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Whose Air?

Assessing Equity in India's Air Quality Policies

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Training students and women to raise awareness within their communities amplifies their role as agents of change in reducing indoor air pollution and improving public health.

Image: Drokpa Films

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The Council on Energy, Environment and Water (CEEW)—**a homegrown institution** with headquarters in New Delhi—is among the **world's leading climate think tanks**. The Council uses **data, integrated analysis, and strategic outreach** to support public policy, transform markets, shape technology, and nudge behaviour. It addresses pressing regional and global challenges through an integrated and internationally focused approach. The Council prides itself on the **independence** of its high-quality research and strives to **impact sustainable development at scale**.

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NATIONAL/INTERNATIONAL

2011 | National Water Resources Framework
2014 | 175 GW renewables target
2015 | International Solar Alliance
2016 | PM *Ujjwala Yojana*
2017 | *Saubhagya Scheme*
2019 | India Cooling Action Plan
2021 | Net Zero by 2070
2022 | *Mission LiFE*
2022 | *National Bioenergy Programme*
2022 | E-waste (Management) Rules
2023 | G20 Green Development Pact
2023 | *National Green Hydrogen Mission*
2024 | Green Steel Taxonomy
2024 | *PM Surya Ghar Yojana*
2025 | *National Critical Mineral Mission*
2025 | Rajya Sabha Guidelines on Crop Residue Burning
2025 | India's Carbon Credit Trading Scheme (CCTS)
2025 | IFSCA's Framework for Transition Bonds
2026 | Disaster Risk Index for 16th Finance Commission
2026 | India's NDC 3.0
2026 | India's Scenarios towards Viksit Bharat and Net Zero

STATE

2022 | *Rajasthan Organic Farming Mission*
2022 | *Jharkhand State Solar Policy*
2022 | *Uttar Pradesh Vidyut Sakhi programme*
2023 | *Rajasthan Renewable Energy Policy and Green Hydrogen Policy, 2023*
2023 | *Uttarakhand Solar Policy*
2025 | Green Odisha Initiative
2025 | *Maharashtra Climate Action Plan 2.0*
2025 | *Delhi Clean Air Action Plan*
2026 | *Delhi EV Policy 2.0*
2026 | Bihar Promotion of New and Renewable Energy Sources
2026 | Gujarat Integrated Renewable Energy Policy and Green Hydrogen Policy
2026 | *Uttarakhand Mukhyamantri Saur Swarojgar Yojana*
2024-26 |
Directives of Commission on Air Quality Management
Net Zero Roadmaps (BH, GJ, TN, UK)
Agroforestry Roadmaps (AS, MH, OD)
140+ Heat Action Plans (GJ, MH, OD, TN)
Treated Used Water Reuse Plans (MH, UP)
Flood Risk Mitigation Plans (GJ, MH)

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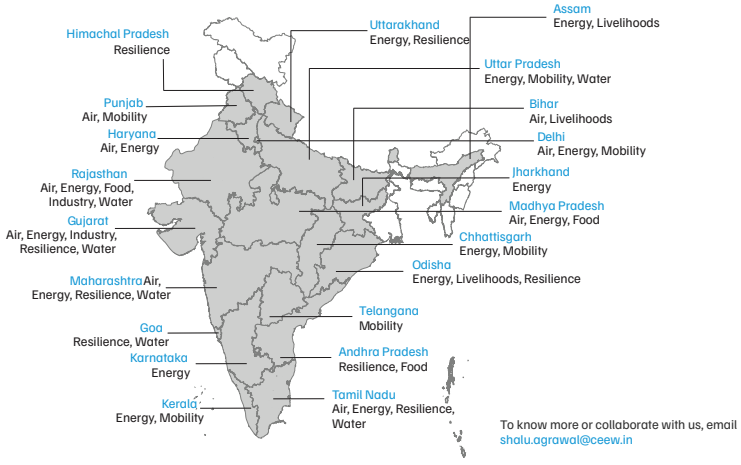

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Executive summary

The *State of Global Air 2025* report estimates that approximately 143,000 deaths among children under five in India in 2023 were attributable to air pollution, which translates to more than one death every four minutes. India faces one of the most severe air pollution crises globally, with millions suffering each year from its adverse health and environmental impacts (Jiang 2023). In response, the Government of India has implemented air quality management programmes and policies aimed at mitigating pollution, reducing exposure, and improving public health. For instance, the *National Clean Air Programme* (NCAP), launched in 2019, is a five-year initiative that has set ambitious targets for India's most polluted cities, while the *Graded Response Action Plan* (GRAP), 2023 specifically addresses the National Capital Region. Despite receiving substantial funding, these programmes have had mixed results. These initiatives overlook a critical dimension – the disproportionate impact on marginalised and vulnerable groups, including women, the elderly, children, indigenous communities, low-income households, and the differently abled. Economic and social inequities, along with gender and cultural dynamics, exacerbate the vulnerability of these groups to the health impacts of air pollution (Kumar et al. 2023). Addressing the crisis requires solutions that extend beyond introducing regulations and technological fixes and instead embrace a more inclusive approach that integrates the lens of gender equity and social inclusion (GESI) into air quality management policies and practices.

Recognising this need, we systematically evaluate Indian air quality management policies' compliance with GESI norms. Through a set of selection criteria, 19 policies across five key sectors were identified: energy access and power generation, low-emission transport, waste management, air quality management, and air pollution and health. While the primary focus was on policies formulated from 2010 to 2024, critical policies from before 2010 are also considered if they are still applicable (e.g., The *Air* (*Prevention and Control of Pollution*) *Act, 1981*, and *Guidelines for Ambient Air Quality Monitoring, 2003*). Erstwhile policies are excluded from the review.

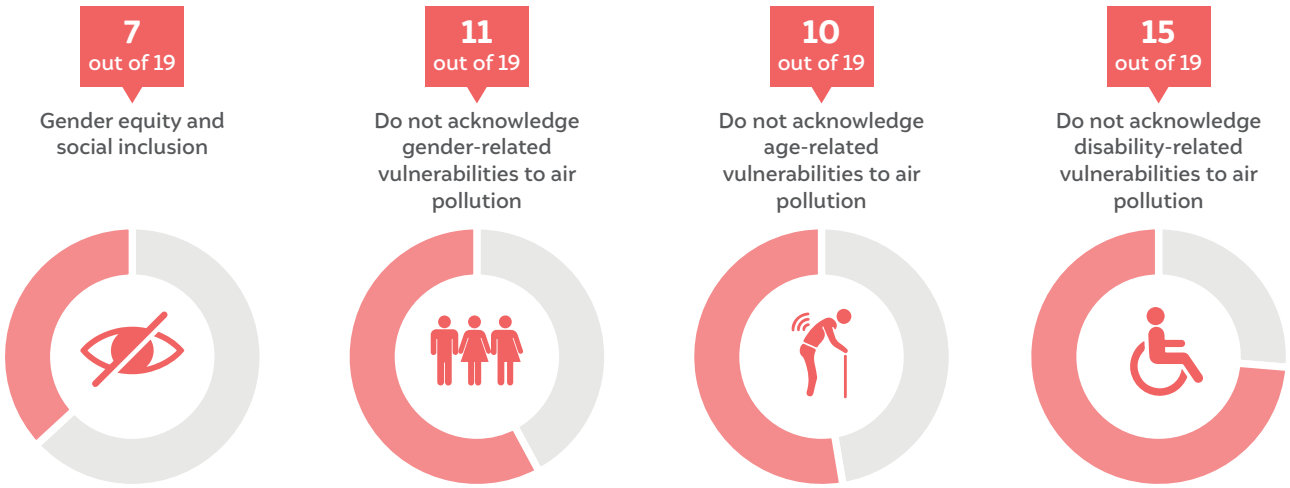
> Socioeconomic status, traditional gender roles, and biological differences shape the varied impacts of air pollution across different genders.

