Center for Research & Security Studies

Rule of Law - Security - Governance

Toxic Smog Over Pakistan

Causes and Remedies

Contents

Acknowledgements

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Finally, we express our sincere appreciation to the organizations, including the World Bank, UN, ADB, and the International Court of Justice, for their potential support in alleviating the environmental challenges highlighted in this investigative report.

Author's Note

Esteemed Leaders at the World Bank, IMF, ICJ, UN, UNDP, and ADB,

With a heavy heart, I write this report as well as an appeal to draw your attention to the unprecedented environmental catastrophe that grips Pakistan every year with the onset of winter; the crisis of toxic air pollution and smog in Punjab, home to 128 million people. Year 2024 has been no exception.

The annual onset of winter has once again brought the devastating India-Pakistan smog into global headlines, with Lahore, Pakistan's second-largest city, recording Air Quality Index (AQI) levels exceeding 1,200—frequently surpassing 1,000. These figures represent an alarming 190-fold breach of the safety limits set by the World Health Organization.

This catastrophic smog has overwhelmed Pakistan's healthcare system, disrupted economic activities, and inflicted immense hardship on millions of people. In a reactive attempt to contain the crisis, the Punjab government has imposed a province-wide lockdown, paralyzing the most populous and economically vital region of the country. Unfortunately, these measures only address the symptoms, leaving the root causes of this environmental disaster unaddressed.
A World Bank study reckons that air pollution costs Pakistan over $47 billion annually—equivalent to 6.5% of its GDP. The human toll is equally harrowing, with air pollution contributing to an estimated 128,000 premature deaths annually.

This letter and the accompanying report plus a rapid assessment report (attachment) also aims to highlight that despite financial assistance by international institutions such as the World Bank, ADB, UNFCCC, EU, and UNDP the smog and air pollution crisis has only worsened with each passing year. Where and how was that external funding spent?

This report not only identifies sources of air pollution including SMOG but also proposes practical and actionable solutions to address the escalating environmental crisis. However, the government has largely resorted to unsustainable and costly stop-gap measures such as irrational lockdowns, cloud seeding, and artificial rainfall, without attending to the root causes of the smog. These temporary fixes have only added more burden to fragile economy—an economy that, as the Prime Minister lamented at the World Economic Forum, has become synonymous with a "global begging bowl."

I urge your esteemed organizations to thoroughly review the enclosed report - being launched by the independent Center for Research and Security Studies - and communicate its recommendations to the Government of Pakistan for implementation.
The report outlines unified, evidence-based solutions that demand immediate and informed action. Key measures include real-time monitoring of greenhouse gas emissions and air pollutants, alongside the implementation of sustainable strategies to combat the root causes of smog and air pollution.

We look forward to your professional review, recommendations thereof and forceful engagement with the government to prevent further degradation of the environment, get rid of the recurring smog and protect lives of tens of millions in Pakistan and the broader South Asian region.

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List of Acronyms

i. **ADB** | Asian Development Bank
ii. **AOD** | Aerosol Optical Depth
iii. **AQI** | Air Quality Index
iv. **AURI** | Acute Upper Respiratory Infections
v. **BC** | Black Carbon
vi. **CAMx** | Comprehensive Air Quality Model with Extension
vii. **CH4** | Methane
viii. **CO** | Carbon Monoxide
ix. **EDGAR** | Emission Database for Global Atmospheric Research
x. **EEA** | European Environment Agency
xi. **EI** | Emission Inventory
xii. **EMEP** | European Monitoring and Evaluation Program
xiii. **FAO** | Food and Agriculture Organization
xiv. **g** | Grams
xv. **GAINS** | Greenhouse Gas Air Pollution Interactions and Synergies
xvi. **GAPF** | Global Atmospheric Pollution Forum
xvii. **Gg** | Giga-Grams
xviii. **GJ** | Giga-Joules
xix. **Gt** | Giga-Tons
xx. **ha** | Hectares
xxi. **ICJ** | International Court of Justice
xxii. **IEA** | International Energy Agency
xxiii. **IMF** | International Monetary Fund
xxiv. **IPCC** | Intergovernmental Panel on Climate Change
xxv. **Kg/m³** | Kilogram per cubic meter
xxvi. **MtCO₂-eq** | Metric tons of CO_2 equivalent
xxvii. **µm** | Micrometer
xxviii. **µg/m³** | Micrograms per cubic meter
xxix. **OGRA** | Oil and Gas Regulatory Authority
xxx. **UN** | United Nations
xxxi. **UNDP** | United Nations Development Programme

Executive Summary

The smog and air pollution crisis in Pakistan and South Asia is primarily caused by vehicular emissions, industrial pollution, fossil-fuel-fired power plants, waste burning, and the coal used in thousands of brick kilns across the region. Smog comprises tropospheric ozone, sulfur oxides, smoke, nitrogen oxides, carbon monoxide, volatile organic compounds, pollen, dust, and ammonia gas, all of which are highly reactive and extremely hazardous to humans, animals, and the environment.

