publicly available and maintaining accessible complaint hotlines, Beijing also included its citizens. High-level goals, precise rules, and steadfast execution all contributed to the development of political will.

Comparative Analysis with Pakistan

There are significant variations between Beijing and Pakistan, yet there are also some shared causes of pollution. Both feature regional sources of particulate pollution, high automobile traffic, and fast urbanisation. But the energy mix is different: Beijing's heating and many industries relied on coal, while Pakistan's power sector (aside from a few coal plants) mainly relies on gas and oil. While wood and biomass are used in impoverished regions, and agricultural fire is a major seasonal polluter, Pakistan does not have extensive winter coal heating in houses.

Institutionally, Pakistan's government is more dispersed (federal vs. provincial), while China's command-and-control structure allowed for quick nation-scale orders. Whereas Pakistan lacked a legally mandated clean-air framework, Chinese cities such as Beijing had long-term five-year plans linked to pollution targets. The enforcement capacity also differs: Pakistan's provincial EPAs are underfunded and frequently do not have real-time monitoring, whereas China's environment government has quadrupled fines and extensive power.

The current air quality in Pakistani cities is frequently better than Beijing's worst. According to WHO statistics, Lahore's annual $PM_{2.5}$ was approximately 115 µg/m³ in 2023, while Beijing's was about 40 µg/m³ in 2019. Beijing's mid-2010s ambitions are more aggressive than Punjab's Smog Mitigation Plan, which intends to reduce $PM_{2.5}$ in Lahore by 35% by the end of ten years. Particulate pollution in Pakistan is increasing; in 2021, the national average was approximately 70 µg/m³ (AQLI), while in China, it decreased. The Journal of the College of Physicians and Surgeons reports that the health effects are severe: it has been estimated that air pollution causes over 128,000 deaths in Pakistan each year and reduces life expectancy by three to seven years.

Extracted Lessons for Pakistan

- **A comprehensive, multi-sector approach**:

  Beijing simultaneously targeted all significant $PM_{2.5}$ sources. This means that Pakistan must coordinate its efforts in the areas of automobiles, industry, energy, agriculture, and urban dust. If stubble burning and brick kilns are left unregulated, a single-track policy (such as focusing just on automobiles) will not work.

- Beijing established quantifiable targets (such as 60 $\mu g/m^3$ by 2017) and delegated accountability to various levels of government. Similar to this, Pakistan should set national and provincial $PM_{2.5}$ targets (more rigorous than the present 15 $\mu g/m^3$, but still below the WHO 5 $\mu g/m^3$ initially) and link them to policy deadlines. Implementation can be focused by transparent monitoring, such as publicly reported AQI.

- **Strict enforcement of the law**:

  Regulations were given strength by China's "strictest" Environmental Law (2015). Although they exist, Pakistan's Environmental Protection Act and NEQS are primarily us ed as guidelines. It is imperative that regulations be strengthened (e.g., by requiring emission licenses, imp osing severe penalties, and giving local EPAs more authority). Beijing demonstrates that effective and credible enforcement is achievable, even when tar geting large corporations.

- **Regional collaboration:**

  Air pollution transcends national boundaries. Beijing united Tianjin and Hebei with its "2+26" plan. Interprovincial or regional coordination is required in Pakistan, particularly for occurrenc es like stubble smoke floating between provinces (e.g., Sindh with Balochistan, Punjab w ith KPK). This can be facilitated by a federal framework.

- **Data-driven policy:**

  Beijing's decisions were informed by extensive surveillance networks. There aren't many reference stations in Pakistan right now. Putting money into monitoring (using satellite data and ground sensors) will assist quantify the impact of policies and find hotspots (such as traffic corridors or brick kiln clusters). Low-cost sensors used in citizen research could be used to augment official data.

- **Economic instruments and incentives:**

  China blended subsidies and prohibitions. Beijing provided scrappage incentives and substantial subsidies for coal-to-gas conversions. Cleaner innovations, such as subsidised electric motorbikes or stubble-using farm equipment, can also be supported by Pakistan. On the other hand, just transitions (such as compensation or training for displaced workers in brick kilns or old-industrial jobs) should go hand in hand with austerity measures (bans, closures, and fines).

- **Public awareness and behaviour:**

  Air quality alerts in Beijing attracted the public, who complied by wearing masks and reducing their driving on alert days. Given that air pollution was classified as a "public health emergency" in the JCPSP report, Pakistan must increase public awareness of the health risks. Behaviour can be influenced by schools, media campaigns, and applications (e.g., ban on crop burning, encourage mask wear on high-pollution days).

- **Technology adaptation:**

  Beijing made use of high-tech solutions, such as remote sensing and sophisticated automobiles. Pakistan can acquire technology even if it might not be able to create at that level domestically. For instance, it is possible to implement efficient cookstoves, create EV charging infrastructure (with Chinese or foreign partners), and adopt the zigzag kilns that are required in China.

- **Building institutional capacity:**

  The knowledge and power of Beijing's municipal environmental bureau increased. In a same vein, Pakistan has to acquire financing (from the national budget or foreign donors) and fortify its institutions (train employees at the EPA, NEQS enforcement agencies, and metro transport authority).

  The Chinese example shows how important political will and cooperation are. Policymakers in Pakistan can adopt Beijing's campaign's "whole-of-government" philosophy while adapting it to the country's unique social and economic circumstances.

Conclusion

Beijing has shown that systematic, multi-level work can defeat the smog dragon with its impressive air quality turnaround. The road ahead for Pakistan is straightforward, if not simple: implement comprehensive policies spanning industry, agriculture, transportation, and energy that are underpinned by robust enforcement and public participation. According to the research, thorough actions quickly improve the quality of the air, which helps to prevent illness and save lives.

The immediate next steps for Pakistani authorities should be to initiate trial initiatives (e.g. EV buses in Lahore, subsidised agricultural equipment in Punjab), scale up air monitoring in all major cities, and finalise and fund the national clean air strategy with specific targets. To dismantle administrative silos, coordination mechanisms (federal-provincial task forces) must be established. In addition, implementing these reforms shows communities and investors that Pakistan takes sustainable development seriously.

In conclusion, Beijing has taught Pakistan that air pollution can be resolved with willpower and effective policymaking. Pakistan's leaders and urban planners may significantly improve air quality by implementing Beijing's emphasis on cross-sector approaches, strict standards, and transparent monitoring—while modifying for local needs and restrictions. Longer, healthier lives and greener, more productive, and livable communities for future generations are the incalculable benefits.