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CLEANING DELHI'S AIR

Implementation Action Plan

April, 2017

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LIST OF ABBREVIATIONS

AMC	**Automatic Monitoring and Control**
BS	**Bharat Stage emission levels**
CAG	**Comptroller and Auditor General**
CEA	**The Central Electricity Authority**
CERC	**Central Electricity Regulatory Commission**
CEMS	**Continuous Emission Monitoring System**
COEMS	**Continuous Online Emission Monitoring System**
CPCB	**Central Pollution Control Board**
CSE	**Centre for Science and Environment**
DACFW	**Department of Agriculture, Cooperation and Farmer's Welfare, Government of India**
DPCC	**Delhi Pollution Control Committee**
ESP	**Electrostatic Precipitator**
EFV	**environment friendly vehicles**
EIA	**Environment Impact Assessment**
EPA	**Environment Protection Act, 1986**
EPBs	**Environmental Protection Bureaus**
ECS	**Equivalent Car Space**
FAUN	**Fasal Avshesh Upyog Nigam**
FGD	**Flue Gas Desulphurisation**
GHGs	**Green House Gases**
ISRO	**Indian Space Research Organisation**
MPD	**Master Plan of Delhi, 2021**
MHCVs	**Medium and Heavy Commercial Vehicles**
Mt	**Million Tons**
MOEFCC	**Ministry of Environment, Forests and Climate Change**
MEP	**Ministry of Environmental Protection**
MoRTH	**The Ministry of Road, Transport and Highways**
MOA	**Model Memorandum of Association**
MCD	**Municipal Corporation of Delhi**
NCT	**National Capital Territory**
NGT	**National Green Tribunal**
NHAI	**National Highways Authority of India**
NMDFC	**National Minorities Development & Finance Corporation**
NPMCR	**Draft National Policy for Management of Crop Residues**
NRSA	**National Remote Sensing Agency**
NSKFDC	**National Safai Karamcharis Finance & Development Corporation**
NOx	**Nitrogen Oxides**
OCSEMS	**Online Continuous Stack Emission Monitoring Systems**
OEMs	**Original Equipment Manufacturers**
PLF	**Plant Load Factor**
PM	**Particulate Matter**
PWD	**Public Works Department**
RMC	**Ready-Mix Concrete**
RES	**Renewable Energy Sources**

RWA	**Resident Welfare Associations**
SDMs	**Sub-Divisional Magistrates of Delhi**
SCR	**Selective Catalytic Reduction**
SPV	**Special Purpose Vehicle**
SPCBs	**State Pollution Control Boards**
SO_2	**Sulphur Dioxide**
TPP	**thermal power plants**
VAT	**the Value-Added Tax**
VVFMP	**Voluntary Vehicle Fleet Modernisation Programme**
WHO	**World Health Organisation**

I. EXECUTIVE SUMMARY

Using the IIT Kanpur's Comprehensive Study on Air Pollution and Green House Gases (GHGs) in Delhi as its basis, this Action Plan suggests measures to control pollution from five major sources of air pollution in Delhi—emissions from coal-fired power plants, vehicular emissions, burning of crop residue, emissions from ready-mix concrete batching plants and dust at construction sites.[1] Although the Central Pollution Control Board has already drawn up a Graded Response Action Plan ('Graded Action Plan'), its main thrust remains the stringent enforcement of existing standards/rules/bans.[2] In this Action Plan, we attempt to go beyond the routine recommendation to strengthen monitoring and compliance and identify a range of actions—legislative, executive, policy, financial—that are needed to give effect to the many solutions that have already been proposed to combat Delhi's air quality crisis.

Our key recommendations are summarised here through three tables. The first focuses on measures necessary to tackle emissions from different sources; the second categorises measures according to the authorities responsible for implementing such measures; while the third sets out the different routes through which some of these key measures may be implemented. The rest of the report contains a more detailed source-wise analysis of: a) the contribution to pollution from the key sources identified in this report; b) reasons for this pollution, including weak legal frameworks or poor enforcement; c) proposed measures to tackle this problem; and d) the responsible authorities, implementation routes and timelines to give effect to these measures.