Inventories compiled by various institutions provide critical insights into the environmental impacts of human activities, offering essential data for assessing and mitigating emissions that contribute to climate change and air pollution.

	Transport	**Industries**	**Crop Residue Burning)**	**Waste Burning**	**Commercial**	**Domestic**
Emissions Inventory of KPK[1]	**85%**	7.9	3.90%	4.3 %	0.48 %	1.9 %
Emissions Inventory of Lahore	**83.15%**	9.07%	3.90%	3.63%	0.14%	0.11%

These emission inventories demonstrate that vehicular emissions are the main source of poor air quality in Lahore and KPK. While data for Punjab is incomplete, it is evident that vehicular emissions are a significant contributor to smog and air pollution.

	Transport	Industry	Energy	Agriculture	*Non – combustion Industrial Processes*	Others
Emission Inventory of Punjab[2]	**39%**	**24%**	16%	11%	9%	1%

Key Findings

1. **Vehicular Emissions:**
   Diesel and petrol in Pakistan contain high levels of sulfur, benzene, and other harmful substances (see Chapter 2). The high sulfur content significantly contributes to particulate matter (PM) emissions during combustion. Despite plans to introduce Euro 5 standards in

[1] *Complied by Adam Smith (ASI) and KPK Government*
[2] *FAO. (2018). Remote Sensing for Spatio-Temporal Mapping of Smog in Punjab and Identification*

2008, implementation has been repeatedly delayed. OGRA and the Ministry of Petroleum have failed to compel local refineries to upgrade, while countries like China and India have already adopted Euro 6 standards.

2. **Smuggled Fuel:**
   Government findings from 2024 reveal that illicit Iranian diesel and petrol account for 30-40% of Pakistan's fuel consumption. These substandard fuels, with high sulfur content and toxic contaminants like manganese and xylene, pose severe health and environmental risks. The government must control this smuggling to prevent further economic and ecological damage.
3. **Fuel Adulteration:**
   Fuel adulteration significantly exacerbates vehicular emissions, releasing toxic pollutants like carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and volatile organic compounds (VOCs). These pollutants are precursors to ground-level ozone and photochemical smog, endangering public health and the environment.
4. **Corruption in Fuel Monitoring:**
   Despite proposing a web-based monitoring system to OGRA to ensure fuel compliance, efforts were thwarted by systemic corruption. This real-time system could eliminate impurities in fuel, offering a cost-effective solution to Pakistan’s environmental crisis.
5. **LPG and Natural Gas Challenges:**
   Declining natural gas production and the increasing use of low-quality, smuggled LPG have worsened air pollution. Adulterating LPG with CO_2 in Sindh and Punjab adds to safety risks, allegedly facilitated by corrupt local authorities and OGRA.
6. **Biomass and Organic Waste Management:**
   The Government of Punjab was advised to convert methane emissions from biomass and organic waste into transport fuels such as CNG and methanol. This sustainable solution, which could replace LPG and make Pakistan self-sufficient in energy, was unfortunately dismissed.
7. **Coal Usage:**
   The extensive use of imported coal in brick kilns and industries costs Pakistan nearly $2 billion annually while severely degrading the environment. Proposals to reduce reliance on coal have been ignored.
8. **Circular Debt and Renewable Energy:**
   In December 2023, a proposal was made to address circular debt by encouraging consumers with rooftop solar systems to use surplus electricity for cooking instead of exporting it to the national grid. This would reduce LNG and LPG imports and combat air pollution, yet it remains pending.
9. **Call for Accountability:**
   The report's concluding section, authored by Mr Nadir Mumtaz, Mr Imtiaz Gul, and Engineer Idrees Abbasi, calls for a comprehensive audit of funds allocated to Pakistan’s

climate change sector. Transparency and accountability are essential for effectively addressing escalating environmental challenges.

This report urges immediate action to combat Pakistan's smog and air pollution crisis. Through practical, low-cost solutions and international cooperation, Pakistan can pave the way toward achieving its net-zero targets and safeguarding its environmental and economic future.