Our analysis underscores gender-differentiated access to resources and healthcare, emphasising how socioeconomic status, traditional gender roles, and biological differences, particularly in relation to reproductive health, shape the varied impacts of air pollution across different genders.

For example, evidence shows that expectant mothers are especially vulnerable to the adverse effects of air pollution, which can increase the likelihood of negative birth outcomes. Yet, only one was found out of the selected policies (*National Programme on Climate Change and Human Health*) substantively acknowledging and addressing this specific vulnerability. Moreover, many policies fail to account for age and socioeconomic disparities, leaving some vulnerable groups under-protected. A notable gap is the limited consideration of individuals with disabilities, who face compounded challenges due to both physical barriers and the lack of policy attention. This analysis reveals a significant gender bias and social exclusion in the current policy landscape, emphasizing the need for a GESI-integrated approach. By employing an intersectional framework, we identify key drivers of marginalisation – including factors such as socioeconomic status, geographic location, and political powerlessness – that drive vulnerability to the impacts of air pollution. As a result, we present a more informed and nuanced understanding of how these compounded vulnerabilities amplify the effects of air pollution on marginalised communities.

The selected policies have been analysed for their GESI-responsiveness, focusing on whether they acknowledge and substantively address both gender equity and social inclusion, and how they define and assess vulnerability to air pollution. A GESI-responsive policy explicitly acknowledges and addresses GESI concerns by recognising the differentiated impacts of air pollution on various genders and socioeconomic groups and integrating measures to address them. This includes implementing targeted measures such as prioritising healthcare access for women and children, ensuring equitable distribution of resources and benefits, incorporating gender-sensitive language and perspectives, and actively engaging marginalised communities, including those with disabilities, in decision-making and policy-implementation processes. Using the methodologies of content and discourse analyses, along with tools like NVivo 14, we critically examine the language and context of these policies and the impact these entail on ground.

Figure 1 Highlights of the air quality management policy analysis, highlighting the degree to which they factor in gender equity and social inclusion



Source: Authors' analysis

Findings from the analysis

- There are significant disparities in how gender and social equity are addressed in air quality management policies. While **two-thirds of the policies acknowledge the differentiated impact of air quality on women and diverse social groups, those focusing on low-emission transport and waste management notably fail to incorporate gender considerations.** This includes several critical air quality management policies that do not recognise the GESI implications of air pollution.
- Some policies acknowledge the disparate impacts of air pollution on women but fail to address gender equity. For example, **the *Saubhagya* scheme**, which aims to provide electricity to all households without power in India, identifies female-headed households as a target group based on deprivation indicators. However, it **overlooks gender dimensions within other marginalised categories, such as Scheduled Caste/Scheduled Tribe communities, landless individuals, and casual labourers**. This indicates the lack of a comprehensive approach to gender equity across all disadvantaged groups.
- In contrast, two policies – the ***Pradhan Mantri Ujjwala Yojana*** **(PMUY) and the *National Programme on Climate Change and Human Health*** **(NPCCHH) – are notable for their gender-responsiveness and social inclusion. Both explicitly address the health risks associated with using traditional cooking fuels and emphasise the need to protect women and children from indoor air pollution.**
- Age-related vulnerabilities are acknowledged in 47 per cent of the selected policies.
- Socioeconomic and occupational exposure vulnerabilities are acknowledged in 42 per cent of the policies. However, **with only five mentions of disability-related vulnerabilities, there appears to be a considerable gap in the policy framework, highlighting the need for greater inclusivity of individuals with disabilities in the context of air pollution.**

Our analysis emphasises the need to integrate gender equity and social inclusivity into air pollution regulations to mitigate health disparities and achieve equitable outcomes. Implementing GESI-responsive policies can ensure a smooth transition to a net-zero-inclusive and equitable future, leaving no one behind.

B. Key policy recommendations

To enhance the GESI-responsiveness of policies addressing air pollution in India, CEEW recommends the following:

- National and state level health and environment ministries and departments to enact policies that mandate the **systematic collection of disaggregated data on air pollution impacts across gender, caste, socioeconomic status, and other parameters of marginalisation through standardised data collection systems.**

- Policymakers within the nodal ministries, non-government organizations and policy think tanks should **conduct a systematic gender analysis during the policy design and implementation phases** to critically assess the unique needs and challenges faced by women, men, and gender-diverse people in the air quality sector.
- Relevant government departments and local bodies involved in public health should develop targeted interventions that address specific vulnerabilities associated with gender, age, economic status, occupational exposure, and disabilities.
- Government stakeholders and civil-society organizations should ensure equitable representation of women, men, and gender minorities in decision-making processes related to air pollution.
- **Active collaboration between key nodal ministries, such as the Ministry of Environment, Forest and Climate Change, Ministry of Health and Family Welfare, Ministry of Women and Child Development, Ministry of Labour and Employment, and Ministry of Housing and Urban Affairs.**
- **Health ministries, local public health departments, media outlets, and community health workers should ensure that health advisories, information campaigns, and healthcare services related to air pollution are accessible to all, including individuals with disabilities**.
- Local government authorities, community development organisations, and non-profits working at the grassroots level should leverage community networks, such as women's self-help groups and local non-governmental organisations (NGOs), to raise awareness and implement air pollution interventions.
- **Ministries of Finance, budget offices, and gender-focused agencies** (e.g., Ministry of Women and Child Development)**, should prioritise (evidence-based) gender budgeting and provide adequate funding for gender-responsive goals and activities within the air quality management sector**.
- Nodal ministries to mandate regular impact assessment of policies on gender and social equity through formalised management information systems (MIS).

GESI-responsive policies and programmes hold the key to formulating transformative solutions. Policies have the potential to push gender-responsive climate action that addresses both environmental and societal concerns and can contribute to the realisation of India's National Determined Contributions (NDCs) and NCAP goals.

GESI-responsive policies and programmes are fundamental to designing transformative solutions that address systemic inequities and foster inclusive development

1. Introduction

India addresses air pollution through a range of policy instruments, including laws, national programmes, sectoral schemes, and regulatory measures implemented by multiple institutions across different levels of government. Most of these measures focus on monitoring air pollution, reducing emissions, ensuring regulatory compliance, and promoting technological solutions (Ganguly et.al. 2020). However, they do not always account for differences across population groups in exposure, health risks, access to protective resources, and participation in decision-making (Joshi and Swarnakar 2023). Consequently, measures designed for the general population may not adequately address the needs and circumstances of those most at risk.

1.1 Gender equity and social inclusion (GESI) in air quality management

India grapples with severe air pollution, consistently ranking among the countries with the most polluted cities globally (Jiang 2023). This environmental crisis has profound implications for public health, adversely affecting the respiratory and cardiovascular systems of the Indian population, and damaging ecosystems (Kumar et al. 2023). Marginalised communities, including women, youth, the elderly, differently-abled individuals, and Indigenous communities, disproportionately experience the detrimental effects of air pollution. Social and economic factors, such as residing near industrial areas and lacking economic resources to combat air pollution, heighten vulnerability (Joshi and Swarnakar 2023). For instance, lower-income women living in urban slums face both gender and economic disparities that intensify their health risks associated with exposure to polluted air. These women often lack access to adequate healthcare and live in areas with insufficient infrastructure, further compounding their vulnerability.