[1] The IIT Kanpur report also identifies the burning of municipal solid waste as a significant source of pollution. However, we have not addressed this source in detail in this action plan given that the Solid Waste Management Rules, 2016 already prescribe some of the measures that are required to tackle the problem, including the identification of suitable landfill sites, bio-remediation of old sites, the segregation of waste at source, and encouraging the composting of bio-degradable waste. The Rules also set in place timeframes for the implementation of these measures between 1-5 years from the date of their notification. Since the Rules were notified on 8 April 2016, it is only now that their impact will begin to be measured.

[2] Central Pollution Control Board, 'Graded Response Action Plan According to Pollution Levels in Delhi and NCR to Inform Public Action and to Take Effective Steps to Combat Public Health Emergencies', <http://indiaenvironmentportal.org.in/files/file/Final%20Submission%20to%20Hon'ble%20Supreme%20Court%20of%20India-02.12.2016.pdf> accessed on 14 March, 2017.

A. SOURCE-WISE MEASURES

SOURCES OF POLLUTION	MEASURES FOR COMBATING POLLUTION	IMPLEMENTING AUTHORITIES
A. Coal-Fired Power Plants	1. Amend the Environment (Protection) Rules, 1986 to require older plants to compulsorily install Flue Gas Desulphurisation technology. 2. Display real-time COEMS data from thermal power plants on government portals such as SAFAR or BHUVAN with unrestricted access to general public. 3. Amend the Environment Impact Assessment Notification, 2006 to require impact assessment studies to take into account the impact of emissions over a greater radius.	Ministry of Power/Central Electricity Authority and Ministry of Environment, Forests & Climate Change
B. Vehicular Pollution	1. Uniformise toll taxes between the Municipal Corporation of Delhi and National Highway Authority of India through an amendment of the toll tax bye laws by means of section 113(2) read with section 150 of the Delhi Municipal Corporation Act, 1957. 2. Link the registration of private vehicles with proof of parking space. 3. Implement a policy for tagging vehicles, through the creation of different colour tags representing different levels of emission standards in vehicles. 4. Set up a Green Police Force for metropolitan cities.	Municipal Corporation of Delhi ('MCD') and Department of Transport, Government of National Capital Territory of Delhi ('Government of NCT of Delhi' or 'Delhi Government')

C. Burning of crop residue	1. Establish a Special Purpose Vehicle, a proposed name for which is the Fasal Avshesh Upyog Nigam (FAUN), to serve as a stand-alone institutional mechanism to deal with crop residue. 2. Provide free-of-cost machinery to farmers to treat crop residue 3. Ensure the collection, storage, transport and sale of crop reside from farmers to production units through State-level nodal agencies. 4. Provide grants to set up manufacturing companies that produce goods from crop residue.	Department of Agriculture, Cooperation and Farmer's Welfare, Government of India
D. Fly-ash emissions from Ready-Mix Concrete Batching Plants (RMC Plants)	1. Issue Environmental Guidelines for RMC Plants under Clause (1) read with Clause (2)(z) of Section 54 of the Air Act, along with Section 21(1) of the Water Act. 2. Issue norms for the registration and approval of RMC Plants under sections 416 read with 417 of the Delhi Municipal Corporations Act, 1957	Ministry of Environment and Forests ('MoEFCC')/Central Pollution Control Board ('CPCB')/Delhi Pollution Control Committee ('DPCC')/ MCD
E. Dust emissions from Construction Sites	1. Amend the Memoranda of Association of Resident Welfare Associations or use the *Bhagidari Scheme* of the Government of the NCT of Delhi to empower them to undertake monitoring of construction activities and report non-compliance with dust-control measures by builders. 2. Allow Grievance Redressal Committees under the Unified Building Byelaws of the NCT of Delhi, 2016 to cancel no-objection certificates for non-compliance	MCD/ Environment Department, Government of NCT of Delhi, Residents Welfare Associations ('RWAs')

	with dust-control norms.	