Chapter 1 - Air Pollution: A Growing Global Environmental Threat

Air pollution is one of the most significant environmental challenges globally, with profound impacts on human health, agriculture, natural ecosystems, and climate patterns. The severity of its effects is projected to intensify in the coming decades. Air pollutants, including aerosols and gases, are especially concerning due to their transboundary nature. These pollutants often originate in one country but travel across borders via air masses, affecting regions where they were neither produced nor utilized.

Such pollutants disrupt Earth's energy balance, alter rainfall patterns, and cause unexpected temperature fluctuations, such as heat waves. Additionally, global studies have shown that atmospheric aerosols, such as black carbon and dust, deposited on snow and glaciers reduce their albedo (reflectivity). This leads to increased absorption of solar radiation, accelerating the melting rates of High Asia glaciers, including those in the Tibetan Plateau, the Himalayas, and the Karakoram ranges.

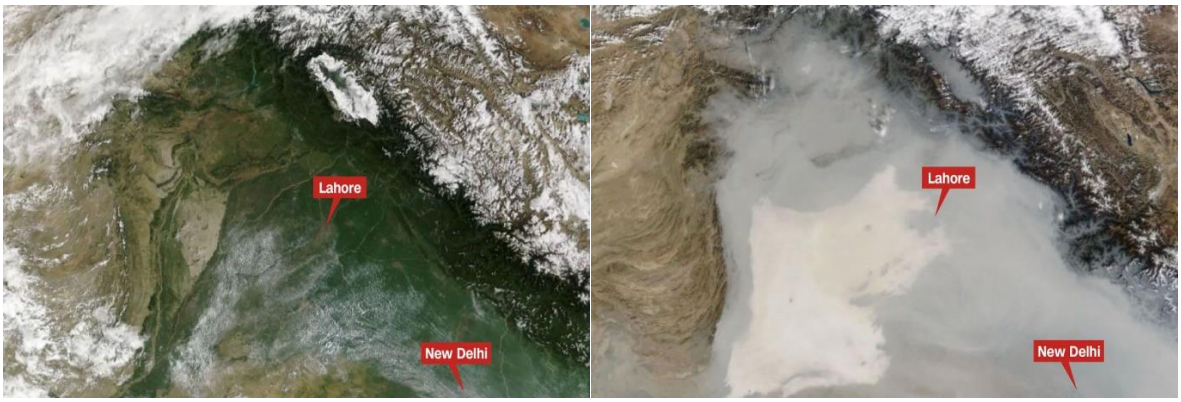
Moreover, air pollutants like carbon monoxide (CO), sulfur dioxide (SO_2), and ozone (O_3) pose severe health risks. According to the World Health Organization (WHO) in September 2021, over 80% of the global population is exposed to air quality levels exceeding WHO's safe limits, contributing to more than three million deaths annually. Addressing air pollution has therefore become a critical global priority, offering significant co-benefits for climate mitigation, environmental conservation, and socio-economic development.

Air Pollution in Pakistan

Winter air quality in Pakistan deteriorates significantly due to the colder, drier air, which traps pollutants close to the ground instead of allowing them to dissipate as warmer air does. This phenomenon creates a hazardous buildup of toxins in the atmosphere, compounding environmental and health crises.

Pakistan is among the countries most severely impacted by air pollution, a pervasive issue with far-reaching consequences for human health, agriculture, and ecosystems. Each winter, a menacing yellow haze blankets the skies across Punjab province, driven by a combination of factors, including emissions from coal-fired power plants, vehicular pollution, stagnant atmospheric conditions, and the burning of agricultural waste by farmers, as reported by the Government of Punjab.

The colder, drier air in winter exacerbates the problem by trapping pollutants close to the ground, preventing their dissipation. This leads to a hazardous buildup of toxins in the atmosphere, intensifying the already dire environmental and health crises.



Satellite imagery from NASA Worldview shows heavy smog over Pakistan's Punjab province and parts of northwest India on November 10, 2024, compared to the same region on August 31, 2024. NASA Worldview/CNN

Punjab, Pakistan's most populous province, is home to two-thirds of the country's population and contributes approximately 60% to Pakistan's annual industrial goods and services. However, rapid industrialization, vehicular emissions, biomass burning, and urbanization in Punjab have significantly escalated air pollution levels. Cities like Lahore and Multan now dominate global rankings for the worst air quality.

According to the Swiss monitoring group IQAir, which collects data from 14 regional stations, Lahore was ranked the most polluted city in the world on November 7, 2024. The city's Air Quality Index (AQI) soared to an alarming 1,165—over 120 times the safe levels recommended by the World Health Organization (WHO). Multan has also emerged as a severe hotspot. On November 9, 2024, Multan recorded an astonishing AQI of 1,914, marking its second consecutive day as the world's most polluted city. These figures underscore the dire air quality degradation afflicting Pakistan, particularly in densely populated regions.