Similarly, indigenous communities that rely on the natural environment for their livelihoods face higher vulnerability due to socioeconomic disparities, including higher poverty levels and inadequate infrastructure, which exacerbate the health impacts they endure. Age and disability are also significant factors that can increase vulnerability to air pollution. Older adults and children are particularly susceptible to the health impacts of polluted air due to their weaker immune systems (Pandey et.al.,2021; Kumar et.al., 2022). Additionally, individuals with disabilities often encounter additional challenges in accessing information and resources to safeguard themselves from air pollution and in coping with the health impacts of exposure. Geography plays a crucial role in determining exposure levels, with people living in industrial areas or near major traffic routes experiencing significantly higher pollution levels.

The power of collective action and shared learning drives transformative change, empowering communities to tackle complex social, environmental, and health challenges.

Race and ethnicity are also significant drivers of disparity, as marginalised racial and ethnic groups often reside in more polluted areas due to historical and systemic inequalities. The absence of gender-sensitive approaches in policy-making can perpetuate these disparities. Policies that fail to consider the differential impacts of air pollution on people and their capacity to respond may fail to effectively address the issue, leaving vulnerable communities at higher risk.

Enhancing citizen engagement and fostering inclusive governance is pivotal in developing inclusive and equitable pathways toward a resilient, net-zero future. A holistic approach to air quality programming must recognise marginalised populations as agents of change, equipped with the necessary knowledge and skills to combat the air pollution crisis. This entails a thorough understanding of the gender and social norms that shape individuals' lived experiences, informed by an assessment of the gendered power dynamics that govern access to resources. Further, it is essential to ensure that solutions to air pollution do not inadvertently further inequalities or yield unintended adverse consequences.

2. GESI analysis of Indian policies and regulatory frameworks on air pollution management

Air pollution represents a critical environmental health crisis globally, with India at its epicentre. According to IQAir's *World Air Quality Report 2023*, 14 of the top 20 most polluted cities in the world are located in India, and a staggering 99.9 per cent of the country's population lives in areas where air quality falls below the World Health Organization's (WHO) recommended standards. The scale of the crisis was evident in 2019 when air pollution in India resulted in approximately 1.6 million premature deaths and economic losses amounting to USD 95 billion, equivalent to 3 per cent of the country's gross domestic product (GDP) (Pandey et al. 2021; Bagepally and Rakesh 2022). Research indicates that air pollution uniquely impacts women and girls, often more adversely than men and boys, due to a combination of biological, socioeconomic, and gender-influenced disparities. These disparities can potentially determine exposure levels and affect the efficacy of solutions. For instance, while general improvements in air quality are beneficial, they may not adequately tackle specific pollution sources that disproportionately affect women's health – a topic explored further in this analysis.

Our analysis is based on a comprehensive desk review to evaluate the integration of gender equity and social inclusion within various policies, programmes, and regulatory frameworks that directly or indirectly influence air quality. We identify and assess the extent to which these initiatives consider and address the diverse impacts of air pollution on different genders and marginalised groups. Further, we propose recommendations for more inclusive policy development.

2.1 Conceptual framework

Our conceptual framework for policy analysis emphasises not only gender-differentiated access and impacts but also employs the lens of intersectionality in air pollution management. We highlight how individuals' access to and control over resources, opportunities, and benefits are shaped by intersecting factors such as gender, socioeconomic status, geographic location, and power dynamics.

> A holistic approach to air quality programming must recognise marginalised populations as agents of change, equipped with the necessary knowledge and skills to combat the air pollution crisis.

Gender-differentiated access to and control over resources and benefits related to air pollution management

In the context of air pollution and health, women and men experience differentiated access to and control over assets, resources, opportunities, and services. These differences are significantly influenced by their respective socioeconomic status, gender roles, and power dynamics. Traditionally, men have better access to financial resources and employment opportunities, which provides them with greater financial freedom to invest in air pollution management solutions and services (Abbas et al. 2023; Sadika et al. 2023) (Figure 2). In contrast, women often face financial limitations that hinder their capacity to make comparable investments, rendering them more vulnerable to the adverse impacts of air pollution. Additionally, education and access to information also hold significant weight in empowering individuals to make informed decisions regarding health and environmental concerns.

Further, gender disparities in healthcare access pose significant challenges in addressing the impacts of air pollution. Women frequently encounter obstacles in accessing healthcare support, hindering their ability to manage health disorders arising from poor air quality, such as respiratory and cardiovascular diseases. These disparities are further exacerbated by traditional, cultural, and societal expectations that ascribe specific gender roles and household responsibilities to women (Ahmed and Mahapatro 2023; Hussian et al. 2023). For instance, women often spend more time indoors cooking with biomass fuels, which exposes them to elevated levels of household air pollution (Choudhuri and Desai 2020; James et al. 2020). Conversely, men's roles typically involve spending more time outdoors, potentially subjecting them to higher levels of outdoor air pollution. Additionally, transportation and mobility are influenced by gender, with women in developing regions often facing limitations in accessing public or personal modes of transportation.

The inherent biological differences between the genders also contribute to the unequal impact of air pollution on health. For example, expectant mothers are particularly vulnerable to the adverse effects of air pollution, which can lead to a higher occurrence of adverse birth outcomes (Pandey et al. 2020). This poses a significant public health challenge, with women enduring most of the consequences, while men, although also affected, do not face the same direct implications for their reproductive health (Ali et al. 2021).

Addressing occupational exposure with a focus on equity is essential to safeguard health, ensuring that the distinct vulnerabilities are recognised and addressed.

Public health efforts must address this stark disparity by implementing targeted policies and interventions to minimise the detrimental effects of air pollution on women's health. Moreover, when governance structures and decision-making institutions are predominantly male, the resulting policies may fail to acknowledge and adequately address women's unique needs and obstacles concerning air quality and access to health services. This uneven gender representation in policy and governance can further entrench inconsistencies in how men and women are impacted by and can combat the risks of air pollution.

Analysing differentiated impacts of air pollution through the lens of intersectionality

Intersectionality is a powerful lens through which one can assess how race, class, gender, sexuality, age, ability, and ethnicity intersect and shape social hierarchies. By employing this framework, valuable insights can be gained into how the effects of air pollution are not uniform for all; different groups are disproportionately affected due to their overlapping identities and social statuses. Within the intersectionality framework, we introduce the concept of 'drivers of marginalisation' (Figure 1), which unpacks the critical contextual factors or conditions that render specific individuals or communities more vulnerable to the adverse effects of air pollution. These drivers include socioeconomic status, geographic location, health disparities, limited education and awareness, inadequate infrastructure, and political powerlessness.

For instance, in the waste management sector, the drivers of marginalisation may include factors such as individuals' or communities' proximity to waste facilities, income levels, residence in informal settlements, occupational exposure, lack of awareness, and the absence of regulatory frameworks. Similarly, when examining indoor air quality management, factors like income and affordability, gender roles, choice of cooking fuels, and cooking practices become crucial in understanding an individual's degree of exposure to and ability to manage the adverse effects of indoor air pollution.

Figure 2 Gender-differentiated access to and control over resources and benefits related to air quality management

Source: Authors' compilation based on a review of the literature

3. Methods and tools

We analysed selected policies and regulatory frameworks to understand the following:

- How and to what extent is gender equity acknowledged and enabled in the selected policies?
- How and to what extent is social inclusion acknowledged and enabled in the selected policies?
- How is vulnerability to air pollution defined in the policies, and which groups or individuals are considered vulnerable?

In our analysis of the GESI-responsiveness of policies, we incorporate two criteria – gender-responsiveness and social inclusion. Initially, policies are assessed for gender-responsiveness (adapted from Tyagi and Das 2018) and are categorised as gender-blind, gender-aware, or gender-responsive. Simultaneously, they are assessed for their level of social inclusion, which encompasses various social groups beyond gender. The policy typologies are as follows:

Gender-blind: Policies falling in this category fail to recognise existing gender disparities, inadvertently perpetuating biases and typically favouring male-centric needs.