B. AUTHORITY-WISE MEASURES

SOURCES OF POLLUTION	AUTHORITIES	IMPLEMENTATION MEASURES
	UNION CABINET, GOVERNMENT OF INDIA	
Burning of crop residue		Provide machinery to farmers free-of-cost to treat crop residue for in-situ and ex-situ utilisation and incentivise the use of custom hiring centres for farm machinery through the establishment of manufacturing units to produce goods from crop residue. This may be done through Cabinet approval under the Transaction of Business Rules of the Cabinet and through an amendment of the Allocation of Business Rules of the Cabinet, wherein FAUN could be established within the mandate of the Department of Agriculture, Cooperation and Farmer's Welfare.
	MINISTRY OF ENVIRONMENT AND FORESTS, GOVERNMENT OF INDIA	
All sources of pollution		Set up a Green Police Force for metropolitan cities through the enactment of a Central statute
Emissions from Coal-Fired Power Plants		Revise the emission limits for older TPPs and make it compulsory for industry owners to install De-Sox and De-Nox technology through an amendment of the Environment (Protection) Rules, 1986
		Mandate De-SOx and De-NOx measures
		Assist the Ministry of Power, and State Authorities in the phasing out of plants
		Enforce installation of FGD/SCR through analyses of monthly compliance reports submitted to the MoEFCC
		In close conjunction with the Ministry of Power, and with the assistance of the CPCB and SPCBs (including the DPCC) institute a training and accreditation programme for the implementation of the COEMS through circulars/office memoranda
	CENTRAL POLLUTION CONTROL BOARD	

Emissions from Coal-Fired Power Plants		Assist the MOEFCC and the Ministry in instituting a training and accreditation programme for the implementation of the COEMS through circulars/office memoranda
		Provide technical input to the MOEFCC to revise emission limits for older TPPs and make it compulsory for industry owners to install De-Sox and De-Nox technology
		Mandate De-SOx and De-NOx measures
	CENTRAL ELECTRICITY REGULATION COMMISSION	
Emissions from Coal-Fired Power Plants		Assess the impact of installation of pollution control technology on electricity tariffs through a technical study
	CENTRAL ELECTRICITY AUTHORITY	
Emissions from Coal-Fired Power Plants		Introduce and institutionalise the COEMS framework by developing and notifying standards and manuals
		Phase out older and inefficient units through a policy document and action plan/roadmap on phasing out TPPs
	MINISTRY OF POWER, GOVERNMENT OF INDIA	
Emissions from Coal-Fired Power Plants		Issue a phase-wise closure notice, with the least efficient being closed first, in consultation with the MOEFCC and State Authorities
		In close conjunction with the MOEFCC, and with the assistance of the CPCB and SPCBs (including the DPCC) institute a training and accreditation programme for the implementation of the COEMS through circulars/office memoranda
	MINISTRY OF ROAD, TRANSPORT AND HIGHWAYS AND AUTOMOBILE MANUFACTURES, GOVERNMENT OF INDIA	
Vehicular Pollution		Change the focus of the VVFMP to all vehicles above 10 years old and include a direct cash incentive in the scheme through a policy document to this effect and through the allocation of funds for the direct cash incentive

	DEPARTMENT OF AGRICULTURE, COOPERATION AND FARMER'S WELFARE, GOVERNMENT OF INDIA	
Burning of crop residue		Supervise the Fasal Avshesh Upyog Nigam
	DEPARTMENT OF INDUSTRIAL POLICY AND PROMOTION AND MINISTRY OF NEW AND RENEWABLE ENERGY, GOVERNMENT OF INDIA	
Burning of crop residue		Encourage private investment in the production of biomass energy and goods manufactured from crop residue through a policy document laying out how to incentivise private manufacturing units producing goods from crop residue or through the Make in India programme to create awareness about subsidies and financial assistance being provided to private investors to set up bio-mass plants
	MINISTRY OF URBAN DEVELOPMENT, GOVERNMENT OF INDIA	
Dust at Construction Sites		Allow people to register complaints regarding dust at construction sites through their phones through updating the Swacch Delhi App to allow dust-related complaints
	STATE GOVERNMENTS OF NCT OF DELHI, PUNJAB, HARYANA AND UTTAR PRADESH	
Burning of crop residue		Provide local authorities with more funding to enforce compliance with the ban on burning crop residue.
	STATE POLLUTION CONTROL BOARDS/ DELHI POLLUTION CONTROL COMMITTEE	
Fly ash from Ready-Mix Concrete Batching Plants and Dust at Construction Sites		Conduct awareness programmes for builders and RMC Plant operators through the DPCC's powers under Clause (1)(a) read Clause (1)(c) of Section 17 of the Air Act
Fly ash from Ready-Mix Concrete Batching Plants		Direct RMC Plants to take specific measures to curb air and water pollution through the issue of Environmental Guidelines under Clause (1) read with Clause (2)(z) of Section 54 of the Air Act, along with Section 21(1) of the Water Act.
Emissions from Coal-Fired Power Plants		Assist the MOEFCC and the Ministry in instituting a training and accreditation programme for the implementation of the COEMS through circulars/office