Causes and Consequences of Smog in Punjab and Beyond

Smog, a severe air quality issue in Punjab, is primarily caused by:

- **Crop Burning:** Farmers burn agricultural residues, releasing harmful pollutants into the atmosphere.

- **Industrial Emissions:** Rapid industrial expansion, coupled with inadequate environmental controls, contributes significantly to pollution.
- **Vehicular Emissions:** The increasing number of vehicles using low-quality fuels exacerbates air pollution.
- **Brick Kilns:** Traditional brick-making practices reliant on coal and biomass fuels are major contributors.
- **Deforestation:** The loss of tree cover worsens air quality by reducing natural carbon sinks.

The health impacts of smog are profound and include:

- **Respiratory Issues:** Conditions such as asthma, chronic bronchitis, persistent coughing, and throat irritation.
- **Cardiovascular Problems:** Increased risks of heart-related diseases.
- **Eye and Skin Irritation:** Immediate effects of prolonged exposure to polluted air.

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Chapter 2 - Breathing Toxicity: Pakistan's Smog Crisis and Euro 5 Non-Compliance

Smog is a scientifically recognized phenomenon characterized by a brownish haze resulting from the chemical interactions of various air pollutants. Key contributors to smog formation include nitrogen oxides (NO_x), carbon monoxide (CO), sulfur compounds, particulate matter (PM), and non-methane volatile organic compounds (NMVOCs). These pollutants undergo photochemical reactions in the presence of sunlight, leading to the production of ground-level ozone and other secondary pollutants. The outcome is smog, which poses significant threats to environmental quality, human health, and visibility.

In response to growing concerns about air pollution from vehicles, the United States enacted the first vehicle emissions standards in 1963, primarily addressing Los Angeles' smog problems. Japan followed suit in 1966 with their own emissions rules, and between 1970 and 1972, Canada, Australia, and the European Union introduced similar standards. Initially, these standards focused mainly on carbon monoxide (CO) and hydrocarbons (HC).

Pakistan adopted the Euro emissions standards, which were first introduced in 1992 with Euro I. These standards have since evolved through several iterations, each progressively tightening limits on emissions. Later, additional standards were implemented, extending to passenger cars, light commercial vehicles, and, eventually, heavy-duty vehicles, as illustrated in the table below.

Stage	Date of Implementation	CO	HC	NOx	PM	**Sulfur limit (ppm)**
Euro I	1992	**4.5**	1.1	8	0.612	600
Euro II	1996	**4**	1.1	7	0.25	500 (diesel)
Euro III	1999	**1.5**	0.25	2	0.02	350 (diesel); 150 petrol
Euro IV	2005	**1.5**	0.46	3.5	0.02	50
Euro V	2008	**1.5**	0.46	2	0.02	10
Euro VI	2013	**1.5**	0.13	0.4	0.01	10

The Euro standards regulate several key pollutants emitted by internal combustion engines. The main pollutants targeted by these standards include:

- **Nitrogen Oxides (NO_x):** NO_x emissions are a major contributor to air pollution and have significant health impacts, including respiratory problems and the formation of ground-level ozone.
- **Carbon Monoxide (CO):** CO is a colourless, odourless gas that can be harmful when inhaled in large amounts. It can cause dizziness, confusion, and even death at high concentrations.
- **Hydrocarbons (HC):** Unburned hydrocarbons contribute to the formation of ground-level ozone and smog, which can have severe health and environmental consequences.
- **Particulate Matter (PM):** PM consists of tiny particles that can penetrate deep into the lungs and even enter the bloodstream, causing a range of health issues from respiratory problems to cardiovascular diseases.

Pakistan's adoption of the European vehicle emission standards, Euro II, in 2012 highlights a significant delay in aligning with global emission norms. This adoption occurred 12 years after Euro II was globally phased out, while Europe is now transitioning to the more stringent Euro VII standards. In stark contrast, neighbouring India implemented India Stage VI standards (equivalent to Euro VI) for all vehicles manufactured from April 1, 2020.

The continued reliance on the outdated Euro II standard in Pakistan has exacerbated vehicular emissions, including nitrogen oxides (NO_x), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs), sulfur oxides (SO_x), total suspended particulates (TSP), and fine particulate matter (PM2.5). These pollutants significantly degrade air quality, contributing to health hazards, environmental damage, and the formation of smog.