Gender-aware: Such policies acknowledge that people have different needs based on gender but do not seek to alter the underlying gender relations. Their aim is primarily to accommodate these differences within existing frameworks.

Gender-responsive: Policies deemed gender-responsive go a step further by focusing on the fundamental sociocultural underpinnings of gender inequalities and entrenched power dynamics. They strive for gender-equitable participation by focusing on distinct needs, roles, and relations to ensure fair access to resources and equitable decision-making processes.

Social equity–targeted: These policies do not explicitly acknowledge or address existing gender inequities but address the air pollution exposure of particular social groups and are socially inclusive.

GESI-blind: These policies do not consider gender or social inclusion and may inadvertently reinforce existing inequalities. Their main objective is to address issues such as air pollution without considering how it may affect different genders or social groups differently.

GESI-aware: These policies recognise the significance of gender and social inclusion and may include some elements that address these issues but do not actively or systematically address them. These policies attempt to be wary of gender and social inclusion issues and to avoid reinforcing existing inequalities.

Support from government stakeholders is crucial in creating an enabling environment for equitable solutions at the grassroots.

GESI-responsive: These policies actively address gender and social inclusion issues and are designed to reduce inequalities. The main objective of these policies is to reduce gender and social inequalities by providing targeted support and interventions that address the specific needs and vulnerabilities of different groups.

3.1 Policy selection criteria

We used a thorough and methodical process for identifying pertinent policies within air quality management. Specifically, our policy selection criteria identified guidelines, regulations, and initiatives concerning air quality management and pollution control through targeted keyword searches.

- **Keywords searches for policies**: 'air quality' and 'policy'; 'air pollution' and 'regulations'; 'environmental policy' and 'air quality management'; 'clean air' and 'legislation'; 'air quality' and 'standards'; 'air pollution control' and 'government initiatives'; 'airborne emissions' and 'regulatory framework'; 'climate policy' and 'air pollutant reduction'; 'urban air quality' and 'policy measures'; 'industrial emissions' and 'environmental policy'; 'gender equity' or 'social inclusion' and 'air pollution regulation'; 'inclusive' and 'air quality standards'; 'gender-sensitive' and 'air pollution control'.
- **Type of policy document**: guidelines, regulations, rules, notifications, circulars, acts, and schemes (mostly at the national level, with two policies at the Delhi–NCR level).
- **Database**: FAOLEX,[1] ECOLEX[2] databases, and nodal ministry websites and portals.
- **Timeframe**: Policies formulated from 2010 to the present are considered. Critical policies before 2010 are also considered if they are still applicable (e.g., The *Air (Prevention and Control of Pollution) Act, 1981*, and *Guidelines for Ambient Air Quality Monitoring, 2003*); erstwhile policies are excluded.
- **Format**: Documents available in English and in a readable format are included (PDF, Word, HTML).

3.2 Policy analysis method

We employ a mixed-method approach that integrates both qualitative and quantitative techniques. This allowed for a comprehensive assessment of how Gender Equity and Social Inclusion (GESI) concerns are reflected and addressed in air quality management policies. The following sections outline the key methodologies used in this analysis:

- **Content analysis**: Content analysis is a quantitative and qualitative research method that involves the systematic interpretation of textual data to understand not only what is being communicated but also how it is communicated. Its primary goal is to identify patterns, themes, biases, and meanings within the text. To achieve this, a coding scheme is developed to quantify and analyse the presence, meanings, and relationships of certain words, themes, or concepts. In the context of air pollution management, content analysis can be employed to quantify the frequency of specific words or phrases related to GESI in policy documents, such as 'gender equality', 'inclusive growth', or 'marginalised groups'. This allows for the identification of patterns and trends, enabling comparisons of different policies regarding their responsiveness to GESI concerns and the extent to which these concerns are integrated into the policies.
- **Discourse analysis**: Discourse analysis is a qualitative research method that examines the language used in policy documents, along with the broader social and political context within which this language is employed. Within the context of air pollution management, discourse analysis can reveal how GESI issues are framed in policy documents, providing insights into the underlying assumptions, values, and power structures. It can also help predict potential outcomes of policy implementation by examining how different groups and issues are represented.

This analysis allows for the identification of patterns and trends, enabling comparisons of different policies regarding their responsiveness to GESI concerns and the extent to which these concerns are integrated into the policies.

1. FAOLEX. n.d. "FAOLEX Database." Food and Agriculture Organization of the United Nations. https://www.fao.org/faolex/en/.
2. ECOLEX. n.d. "ECOLEX." https://www.ecolex.org/.

- **Software-based policy review:** We used qualitative data analysis software NVIVO 14 for machine-assisted content analysis of the policy documents.
- **Coding scheme:** We utilised a combination of deductive and inductive coding. Initially, codes were predefined based on air quality management literature and the study's conceptual framework. Subsequently, these codes were refined iteratively while analysing the policy data. Table 1 presents the codebook used for the policy analysis.

3.3 Limitations of the analysis

- Our policy analysis does not account for the gaps between policy design and implementation; due to time and resource constraints, policy impact or implementation status could not be analysed.
- Since the analysis was primarily undertaken at the national level, the results cannot be generalised for different Indian states. This would require another round of state-level policy analysis.

3.4 List of policies

Based on the selection criteria, we identified 19 policies from 2010 to 2024, distributed across five sectors (Table 2): energy access and power generation, low-emission transport, waste management, air quality management, and air pollution and health.

Table 1 Coding scheme employed in NVivo 14

Codes	Word search criteria
Gender-related references Age-related references 	gender, women, woman, girl, girls, female, females, men, man, male, males, boy, boys, transgender, LGBTQI + old, elder, elderly, child, children, students, adult, infant, senior citizen, age
Disability-related references 	people with disabilities, persons with disability, disabled, specially-abled, differently-abled, handicap, *divyang*, able-bodied
Socio-economic/ occupational marginality- related References 	workers, labourers, construction workers, road sweepers, rickshaw pullers, auto drivers, healthcare workers, Accredited Social Health Activists (ASHA) workers, *Aanganwadi*, AWA, waste-pickers, outdoor workers, migrants, sanitation workers, landless, households without shelter, destitute, economically poor
Vulnerability and exposure related references 	vulnerable population, vulnerability, vulnerabilities, vulnerable groups, population vulnerability, health vulnerability, climate variability, exposure, exposed

Source: Authors' compilation based on the inductive coding method

Table 2 List of policies selected for GESI analysis

Sector	Policy	Year	Abbreviation
Energy access and power generation	*Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya)*	2017	PMSBHGY
	National Solar Mission (Jawaharlal Nehru National Solar Mission)	2010	NSM
	Pradhan Mantri Ujjwala Yojana (PMUY)	2016	PMUY
	Environment (Protection) Amendment Rules, 2015 (Thermal Power Plant Emissions Regulations)	2015	EPAR (Thermal Power)
Low-emission transport	*FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) Scheme-2*	2019	FAME 2
	Auto Fuel Policy	2014	AFP
Waste management	*Crop Residue Management Operational Guidelines*	2023	CRM
	Solid Waste Management Rules	2016	SWMR
	Construction and Demolition Waste Management Rules	2016	CDWMR
Air quality management	*National Ambient Air Quality Standards*	2019	NAAQS
	The Air (Prevention and Control of Pollution) Act	1981	APCPA
	National Clean Air Program (NCAP)	2019	NCAP
	Graded Response Action Plan (GRAP)	2023	GRAP
	Commission for Air Quality Management Act	2021	CAQM
	Smart City Mission	2015	SCM
	Guidelines for Ambient Air Quality Monitoring	2003	GAAQM
Air pollution and health	*National Programme on Climate Change and Human Health – Guidelines*	2022	NPCCHH-G
	National Programme on Climate Change and Human Health – Advisory on air pollution and health	2022	NPCCHH-A
	National Programme on Climate Change and Human Health – Adaptation plan for diseases due to air pollution	2021	NPCCHH-AP

Source: Authors' compilation

For an explanation of each policy's relevance to the analysis, see Annexure 1.