		memoranda
		Enforce installation of FGD/SCR through inspections and surprise-checks by SPCBs/DPCC officials
	MUNICIPAL CORPORATIONS OF DELHI	
Dust at Construction Sites		Empower RWAs to monitor construction activities through a modification of the Draft MOA for RWAs
Fly ash from Ready-Mix Concrete Batching Plants		Direct RMC Plants to control fly ash emissions through the issue of norms under Sections 416, read with 417 of the Delhi Municipal Corporations Act, 1957
Vehicular Pollution		Equalise the parking rates for structured and surface parking by revising surface parking rates through a resolution and issuing directions with the revised rates to third party contractors
		Increase the parking charges for personal vehicles by revising rates of personal vehicles through a resolution and issuing directions to local zonal officers to collect parking fees annually
		Prohibit Free Parking by conducting a survey to identify free parking zones and auctioning new zones to third parties to collect parking charges
		Regularise Parking Spaces in Residential Colonies through a policy setting out the rules for on-street parking in residential colonies, through an amendment of the Memoranda of Association of RWAs, including the regulation of parking spaces within their objective and through a drive to identify, mark and license parking spots.
		Uniformise toll taxes between the MCD and NHAI through an amendment of the toll tax bye laws by the MCD. See section 113(2) read with section 150 of the Delhi Municipal Corporation Act, 1957
	DEPARTMENT OF TRANSPORT, GOVERNMENT OF NCT OF DELHI	

Vehicular Pollution		Increase the parking charges for personal vehicles by revising rates of personal vehicles through a resolution and issuing directions to local zonal officers to collect parking fees annually
		Develop a Traffic Police Manual on Air Pollution by designing a vehicular pollution protocol for the traffic police officers to follow.
		Link the Registration of vehicles with Proof of Parking Space through an order to local zonal offices
		Conduct a Vehicle Tag Drive extending benefits to environment friendly tags through a policy document setting the criteria for different colour tags and through an implementation drive.
	DELHI SECRETARIAT, GOVERNMENT OF NCT OF DELHI	
Fly ash from Ready-Mix Concrete Batching Plants and Dust at Construction Sites		Recruit more monitoring officers for the DPCC and the MCD through the allocation of funds in the annual budget.
Dust at Construction Sites		Empower Grievance Redressal Committees to cancel no-objection certificates for non-compliance with dust-control norms through a notification amending Clauses 1.5.4 and 1.8 of the UBBLD
		Empower RWAs to monitor construction activities through a modification of the Draft MOA for RWAs
Vehicular Pollution		Change the tax rate of diesel through a notification (post-GST), since the tax rate is proposed to be changed within the same bracket
		Increase Road Tax and adopt a sliding scale to determine the rate of road tax through an amendment of Schedule 1 read with section 3 of the Delhi Motor Vehicles Taxation Act, 1962
		Uniformise toll taxes between the MCD and NHAI
	DEPARTMENTS OF COMMERCE AND INDUSTRY IN THE GOVERNMENTS	

	OF NCT OF DELHI, PUNJAB, HARYANA AND UTTAR PRADESH	
Burning of crop residue		Encourage private investment in the production of biomass energy and goods manufactured from crop residue in conjunction with Department of Industrial Policy and Promotion, and Ministry of New and Renewable Energy, Government of India
	DEPARTMENTS OF POWER IN THE GOVERNMENTS OF NCT OF DELHI, PUNJAB, HARYANA AND UTTAR PRADESH	
Emissions from Coal-Fired Power Plants		Assist the Ministry of Power, and State Authorities in the phasing out of plants
Burning of crop residue		Encourage private investment in the production of biomass energy and goods manufactured from crop residue in conjunction with Department of Industrial Policy and Promotion, and Ministry of New and Renewable Energy, Government of India
	DEPARTMENT OF ENVIRONMENT, GOVERNMENT OF NCT OF DELHI	
Dust at Construction Sites		Direct RWAs to monitor compliance with dust control measures at construction sites under *Bhagidari* Scheme of the NCT of Delhi