For instance, in Lahore, the emissions inventory from various sectors, as reported by the Government of Punjab (GoPu), highlights the role of fuel types in determining sectoral emissions. The data underscores the urgent need for cleaner fuels and stricter compliance with modern emission standards to mitigate the harmful impacts on air quality, public health, and ecosystems.

Concentration of Pollutants (Tons) from different sectors							
Emissions (Tons)	**Transport**	**Industry**	**Agriculture (Crop Residue Burning)**	**Waste Burning**	**Commercial**	**Domestic**	**Emissions Total**
NOx	**3,390**	2,296	158	240	142	104	6,330
CO	**101,820**	258	4,582	4,220	62	44	110,987
NMVOC	**21,440**	20	34	90	4	3	21,591
TSP	**170**	138	398	350	1	2	1,060
PM2.5	**397**	29	371	320	1	1	1,120

The results indicate that the transport sector is the primary contributor to Lahore's deteriorating air quality, with non-methane volatile organic compounds (NMVOCs) and nitrogen oxides (NO_x) being the second most significant pollutants, primarily from the transport and industrial sectors. The data also quantifies emissions of fine particulate matter, including total suspended particulates (TSP), PM2.5, and PM10, which play a critical role in the formation of smog, particularly during Lahore's winter months.

High Sulfur Content in Fuels

In Pakistan, diesel and petrol typically contain around 3% sulfur, significantly contributing to particulate matter (PM) emissions during combustion. Efforts to reduce sulfur levels have faced repeated delays. The maximum allowable sulfur content was initially set to be reduced from 10,000 parts per million (ppm) to 500 ppm by 2008, but this was postponed to 2010 and then again to 2012 due to the need for refinery retrofitting.

The deadline was further extended to December 2017. However, refinery upgrades have been neglected, with all five refineries operating outdated hydro-skimming or semi-conversion technologies. As a result, the refined petroleum products meet only the outdated EURO II standards and use obsolete RON 87 and RON 91 grades, which have been phased out globally.

Recently, the Petroleum Division and the Oil and Gas Regulatory Authority (OGRA) missed a crucial deadline set by the Special Investment Facilitation Council (SIFC) for refinery upgrades. This deadline, initially set for November 10, 2024, aimed to address tax exemptions and bolster the sector amidst concerns over smuggling and unresolved tax issues.

Case Studies I - China

Beijing, once one of the most polluted cities in the world in the mid-1990s, has since made significant strides in reducing air pollution. In addition to replacing subcritical coal power plants with ultra-supercritical plants, China has implemented several strategies to control transportation-related air pollution, including setting stringent emission standards for vehicles.

China introduced the **China 5** and **China VI** emission standards, which are similar to or more stringent than European standards:

- **China 5:** This standard aligns closely with Euro 5 but includes stricter emission limits for diesel light-duty vehicles (LDVs) and sets particulate matter (PM) limits for gasoline LDVs.

- **China VI:** More stringent than Euro 6, China VI also incorporates real-world emission testing. It is expected to reduce emissions from heavy-duty vehicles by 82% for PM2.5 and 86% for NO_x by 2030.

Case Studies II - India

India has also taken significant steps to reduce air pollution from transportation, primarily through the introduction of **India Stage Emission Standards (BSES)**. While Pakistan's refineries remain at Euro-2 standards, India implemented **India Stage IV (BS-IV)**, equivalent to Euro IV, on April 1, 2017. These standards regulate vehicular emissions and are largely based on European (Euro) standards. India then transitioned to **BS-VI** standards in 2020, which align closely with Euro 6/VI norms.

Chapter 3 - LPG Adulteration: The Hidden Menace Behind Pakistan's Smog

LPG Adulteration and Its Impact on Pakistan

Pakistan's energy sector, regulated by the Oil and Gas Regulatory Authority (OGRA), is grappling with a growing reliance on Liquefied Petroleum Gas (LPG) due to an 8-10% annual decline in domestic natural gas production. LPG now constitutes 1.5% of the country's energy mix, but with domestic production meeting only 40% of demand, over 2 million tons of LPG are consumed annually, much of which is imported under lax regulatory oversight.

Adulteration Practices and Their Risks

Imports, primarily through land routes like Taftan, Gabd, and Mand, often originate from outdated refineries and lack stringent quality controls. This allows hazardous impurities to flood the domestic market, worsening air pollution and public health crises.