4. Findings

In this section, we delve into the GESI landscape within air pollution policies. Identified patterns reveal a spectrum of responsiveness, ranging from policies lacking GESI integration to those demonstrating targeted approaches. Our analysis methodically identifies and quantifies the occurrences of specific themes or concepts pertinent to GESI within the policy texts. We analyse policies through the lens of the following questions:

1. To what extent do the selected policies acknowledge and enable gender equity?
2. How effectively do the selected policies acknowledge and enable social inclusion?
3. How do the policies define vulnerability to air pollution, and which groups or individuals are considered vulnerable?

Table 3 illustrates the outcomes of the content analysis, mapping the frequency of the concepts identified through the developed coding scheme (Table 1) within each selected policy document.

4.1 GESI-blind policies

Seven of the 19 reviewed policies lack a GESI perspective in their regulatory frameworks. These policies are the *Environment (Protection) Amendment Rules, 2015*, which pertain to thermal power plant emissions regulations; the *Faster Adoption and Manufacturing of Hybrid and Electric Vehicles Scheme-2* (FAME); the *Guidelines for Ambient Air Quality Monitoring; the Commission for Air Quality Management Act*; the *Air (Prevention and Control of Pollution) Act*; the *National Ambient Air Quality Standards*; and the *Crop Residue Management Operational Guidelines*. These policies fail to acknowledge the differential impact of air quality issues on various genders and marginalised groups.

GESI-responsive policies ensure that programmes are inclusive and equitable, addressing the diverse needs and challenges of marginalised groups in managing air pollution.

Table 3 Results of the content analysis of the selected policies showcasing the extent of themes or concepts pertinent to GESI within the policy texts

Policy	Gender-related references (Frequency)	Age-related references (Frequency)	Disability-related references (Frequency)	Socio-economic/ occupational marginality-related references (Frequency)
PMSBHGY	1	2	1	3
NSM	1	1	0	0
PMUY	19	6	0	0
EPAR (thermal power)	0	0	0	0
FAME 2	0	0	0	0
AFP	0	8	1	1
CRM	0	0	0	0
SWMR	0	0	0	21
CDWMR	0	0	0	6
NAAQS	0	0	0	0
APCPA	0	0	0	0
NCAP	4	4	0	1
GRAP	0	2	0	0
CAQM	0	0	0	0
SCM	2	4	1	0
GAAQM	0	0	0	0
NPCCHH-G	2	0	2	17
NPCCHH-A	3	3	0	2
NPCCHH-AP	17	22	24	30

Source: Authors' analysis

4.2 Gender equity

Gender-blind: When analysed for the integration of gender equity concerns, 11 of the 19 policies were found to be gender-blind. Specifically, all **low-emission transport and waste management** policies failed to incorporate gender equity considerations. Further, 5 out of 7 policies on **air quality management** were identified as gender-blind.

Gender-aware: While some policies acknowledge the disproportionate impacts of air pollution on women, they do not engage with concerns of gender equity in depth. These policies are *Pradhan Mantri Sahaj Bijli Har Ghar Yojana* (*Saubhagya*) *2017*, *National Solar Mission* (*Jawaharlal Nehru National Solar Mission*) *2010*, *National Clean Air Program* (*NCAP*) *2019*, *Smart City Mission 2015*, the guidelines and advisory on the *National Programme on Climate Change and Human Health 2022*. For example, *Saubhagya* aims to ensure electricity connectivity for all households without power in India. It identifies female-headed households as one of its target groups based on deprivation indicators. However, it overlooks gender dimensions in other marginalised categories, such as SC/ST communities, landless individuals, and casual labourers. This approach implies a lack of depth in addressing gender equity across all disadvantaged groups.

Gender-responsive: Two policies, i.e., the *Pradhan Mantri Ujjwala Yojana, 2016*, and the *National Programme on Climate Change and Human Health Adaptation Plan for Diseases due to Air Pollution, 2021*, had the most significant number of gender references in the policy text.

PMUY explicitly addresses:

- **Health hazards from traditional cooking fuels**: The policy highlights the significant health risks that traditional cooking fuels such as firewood and cow dung pose to women and children. These fuels emit

harmful smoke containing particulate matter and chemicals, which can lead to both acute and chronic respiratory illnesses, including pneumonia and lung cancer.

- **Transition to clean cooking fuels**: The primary objective of the scheme is to safeguard the health of women and children by transitioning from traditional biomass fuels to clean cooking fuels, specifically liquefied petroleum gas (LPG). This transition aims to reduce exposure to harmful kitchen smoke and improve overall health outcomes.
- **Reduction in drudgery for women**: The policy acknowledges the burden placed on women and girls in gathering, processing, and transporting firewood for cooking. By providing LPG connections, it aims to alleviate this drudgery, saving time spent on cooking and related activities, and potentially enabling women to participate in productive economic activities, thus improving their economic status.

Likewise, **NPCCHH-AP** addresses gender equity concerns in the following ways:

- **Identification of vulnerable populations**: The policy specifically identifies vulnerable groups, such as pregnant women, children under 14, and others who are particularly susceptible to the health impacts of air pollution. This recognition is considered crucial for developing targeted interventions that address the unique needs of these groups.
- **Women and child development focus**: The policy acknowledges the significant role of the Women and Child Development Department in advocating for measures to protect women and children from exposure to indoor air pollution, especially from biomass burning. It highlights the disproportionate impact that air pollution has on women and children, stressing the need for specific protective measures.
- **Community engagement and empowerment**: The policy encourages community engagement through awareness campaigns and social mobilisation, often engaging women's self-help groups and community leaders. This approach recognises and utilises the influential role of women in community health and environmental initiatives.
- **Linkage with cleaner fuel initiatives**: The policy recognises initiatives like PMUY, which increase the availability of cleaner fuels to rural and tribal areas. This linkage is essential for addressing the impacts of air pollution on women and children, who are typically the primary users of household fuels.
- **Healthcare capacity building**: The policy emphasises strengthening the capacity of the health system, by training health professionals and community health workers. Through this, the policy aims to ensure that healthcare providers are equipped to address air pollution–related health issues, which disproportionately affect women and children.

Breaking barriers and challenging stereotypes are essential steps toward achieving equitable solutions in air pollution management, ensuring inclusive participation and benefits for all.

- **Role of community health workers**: The policy underscores the role of community health workers, such as ASHA workers, in raising awareness at the community level about air pollution sources, health problems, and prevention methods. These workers are often women and are influential in reaching out to and educating other women in the community.

4.3 Social inclusion

In addition to gender equity concerns, we also focused on social inclusion, particularly examining how policies address vulnerabilities related to age, economic status, occupational exposure, and disability in the context of air pollution.

Our analysis reveals that age-related vulnerabilities related to air pollution, particularly those affecting children and the elderly, were explicitly acknowledged in 9 policy instances, reflecting a reasonable level of consideration. Socioeconomic and occupational exposure vulnerabilities, affecting groups such as workers, labourers, construction workers, road sweepers, rickshaw pullers, auto drivers, healthcare workers, ASHA workers, *Aanganwadi* workers, AWA, waste-pickers, outdoor workers, migrants, sanitation workers, landless, households without shelter, and destitute, are referenced in eight instances, indicating a moderate recognition of these factors. However, disability-related vulnerabilities were mentioned only in five instances, highlighting a substantial gap in the policy framework and stressing a need for greater inclusivity for individuals with disabilities in the context of air pollution.