C. AVENUES FOR IMPLEMENTING MEASURES

1. Legislative/Regulatory Measures

LEGISLATION/RULE REQUIRING AMENDMENT	OBJECTIVE	IMPLEMENTING AUTHORITY
Environment (Protection) Rules, 1986	Revision of emission limits for older TPPs and the compulsory installation of De-Sox and De-Nox technology	MOEFCC, with technical assistance from the CPCB
Schedule 1 read with section 3 of the Delhi Motor Vehicles Taxation Act, 1962	Increase in Road Tax and adoption of a sliding scale to determine the rate of road tax	Department of Transport, Government of NCT of Delhi
Memoranda of	Regularisation of Parking Spaces in	Government of NCT of Delhi

Association of RWAs, including the regulation of parking spaces within their objective	Residential Colonies	
Toll tax bye laws by the MCD. Please see section 113(2) read with section 150 of the Delhi Municipal Corporation Act, 1957	Uniformity in toll taxes between the MCD and NHAI	Municipal Corporation of Delhi; Government of NCT of Delhi
The enactment of a Central statute	Establishment of a Green Police Force for metropolitan cities	Ministry of Environment and Forests/Ministry of Home Affairs, Government of India
Environmental Guidelines under Clause (1) read with Clause (2)(z) of Section 54 of the Air Act, along with Section 21(1) of the Water Act	Issuance of directions to RMC Plants to take specific measures to curb air and water pollution	DPCC
Through the issue of norms under Sections 416, read with 417 of the Delhi Municipal Corporations Act, 1957	Issuance of directions to RMC Plants to control fly ash emissions	Municipal Corporation of Delhi
Clauses 1.5.4 and 1.8 of the UBBLD	Empowerment of Grievance Redressal Committees to cancel no-objection certificates for non-compliance with dust-control norms	Government of NCT of Delhi

2. Executive/Policy Measures

NOTIFICATION/ORDER/CIRCULAR TO BE ISSUED	OBJECTIVE	ISSUING AUTHORITY
Policy document and action plan/roadmap on phasing out TPPs	Phasing out older and inefficient Units	Central Electricity Authority
Development of standard procedures and technical manuals for emission control and monitoring equipment	Implementation of the COEMS Framework	Central Electricity Authority
1. Revision of surface parking rates through a resolution 2. Issuance of directions with the revised rates to third party contractors	Equalisation of parking rates for structured and surface parking	MCD
1. Revision of rates of personal vehicles through a resolution 2. Issuance of directions to local zonal officers to collect parking fees annually	Increase in parking charges for personal vehicles	MCD/Department of Transport, Government of NCT of Delhi
Formulation of a vehicular pollution protocol for the traffic police officers to follow	Development of a Traffic Police Manual on Air Pollution	Delhi Police, Department of Transport, Government of NCT of Delhi
Issuance of a notification, since the tax rate is proposed to be changed within the same bracket	Change of tax rate on diesel (Post-GST)	Government of NCT of Delhi
1. A survey to be conducted to identify free parking zones 2. Auction of new zones to third parties to collect parking charges	Prohibition on Free Parking	MCD
1. Formulation of a policy setting out the rules for on-street parking in residential	Regularisation of Parking Spaces in Residential Colonies	MCD and RWAs

colonies 2. A drive to be conducted to identify, mark and license parking spots		
Issuance of an order to local zonal offices	Linkage of Registration of vehicles with Proof of Parking Space	Department of Transport, Government of NCT of Delhi
1. Formulation of a policy document to this effect 2. Allocation of funds for the direct cash incentive	Change of focus of the VVFMP to all vehicles above 10 years old and include a direct cash incentive in the scheme	Ministry of Road, Transport and Highways and Automobile Manufactures, Government of India
1. Formulation of a policy document setting the criteria for different colour tags 2. Implementation drive	Vehicle Tag Drive to extend benefits to environment friendly tags	Department of Transport, Government of NCT of Delhi
Cabinet approval under the Transaction of Business Rules of the Cabinet. Amendment of the Allocation of Business Rules of the Cabinet to establish FAUN under the Department of Agriculture, Cooperation and Farmer's Welfare.	1. Provide machinery to farmers free-of-cost to treat crop residue for in-situ and ex-situ utilisation 2. Incentivisation for the use of custom hiring centres for farm machinery 3. Establishment of manufacturing units to produce goods from crop residue	Union Cabinet, Government of India
Formulation of policy document laying out how to incentivise private manufacturing units producing goods from crop residue	Encouragement to private investment in the production of biomass energy and goods manufactured from crop residue	Department of Industrial Policy and Promotion, Government of India/Departments of Commerce and Industry in the Governments of the NCT of Delhi, Punjab, Haryana and Uttar Pradesh Ministry of New and Renewable Energy, Government of India/Departments of Power in