In Sindh and Punjab, LPG is frequently adulterated with carbon dioxide (CO_2), allegedly involving collusion among OGRA, the Hydrocarbon Development Institute of Pakistan (HDIP), and local authorities. This practice increases vaporization pressure artificially but compromises product quality, leading to structural weaknesses in storage tanks that have caused fatal explosions.

Imported LPG also contains harmful impurities such as:

- **Carcinogenic hydrocarbons** like ethylene and propylene.
- **Sulfur compounds**, which contribute to acid rain and respiratory diseases.
- **Benzene and toluene**, known for severe health impacts, including cancer.

The incomplete combustion of these adulterated hydrocarbons generates carbon monoxide (CO), a toxic gas contributing to urban smog and ground-level ozone formation. Studies by NASA and the Environmental Protection Agency (EPA) have linked such emissions to severe environmental and health consequences.

Illegal Practices and Weak Enforcement

Illegal LPG decanting—transferring gas between cylinders at unauthorized facilities—is widespread, resulting in frequent fire-related accidents. Despite issuing over 315 licenses to LPG marketing companies and 5,800 to distributors, OGRA has failed to curb these practices effectively. Most refilling operations take place outside licensed facilities, reflecting weak enforcement and regulatory oversight.

Fuel Adulteration Beyond LPG

Adulteration is not confined to LPG; it is rampant in petrol and diesel as well. Blending naphtha with petrol and kerosene with high-speed diesel (HSD) compromises fuel quality and increases emissions of harmful pollutants like carbon monoxide and particulate matter (PM2.5 and PM10).

Pakistan also faces a proliferation of illegal fuel retail outlets, with over 1,500 such operations sourcing adulterated fuels from smugglers and black markets. Regulatory bodies, including OGRA and the Ministry of Energy, have failed to crack down on these outlets effectively.

Learning from India's Model

India's Bharat Petroleum provides a model for improving LPG sector operations. Its integrated supply chain management and quality assurance measures ensure high standards and consumer safety. Key initiatives include:

- **Tamper-proof seals with QR codes** to guarantee product integrity.
- **Real-time tracking systems** for supply chain transparency.
- **Consumer education programs** on safe LPG usage.

Adopting such practices could significantly improve safety, reduce environmental degradation, and enhance consumer confidence in Pakistan.

Chapter IV - Coal-Fired Power Plants

The coal-fired power plants established under the China-Pakistan Economic Corridor (CPEC) have emerged as a critical area of concern, given their impact on Pakistan's economy and environment. These plants have set global benchmarks for high electricity tariffs, even surpassing some of the most expensive rates worldwide.

The tariff structure for these coal plants includes two components:

1. **Energy Purchase Price (EPP)**: Covers the cost of generating electricity.
2. **Capacity Purchase Price (CPP)**: Ensures payment for the plant's operational readiness, regardless of energy produced.

For context, Denmark, a nation known for its high electricity costs, charges approximately **USD 0.54 per kWh**, which is significantly lower than the tariff rates of certain CPEC coal plants.

- **China Hub Power Plant**: Total tariff of **USD 1.25 per kWh**, more than double Denmark's rate.
- **Port Qasim Power Plant**: Total tariff of **USD 0.57 per kWh**, marginally above Denmark's rate.
- **Sahiwal Coal Power Plant**: Total tariff of **USD 0.27 per kWh**, lower but still high compared to global standards.

Coal Plants CPEC	Installed Capacity MW	Energy (KWH)	CPP Charges (PKR)	CPP (PKR/kWh)	Total Generation Cost (EPP+CPP) (PKR million)	Total Tariff (PKR/kWh)	Tariff in USD
China Hub	1,320	476	142,840	299.99	166,612	350	1.25
Port Qasim	1,320	786	107,457	136.7	125,215	159	0.57
Sahiwal Coal	1,320	2,075	117,284	56.52	158,267	76	0.27

The environmental toll of these coal plants is significant. Reliance on coal has resulted in:

- Persistent smog in major urban areas, worsening air quality.
- Increased greenhouse gas emissions, making climate goals harder to achieve.
- A dependency on non-renewable resources, contrary to global trends favoring clean energy.

Conclusion and Way Forward

For over fourteen years, the Ministry of Petroleum and OGRA have failed to address the critical issue of air pollution, exacerbated by outdated fuel standards. This inaction has resulted in severe environmental and public health consequences, directly affecting millions of Pakistanis. The repercussions are evident:

- Health crises caused by prolonged exposure to toxic air pollutants
- Environmental degradation marked by polluted skies and unchecked emissions
- Economic vulnerabilities compounded by outdated energy policies
- Human suffering as communities bear the cost of worsening air quality

Despite mounting evidence, efforts to adopt Euro VI fuel standards have stalled, illustrating a troubling pattern of institutional inertia and unfulfilled commitments. The continued silence from key regulators is an abdication of responsibility, leaving the nation to bear the burden of this avoidable crisis.