Policies specifically addressing vulnerabilities due to occupational exposure:

- The ***Guidelines on Environmental Management of Construction & Demolition (C&D) Wastes*** mention the provision of drinking water, sanitary facilities, and washing/bathing facilities for construction workers, proper lighting arrangements for night operations to ensure worker safety during landfill operations after dark, and earplugs for workers during operations.

- The ***Solid Waste Management Rules, 2016*** highlights the importance of engaging key stakeholders, such as waste pickers and self-help groups, in solid waste management strategies. It facilitates the formal registration of waste pickers and promotes their integration into the solid waste management system. It also encourages SHGs to undertake training on safe waste handling and management practices. Further, it mandates using personal protective equipment for all workers handling waste to safeguard their health and safety.

- The ***National Programme on Climate Change and Human Health (NPCCHH)*** identifies occupational hazards faced by groups exposed to air pollution, including outdoor workers such as traffic police, construction workers, and street vendors. While it aims to capacitate and strengthen the healthcare workforce, the policy also prioritises measures that safeguard the health and safety of healthcare workers and professionals who address diseases related to air pollution.

Policies addressing age-related vulnerabilities to air pollution:

- The ***Pradhan Mantri Ujjwala Yojana, 2016***, implicitly acknowledges the health risks faced by children, particularly due to smoke exposure from traditional cooking methods. By providing LPG connections to households, the policy aims to create a healthier living environment for children, safeguarding them against respiratory problems and other health hazards associated with smoke and soot. Additionally, the policy recognises that in many households, girls often near the responsibility of gathering firewood and assisting in cooking with traditional fuels, which can impede their education. By reducing these burdens, PMUY indirectly contributes to better school attendance and educational opportunities for girl children.

- The ***Graded Response Action Plan (GRAP), 2023***, includes specific provisions for children and the elderly, particularly in response to 'severe' and 'severe+' air quality conditions. Recognising the vulnerability of young children to air pollution, the GRAP policy suggests that state governments in the National Capital Region (NCR) and the Government of the National Capital Territory of Delhi (GNCTD) may

Disability-related vulnerabilities were mentioned only in five instances, highlighting a substantial gap in the policy framework and stressing a need for greater inclusivity for individuals with disabilities in the context of air pollution.

discontinue physical classes in schools for children up to Class V during severe air quality conditions. The shift to online classes is recommended to ensure educational continuity while protecting the health of children. As air quality worsens, the policy extends the recommendation to include higher grades (VI–X and XI).

The elderly, children, and individuals with chronic health conditions are advised to limit outdoor activities and stay indoors as much as possible during high-pollution days.

Policies addressing vulnerabilities of differently-abled individuals to air pollution:

- The perception of disability as a critical vulnerability in policy responses to climate change and air pollution is often limited. However, in its guidelines and adaptation plan, the **NPCCHH** explicitly addresses disability. In collaboration with the WHO, the NPCCHH developed a checklist to help identify gaps and actions for enhancing climate resilience in healthcare facilities (HCFs). This checklist includes open-ended questions on various aspects, such as emergency management, facilities management, services, and supply chain management. Notably, one of the questions in the checklist is, "Does your facility have separate clean, functional toilets for male, female, LGBT, *Divyang*, etc., with a regular supply of running water?" By integrating *Divyang*-friendly (differently-abled-friendly) measures at the design stage, the policy highlights the importance of ensuring that the design and infrastructure of these facilities are accessible and accommodating to people with disabilities from the outset.

4.4 Definition of 'vulnerability/ vulnerable groups'

In the context of air pollution, 'vulnerable groups' refer to sections of the population that are more susceptible to the adverse health impacts of air pollution due to diverse factors such as age, health status, socioeconomic conditions, or exposure levels. These groups often include children and infants; elderly individuals; people with pre-existing health conditions (respiratory or cardiovascular conditions, such as asthma, COPD, heart disease, or diabetes); pregnant women; low-income and marginalised communities; outdoor and manual workers; and individuals with disabilities.

Policy-wise, there is variability in the recognition of vulnerable groups. The NPCCHH stands out as the most comprehensive. In contrast, policies like the FAME Scheme and the *Guidelines on Ambient Air Quality* have a more limited scope in acknowledging vulnerability to air pollution. Children and infants, along with elderly individuals, are the most consistently recognised across policies, whereas pregnant women and individuals with disabilities are the least recognised. Table 4 presents the various vulnerable groups that are acknowledged in the selected policies.

Clean cooking solutions aim to alleviate drudgery, saving time spent on cooking and related activities, and potentially enabling women to participate in productive economic activities.

Table 4 Marginal groups acknowledged in the selected policies for their differentiated vulnerability to air pollution

Sector	Policy	Drivers of marginalisation/ vulnerability						
		Gender	Children and infants	Elderly individuals	People with pre-existing health conditions	Low-income and marginal-ized commun-ities	Outdoor and manual workers	Individuals with disabilities
Energy Access and Power Generation	Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya)	✓	✓	✗	✗	✓	✓	✓
	National Solar Mission (Jawaharlal Nehru National Solar Mission)	✗	✗	✗	✗	✗	✗	✗
	Pradhan Mantri Ujjwala Yojana (PMUY)	✓	✓	✗	✗	✗	✗	✗
	Environment (Protection) Amendment Rules, 2015 (Thermal Power Plant Emissions Regulations)	✗	✗	✗	✗	✗	✗	✗
Low-Emission Transport	FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) Scheme- 2	✗	✗	✗	✗	✗	✗	✗
	Auto Fuel Policy	✗	✓	✗	✓	✗	✗	✗
Waste Manage-ment	Crop Residue Management Operational Guidelines	✗	✗	✗	✗	✗	✗	✗
	Solid Waste Management Rules	✗	✗	✗	✗	✗	✓	✗
	Construction and Demolition Waste Management Rules	✗	✗	✗	✗	✗	✓	✗
Air Quality Manage-ment	National Ambient Air Quality Standards	✗	✓	✓	✗	✓	✗	✗
	The Air (Prevention and Control of Pollution) Act	✗	✗	✗	✗	✗	✗	✗
	National Clean Air Program (NCAP)	✓	✓	✗	✗	✗	✓	✗
	Graded Response Action Plan (GRAP)	✗	✓	✓	✓	✗	✗	✗
	Commission on Air Quality Management	✗	✗	✗	✗	✗	✗	✗
	Smart City Mission	✓	✓	✓	✗	✓	✗	✓
	Guidelines for Ambient Air Quality Monitoring	✗	✗	✗	✗	✗	✗	✗
Air Pollu-tion and Health	National Programme on Climate Change and Human Health- Guidelines	✓	✓	✓	✓	✓	✓	✓
	National Programme on Climate Change and Human Health- Advisory on air pollution and health	✓	✓	✓	✓	✓	✓	✗
	National Programme on Climate Change and Human Health- Adaptation Plan for diseases due to air pollution	✓	✓	✓	✓	✓	✓	✓

Source: Authors' analysis

The **NPCCHH** provides a comprehensive definition of vulnerable groups.

The following people may be considered vulnerable to health consequences of air pollution:

- **Age group**: Children under the age of five and elderly individuals.
- **Pregnant women**: Exposure during pregnancy may have consequences for the child in the womb.
- **Predisposed health or medical conditions**: Individuals with pre-existing illnesses of the respiratory and cardiovascular system, etc., are at high risk.
- **Low socioeconomic conditions**: Individuals with poor nutritional status and those living in poor housing, using fossil fuels for cooking, heating, and lighting purposes have high risk.
- **Occupational group**: Individuals with the possibility of prolonged exposure, such as traffic police officers, traffic volunteers, construction workers, road sweepers, rickshaw pullers, auto-rickshaw drivers, roadside vendors, and those working outdoors in polluted settings are at high risk. Women burning biomass for cooking and sweeping dust are vulnerable on account of their household work.