		the Governments of NCT of Delhi, Punjab, Haryana and Uttar Pradesh

3. Compliance/Enforcement Measures

ISSUE REQUIRING MONITORING/ENFORCEMENT	MEASURES REQUIRING INCREASED OFFICIAL MANPOWER	MEASURES REQUIRING TECHNOLOGY	MEASURES REQUIRING CITIZEN-SUPPORT	MEASURES REQUIRING AWARENESS AND TRAINING
Ministry of Power, in consultation with State authorities and the MoEFCC, to issue a phase-wise closure notice, with the least efficient being closed first	Public and private manufacturing units producing goods that use crop residue to pay farmers fixed prices for crop residue, depending upon the weight of the residue, as set out by FAUN	Ministry of Urban Development, Government of India to allow people to register complaints regarding dust at construction sites through the Swacch Delhi App on their phones	Municipal Corporation of Delhi/Department of Environment, Government of NCT of Delhi to issue directions to RWAs under the *Bhagidari* Scheme of the NCT of Delhi	the MoEFCC and Ministry of Power, with the technical assistance of the CPCB and SPCBs/DPCC to institute a training and accreditation programme in relation to the COEMS Framework
SPCBs/DPCC to enforce installation of FGD/SCR through inspections and surprise-checks	Government of NCT of Delhi to recruit more officers into the DPCC and MCD to monitor dust emissions at construction sites and fly ash emissions at RMC Plants			Ministry of New and Renewable Energy, Government of India/Departments of Power in the Governments of NCT of Delhi, Punjab, Haryana and Uttar Pradesh to create awareness about subsidies and financial assistance being provided to private investors to set up bio-mass plants under the Make in India

				programme
Regional Offices of the MOEFCC to enforce installation of FGD/SCR through analyses of monthly compliance reports submitted to the MoEFCC				DPCC to conduct awareness programs for RMC Plant operators under Clause (1)(a) read Clause (1)(c) of Section 17 of the Air Act
The CERC to assess the impact of installation of pollution control technology on electricity tariffs through a technical study				

II. SOURCE-WISE ANALYSIS

A. Coal-Fired Power Plants

1. Contribution to Pollution

The IIT Kanpur's Comprehensive Study on Air Pollution and Green House Gases (GHGs) in Delhi ('IIT Kanpur Report') states that 13 thermal power plants ('TPPs') with a capacity of over 11000 MW in the radius of 300km of Delhi are expected to contribute to air pollution in the city.[3] Under windy conditions, the influence of the emissions from TPPs can be tracked to distances as far as 400 km from the source region.[4] The secondary particles emitted from these plants contribute 30% and 15% of $PM_{2.5}$ in winters and summers respectively. In summers, coal and fly ash contribute approximately 30% of PM_{10}. Additionally, fly ash stored at ash ponds at TPPs also contributes to particulate matter. According to the Centre for Science and Environment ('CSE') report of 2016, coal-based TPPs contribute to 45% of Sulphur Dioxide ('SO_x'), 30% of Nitrogen Oxides ('Nox') and 80% of mercury of all industrial emissions in India.[5]

SO_2 and NOx generated from thermal power emissions go on to form secondary particles such as NO_3^-, SO_4^{-2}, and NH_4^+, which are highly toxic and greatly pollute the air. According to the IIT Kanpur Report, controlling emissions of SO_2 and Nox in thermal power plants can reduce PM_{10} concentration by approximately 99 µg/m3 and $PM_{2.5}$ by about 57 µg/m3 in Delhi.