The status quo is no longer tenable. Addressing this crisis requires immediate, transformative reforms. Pakistan must prioritize:

- Upgrading fuel standards to align with Euro VI, ensuring cleaner and safer fuels
- Modernizing petroleum infrastructure, focusing on refineries, to meet global environmental benchmarks
- Enforcing stricter regulations on fuel adulteration and ensuring proper regulatory oversight
- Shifting towards renewable energy sources such as solar, wind, and biomass to reduce dependency on fossil fuels
- Restructuring OGRA and the Ministry of Petroleum to foster effective governance and oversight

While the solutions are clear and actionable, their success hinges on decisive leadership. The frameworks and technologies are in place, but without strong political will and a commitment to reform, these solutions risk remaining unimplemented, and the crisis will only deepen.

Moreover, this issue transcends national borders. The international community must step up with technical expertise, financial support, and collaborative efforts to help Pakistan break free from its cycle of inefficiency. Only through a united, concerted effort can Pakistan move toward a sustainable, healthier future for its citizens.

Pakistan now stands at a crossroads: continue down a path of inaction and environmental decline, or embrace the reforms needed to secure a cleaner, more prosperous future for its people and the generations that follow

Annex

I - Author's Profile

Arshad H. Abbasi – Environmental Advocate and Engineer

Arshad H. Abbasi is a dedicated environmental advocate and seasoned professional engineer with extensive experience in Pakistan's water and energy sectors. His work exemplifies a profound commitment to climate action and sustainable development, driven by a lifelong connection to nature. Growing up in the scenic foothills of the 7,600-foot-high Patriata Mountain (New Murree), surrounded by dense blue-pine forests, instilled in him an enduring appreciation for environmental preservation.

A trailblazer in environmental advocacy, Abbasi is renowned for spearheading a successful scientific campaign to halt the New Murree Project, which would have cleared thousands of acres of ancient conifer forests. His independent efforts in publishing research and leading public advocacy have become a hallmark of environmental activism in Pakistan, earning praise from global leaders such as Mr. Achim Steiner, Deputy Secretary-General of the United Nations.

His contributions extend to climate change research, including raising awareness about the melting of Himalayan glaciers and advocating for the preservation of the Siachen Glacier, a critical climate indicator. His efforts have been recognized internationally, including acknowledgment from Dr. Rajendra Kumar Pachauri, former chairman of the Intergovernmental Panel on Climate Change (IPCC).

Abbasi has also been a vocal critic of Pakistan's increasing reliance on low-efficiency coal-fired power plants, particularly those established under the China-Pakistan Economic Corridor (CPEC). He has consistently highlighted the environmental and economic repercussions of these projects, including their contribution to rising energy costs, air pollution, and persistent smog. His evidence-based critiques have been widely recognized by academic and international platforms, reflecting his unwavering dedication to promoting sustainable energy policies.

Abbasi's work has made a lasting impact on both academic and policy spheres, with his research being incorporated into university curricula and cited by global institutions. His passionate advocacy and evidence-based approach continue to inspire efforts to address climate change and promote sustainable practices in Pakistan and beyond.

II – Pre-Feasibility Report: Pine (Conifer) Forest Waste to Replace Coal, Firewood Burning and LPG in South Asia

By Engineer Arshad H Abbasi

In the past various studies were conducted to use biomass for the electricity needs of Pakistan only. However, this technical report aims to assess the current situation and future projections of coal used in Industry, Cement, and Brick kilns by biomass as well as to replace LPG in commercial and demotic sectors using pellets made of pine needles, cones, and resin.

For this purpose, I critically reviewed extensive literature i.e., research papers, energy reports, official statistical data, relevant regulations, and government policies. Research findings reveal that the abundant pine needles, cones, and resin are available

Forest Cover in 000 Acres	**AJK**	**Baluchistan**	**GB**	**KP**	**Punjab**	**Total**
Conifer Forest	16	42	660	940	30	1913

The above data show that Pakistan has a significant abundance of pine trees, resulting in a readily available supply of pine needles. These needles are a natural byproduct of pine forests and are often considered a waste material.

In Pakistan, where pine forests abound, pine needle pellet manufacturing offers a unique opportunity to convert readily available waste material into valuable biomass fuel. This process not only helps address waste management challenges but also contributes to sustainable energy production.