Women community leaders are key to addressing air pollution and driving grassroots change.

Table 5 Overall results for GESI-responsiveness of selected policies

Overall GESI-responsiveness[3] of policies addressing air pollution									
Sector	**Policy**	**Year**	**Policy Relevance**	**Direct/ Indirect relevance**	**Does it acknow-ledge gender concerns?**	**Does it address gender concerns?**	**Does it acknow-ledge social equity concerns?**	**Does it address social equity concerns?**	**Overall GESI (Gender Equity and Social Inclusion) responsiveness**
Energy access and power generation	PMSBHGY	2017	Electrification and pollution reduction	Indirect	✓	✗	✓	✓	Gender-aware; social-equity-targeted
	NSM	2010	Clean energy utilization	Direct	✓	✗	✓	✗	GESI-aware
	PMUY	2016	Indoor air quality improvement	Direct	✓	✓	✓	✓	GESI-responsive
	EPAR (Thermal Power)	2015	Emission control installation	Direct	✗	✗	✗	✗	GESI-blind
Low-emission transport	FAME-2	2019	Electric vehicle adoption	Indirect	✗	✗	✗	✗	GESI-blind
	AFP	2014	Fuel quality enhancement	Direct	✗	✗	✓	✗	GESI-blind
Waste manage-ment	CRM	2023	Agricultural burning prevention	Direct	✗	✗	✗	✗	GESI-blind
	SWMR	2016	Open burning minimisation	Indirect	✗	✗	✓	✓	Gender-blind; social-equity-targeted
	CDWMR	2016	Construction pollution management	Direct	✗	✗	✓	✓	Gender-blind; social-equity-targeted
Air quality manage-ment	NAAQS	2019	Air quality standards setting	Direct	✗	✗	✗	✗	GESI-blind
	APCPA	1981	Pollution prevention framework	Direct	✗	✗	✗	✗	GESI-blind
	NCAP	2019	Targeted pollution mitigation	Direct	✓	✗	✓	✗	GESI-aware
	GRAP	2023	Air quality emergency response	Direct	✗	✗	✓	✓	Gender-blind, Social-equity-targeted
	CAQM	2021	Air quality governance	Direct	✗	✗	✗	✗	GESI-blind
	SCM	2015	Urban environment enhancement	Direct	✓	✗	✓	✗	GESI-aware
	GAAQM	2003	Monitoring system establishment	Direct	✗	✗	✗	✗	GESI-blind
Air pollution and health	NPCCHH-G	2022	Health risk mitigation	Direct	✓	✓	✓	✓	GESI-responsive
	NPCCHH-A	2022	Pollution exposure reduction	Direct	✓	✓	✓	✓	GESI-responsive
	NPCCHH-AP	2021	Health adaptation strategies	Direct	✓	✓	✓	✓	GESI-responsive

Source: Authors' analysis

3. GESI-blind: These policies do not take gender or social inclusion into consideration and may inadvertently reinforce existing inequalities. Their main objective is to address the issue at hand, such as air pollution, without considering how it may affect different gender or social groups differently.

   GESI-aware: These policies recognise the importance of gender and social inclusion and may include some elements that address these issues, but do not actively or systematically address them. The main objective is to be mindful of gender and social inclusion issues and to avoid reinforcing existing inequalities.

   GESI-responsive: These policies actively address gender and social inclusion issues and are designed to reduce inequalities. The main objective is to actively reduce gender and social inequalities by providing targeted support and interventions that address the specific needs and vulnerabilities of different groups.

   Social-equity-targeted: These policies only acknowledge and address existing social inequities while addressing air pollution without addressing gender concerns. These policies identify and aim to mitigate the unique impacts that air pollution may have on certain social groups.

5. Conclusions and recommendations

Our policy analysis reveals a significant gap in integrating Gender Equity and Social Inclusion (GESI) within India's air quality management framework. Of the 19 reviewed policies, 7 were identified as GESI-blind, indicating a systemic oversight in acknowledging the nuanced impacts of air pollution across different social strata and genders. Most of the reviewed policies did not recognise gender differences in exposure and susceptibility to air pollution, rendering them gender-blind. This oversight suggests a pervasive gender bias within policy frameworks, potentially resulting in interventions that fail to address or even exacerbate existing disparities.

Despite recognising the disparate impact of air pollution on women, the policies classified as gender-aware lacked the depth needed to address these inequities effectively. For instance, policies like the Saubhagya scheme fell short in their gender equity considerations, reflecting only a surface-level engagement with these critical issues. In contrast, the *Pradhan Mantri Ujjwala Yojana* (PMUY) and the *National Programme on Climate Change and Human Health* (NPCCHH) demonstrated a higher degree of gender-responsiveness. However, the limited number of gender-responsive policies highlights the need for a broader and more consistent application of a gender lens in policy development.

Additionally, most policies failed to acknowledge age and socioeconomic factors, leaving certain vulnerable groups inadequately protected. A critical gap is the limited consideration given to individuals with disabilities, who face compounded challenges due to both physical barriers and policy neglect. The following recommendations aim to foster a more inclusive policy environment. However, the successful implementation of these recommendations depends on several factors, such as the diligent collection and application of gender-disaggregated data to inform policy decisions, political commitment to embed gender analysis throughout policy cycles, ensuring that policies are not just nominally but substantively gender-responsive and inclusive, the commitment to move beyond recognition to active redressal of identified vulnerabilities, and the effectiveness of community engagement strategies.

Specific policy recommendations to enhance the GESI-responsiveness of policies regulating air pollution in India

1. **Mandate systematic data collection**: government and policy making bodies like MOEFCC and MoHFW should enact policies that mandate the systematic collection of disaggregated data on air pollution impacts across gender, caste, socioeconomic status, and other parameters of marginalisation. This can be achieved by implementing standardised protocols integrated with health systems. Utilising health data agencies and digital platforms for advanced analytics will enhance data collection, storage, and

Government programmes should leverage support from community networks to raise awareness and implement air pollution interventions.

real-time analysis, ensuring the inclusion of remote and marginalised communities. Additionally, it is essential to strengthen the capacities of national- and local-level governance bodies to implement and manage this process effectively.

2. **Conduct gender analysis in policy design**: policy makers and programme designers should incorporate a systematic gender analysis during the policy design and implementation phases to critically assess the unique needs and challenges faced by gender-diverse people. Without this analysis, there is a risk of reinforcing existing inequalities or overlooking distinctive challenges faced by different gender groups.

3. **Develop targeted interventions**: government and non-government agencies should develop interventions that address specific vulnerabilities associated with gender, age, economic status, occupational exposure, and disabilities. These interventions should be designed to mitigate the unique risks and exposure levels that different groups face due to air pollution, ensuring their needs are substantively and effectively met. For instance, PMUY can be expanded to address indoor air pollution sources beyond cooking, such as fossil fuel-based heating and lighting sources, which may disproportionately affect children and individuals with pre-existing health conditions. Additionally, address the high exposure of transport-disadvantaged groups to on-road pollution – including women, children, older adults, and persons with disabilities – who rely on public transit and shared transport (Goel, 2023; Kakar et.al., 2021) . These groups often spend prolonged periods in highly polluted areas while waiting for transport.

4. **Ensure equitable representation**: local governance bodies and civil society organizations should ensure and enable inclusion of women, men, and gender minorities in decision-making processes related to air pollution. This includes employing participatory approaches and holding consultations with pertinent groups and stakeholders.

5. **Foster ministerial collaboration**: Central and State government stakeholders should facilitate active collaboration between key nodal ministries, such as the Ministry of Environment, Forest and Climate Change, Ministry of Health and Family Welfare, Ministry of Women and Child Development, Ministry of Labour and Employment, and Ministry of Housing and Urban Affairs. These ministries should collaborate in the design and implementation of air pollution management policies. Additionally, they should appoint GESI co-ordinators to oversee efforts aimed at mitigating air pollution and reducing the exposure of all vulnerable and marginalised populations.