Let's delve into the process of pine needle pellet manufacturing, highlighting its significance in our scenario.

1. **Collection:** The first step in pine needle pellet manufacturing involves the collection of pine needles. These needles are often found in abundance on the forest floor or as residue from forest management activities. Dedicated collection teams gather the needles, ensuring sustainable harvesting practices to minimize ecological impact.
2. **Drying and Shredding:** Once collected, the pine needles undergo a drying process to reduce their moisture content. This step is crucial to ensure the quality and efficiency of the pellets. After drying, the needles are shredded into smaller pieces, making them suitable for pillarization.
3. **Pillarization:** Universally, the shredded pine needles are then fed into a pelletizing machine. The machine applies heat and pressure, compressing the material to form

cylindrical pellets. Binders or additives may be used during the process to enhance pellet durability and combustion characteristics.

4. **Cooling and Packaging:** The freshly formed pine needle pellets are cooled to stabilize their structure and remove excess heat. They are then screened to remove any fine particles or impurities. Finally, the pellets are packaged in bags or bulk containers for storage, transportation, and distribution.

5. **Utilization:** Pine needle pellets serve as a clean and renewable energy source. They can be used in various applications, including residential heating, commercial and industrial boilers, and the cement industry. The pellets offer a sustainable alternative to fossil fuels, particularly coal, reducing greenhouse gas emissions and promoting a greener energy landscape.

Use of Coal in Pakistan

	Industry	Power	Brick Kiln	Cement
Coal (000 metric ton)	2	12,808	5,643	9,245

Pakistan uses coal for electricity generation, as a substitute for imported energy sources in industries, and for domestic use. Coal is a key component of Pakistan's energy mix, with the power sector consuming around 47% of the country's total coal consumption each year. Other major consumers include the brick kiln industry (22.5%) and the cement industry (33%).

Initial findings reveal that imported coal cost USS/Ton 110 or Rs/Ton 31,210 in May. The net calorific value of coal is 23000 BTU/Kg. while the heating value of pure needles is 17671BTU/KG, the heating value of pine resin and cone is around 35555 Btu/KG

Cone of Pine Tree

Initial Findings

The abundance of pine needles, cones, and resin in our region offers a remarkable opportunity. These biomass resources are sufficient to replace the annual import of $1.5 billion worth of coal. Moreover, converting pine into pellets can provide a cost-effective alternative to LPG (Liquefied Petroleum Gas) in Azad Jammu and Kashmir (AJK) and Gilgit Baltistan.

While the exact cost of converting pine into pellets needs to be calculated, it is evident that this conversion cost is significantly lower than the cost of LPG. Harnessing our indigenous biomass resources can reduce our reliance on imported fuels, promote energy security, and contribute to a sustainable future.

Recommendations

To harness the potential of pine biomass, we need to undertake a comprehensive feasibility study and develop a detailed working plan. This plan should aim to:

- Completely replace coal imports
- Partially replace LPG usage in AJK, KPK, EXFATA, Hilly areas of Punjab and Gilgit Baltistan.

The feasibility report should assess the availability of pine biomass, conversion technologies, infrastructure requirements, environmental impact, and economic viability. The working plan should outline the steps necessary for implementation, including timelines, resource allocation, and stakeholder engagement.

By doing so, we can create a roadmap for a sustainable energy transition, reducing our reliance on imported fuels and mitigating the environmental impact of fossil fuels.

III – Cabinet Division Notification on Probing into Shortage of Petroleum Products

NOTIFICATIONS AND TORs

1.1 Cabinet Division, Government of Pakistan constituted an Inquiry Commission, under Pakistan Commission of Inquiry Act, 2017 to probe into the **shortage of petroleum products** in the country and matters related or incidental thereto vide **Notification No.01/05/2020 Lit-III dated 28th July, 2020.** The Commission comprised of the following members:

i.	Mr. Abubakar Khudabakhsh, Addl. Director General, Federal Investigation Agency (FIA)	Chairman
ii.	Representative of Attorney-General of Pakistan (Mr. Amir Rehman, Additional Attorney General of Pakistan)	Member
iii.	Representative of Intelligence Bureau (I.B.) (Capt. R. Rommel Akram, Deputy Director General I.B.)	Member
iv.	Representative of FIA (Mr. Sajid Akram, Director FIA)	Member
v.	Director General, Anti-Corruption Establishment, Punjab (Mr. Gohar Nafees)	Member
vi.	Mr. Rashid Farooq, Former DG Oil, Petroleum Division	Member
vii.	Mr. Asim Murtaza, C.E.O, Petroleum Institute of Pakistan	Member