6. **Ensure accessible information and services**: national health departments and local authorities should Ensure that health advisories, information campaigns, and healthcare services related to air pollution are accessible to all, including individuals with disabilities. This can be achieved by using multiple languages and formats (including braille and sign language) for communication.

7. **Leverage community networks**: Government programmes should leverage support from community networks such as women's self-help groups and local non-governmental organisations (NGOs), to raise awareness and implement air pollution interventions. These groups can be instrumental in addressing the needs of women and socially marginalised groups. These networks can act as a bridge between policymakers and the community, providing feedback on on-ground realities and the effectiveness of air pollution initiatives.

8. **Prioritise gender budgeting**: Financial planning bodies within key ministries should allocate adequate funding for gender-responsive goals and activities. This would also enable the collection and analysis of gender-disaggregated data.

9. **Regularly assess policy impact**: Government agencies responsible for monitoring air pollution policies, in collaboration with independent evaluation bodies, should regularly assess impact of policies on gender and social equity through formalised management information systems (MIS). Establish mechanisms for feedback and continuous improvement, such as surveying and interviewing diverse community members to capture their direct experiences and perspectives on the policy's impact. Incorporate gender-specific indicators and measure gender-differentiated implications in the monitoring and evaluation of policy actions. Additionally, hosting public forums and workshops can provide a platform for these communities, especially the marginalised, to voice their experiences and provide valuable suggestions.

Acronyms

ASHA	accredited social health activist
C&D	construction and demolition
COPD	chronic obstructive pulmonary disease
FAME	*Faster Adoption & Manufacturing of Electric Vehicles*
GESI	gender equity and social inclusion
GNCTD	Government of the National Capital Territory of Delhi
GRAP	*Graded Response Action Plan*
LGBT	lesbian, gay, bisexual, and transgender
MIS	management information systems
MoEFCC	Ministry of Environment, Forest and Climate Change
MoHFW	Ministry of Health and Family Welfare
NCAP	*National Clean Air Programme*
NCR	National Capital Region
NGOs	non-government organisations
NPCCHH	*National Programme on Climate Change and Human Health*
PMUY	*Pradhan Mantri Ujjwala Yojana*
SC/ST	Scheduled Caste/Scheduled Tribe
ULBs	urban local bodies
WHO	World Health Organization

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Annexure 1

Table A1 Detailed policy selection criteria with context and relevance for the Air quality management

Sector	Policy	Year	Air pollution management context	Direct/Indirect relevance
Energy access and power generation	Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya)	2017	The scheme primarily aims to provide electricity to all households – a critical step in addressing energy poverty. An analysis of this policy may be relevant for air quality management as it indirectly promotes the use of electricity for cooking and lighting, reducing the reliance on more polluting sources like biomass and kerosene. This shift improves outdoor and indoor air quality, particularly in rural areas.	Indirect
	National Solar Mission (Jawaharlal Nehru National Solar Mission)	2010	The National Solar Mission encourages using clean and renewable energy sources, such as solar power, which reduces the reliance on fossil fuels for electricity generation, thus helping reduce air pollution.	Direct
	Pradhan Mantri Ujjwala Yojana (PMUY)	2016	PMUY provides clean cooking fuel (LPG) to households, reducing their reliance on biomass and kerosene, which can improve indoor and outdoor air quality.	Direct
	Environment (Protection) Amendment Rules, 2015 (Thermal Power Plant Emissions Regulations)	2015	These regulations aim to limit emissions from thermal power plants, which are significant sources of air pollution. They mandate the installation of pollution-control equipment to reduce emissions, thus improving air quality.	Direct
Low-emission transport	FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) Scheme- 2	2019	FAME-2 incentivises the adoption of electric and hybrid vehicles, which can reduce air pollution in urban areas by replacing conventional internal combustion engine vehicles with cleaner alternatives.	Indirect
	Auto Fuel Policy	2014	The Auto Fuel Policy seeks to improve fuel quality and vehicle emissions standards, which can contribute to reducing vehicular air pollution.	Direct
Waste manage-ment	Crop Residue Management Operational Guidelines	2023	These guidelines provide specific recommendations for managing crop residue to reduce the practice of stubble burning and related air pollution.	Direct
	Solid Waste Management Rules	2016	These rules focus on waste management, which indirectly helps manage air pollution by reducing the open burning of waste.	Indirect
	Construction and Demolition Waste Management Rules	2016	Proper waste management can help reduce air pollution by minimising the release of particulate matter and other pollutants during construction and demolition activities.	Direct

Air quality management	National Ambient Air Quality Standards	2019	These standards set permissible limits for air pollutants in industrial, residential, and sensitive areas. Setting these standards is vital for monitoring and regulating air pollution levels – a fundamental step towards mitigating and reducing public exposure to air pollutants.	Direct
	The Air (Prevention and Control of Pollution) Act	1981	This act provides the legal framework for the prevention, control, and abatement of air pollution, giving authorities the power to combat air pollution.	Direct
	National Clean Air Program (NCAP)	2019	NCAP is a comprehensive programme focused on mitigating air pollution and reducing PM2.5 and PM10 levels by 20–30% by 2024 in identified non-attainment cities. It also encourages industries in these areas to adopt cleaner technologies and practices to meet air quality standards.	Direct
	Graded Response Action Plan (GRAP)	2023	GRAP is a set of emergency measures to be implemented when air quality deteriorates, including vehicle restrictions and closing polluting industries to reduce air pollution.	Direct
	Commission on Air Quality Management	2021	The commission oversees and implements measures to control air pollution, signalling the government's commitment to tackling the issue.	Direct
	Smart City Mission	2015	While the Smart City Mission primarily focuses on urban development, it can indirectly improve air quality by promoting sustainable transportation, waste management, and green infrastructure.	Direct
	Guidelines for Ambient Air Quality Monitoring	2003	These guidelines establish the framework for monitoring air quality, essential for tracking progress and implementing effective policies to mitigate air pollution.	Direct
Air Pollution and Health	National Programme on Climate Change and Human Health – Guidelines	2022	The programme raises awareness among the public, healthcare professionals, and policymakers about the health risks associated with air pollution. It provides guidelines for monitoring air quality and assessing health risks associated with air pollution. It also offers recommendations on reducing emissions from various sources, such as industrial activities and transportation, which are essential for managing and reducing air pollution.	Direct
	National Programme on Climate Change and Human Health Advisory on air pollution and health	2022	The advisories issued under the programme offer practical advice to individuals on how to protect themselves from air pollution.	Direct
	National Programme on Climate Change and Human Health-Adaptation Plan for diseases due to air pollution	2021	The adaptation plans address the long-term health impacts of air pollution and provide strategies to cope with increased disease burdens.	Direct

Source: Authors' compilation based on the policy selection criteria

Notes:

Explanation for policy selection-

Sector: Major sectors contributing to air pollution

Policy: Policies consisting of government guidelines, regulations, rules, notifications, circulars, acts, schemes, etc., are shortlisted from FAOLEX, ECOLEX databases, and nodal ministry websites and portals.

Year: Policies formulated from 2010 –present are considered; in some cases, critical policies before 2010 are also considered if they are still applicable.

Air Pollution Management Context: Explanation of each policy's relevance to our analysis.

Direct/Indirect relevance: Direct relevance – If the policy documents mention critical words like 'air pollution', 'emissions', 'PM2.5', 'air quality', etc. in their objectives, strategies, etc. Indirect relevance – If the policy does not explicitly aim at reducing air pollution, but air pollution management and exposure reduction are co-benefits.

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