In the table below, we have compiled a list of the coal-based TPPs in and around 300 km of New Delhi, and have also specified their capacity and the State in which they are located:

Table 1: List of Thermal Power Plants within a 300-km radius of New Delhi

S.No.	Power Plant	Existing Capacity in MW	State
1.	**Badarpur Thermal Power Plant, Badarpur**	720	New Delhi
2.	**Dadri Thermal Power Plant, Gautam Buddh Nagar**	1820	Uttar Pradesh

[3] Indian Institute of Technology Kanpur, 'Comprehensive Study on Air Pollution and Green House Gases (GHGs) in Delhi' (January 2016), <http://delhi.gov.in/DoIT/Environment/PDFs/Final_Report.pdf> accessed on 2 February, 2017 ('IIT Kanpur Report').

[4] Guttikunda SK and Jawahar P, 'Atmospheric Emissions and Pollution from the Coal-Fired Thermal Power Plants in India' (2014) 92 ATMOSPHERIC ENVIRONMENT 449.

[5] Centre for Science & Environment, 'New Environmental Norms for the Power Sector: Proceedings and Recommendations of the Stakeholder Workshop Organized by CSE', <http://cseindia.org/userfiles/new-environmental-norms-report.pdf> accessed on 14 March, 2017.

3.	**Harduaganj Thermal Power Plant, Aligarh**	665	
4.	**Rosa Thermal Power Plant, Shahjahanpur**	1200	
5.	**Faridabad Thermal Power Plant, Faridabad**	55	Haryana
6.	**Panipat Thermal Power Plant, Panipat**	1360	
7.	**Rajiv Gandhi Thermal Power Plant, Hisar**	1200	
8.	**Indira Gandhi Thermal Power Plant, Jhajjhar**	1500	
9.	**Deenbandhu Chhotu Ram Thermal Power Station, Yamuna Nagar**	600	
10.	**Guru Gobind Singh Super Thermal Power Plant, Rupnagar**	1260	Punjab
11.	**Guru Hargobind Thermal Plant, Lehra Mohabbat**	420	
12.	**Guru Nanak Dev Thermal Plant, Bathinda**	440	
13.	**Rajpura Thermal Power Plant, Patiala**	1400	

2. Reasons for the problem

A weak monitoring mechanism and insufficiently stringent standards are the primary reasons for the large percentage of toxic emissions from TPPs. The legal framework governing TPPs does not require plant operators to compulsorily install specific technologies and devices for controlling pollution. While emission limits have been prescribed, they cannot be achieved without also prescribing appropriate technology to absorb/reduce excess emissions. This leaves room for the under-reporting of emission values by power companies to demonstrate compliance with the prescribed limits. Additionally, despite proper regulation and mandated targets, the maintenance of ash pond and utilization of fly ash remains a great challenge.

(a) *Weak Legal/Policy Framework*

The pollution emitted from TPPs can be effectively controlled using air pollution abatement technologies. At present, such technology is mandatorily required only in the case of particulate matter—TPPs are required to install Electrostatic Precipitators ('ESPs') for stack and beneficiation of Indian coal with imported coal to reduce the ash content. However, no technology has been mandated so far to curb NOx and SOx emissions.

(i) Emission Standards for Thermal Power Plants

In December, 2015, the MoEFCC notified the first ever emissions standards for TPPs in India under the Environment (Protection) Amendment Rules, 2015. The notification prescribed stricter standards for TPPs that would be commissioned in 2017, but prescribed relaxed emission limits for existing and older thermal power plants. The standards failed to prescribe any legally binding technical measures for deNOx-ing and deSOx-ing the emissions. A summary of the new emission standards for thermal power plants is provided below:

Table 2: New Emission Standards for Thermal Power Plants under the Environment (Protection) Amendment Rules, 2015

Units in mg/Nm^3	PM	SO_2	NOx	Mercury
Units installed till 2003	100	<500 MW—600 ≥500 MW—200	600	≥500 MW—0.03
Units installed between 2004 and 2016	50	<500 MW—600 ≥500 MW—200	300	0.03
Units installed after Jan 2017	30	100	100	0.03

To get a better sense of how these standards will apply to existing TPPs, see the table below for a breakup of existing TPPs in India as of 31st August, 2016.

Table 3: Thermal Power Producing Units in India as of 31st August 2016 (Source: CSE Report, 2016)

Unit size	Capacity in MW				
	+25 years	1990–2003	2004–08	2009–16*	Total
up to 250 MW	28,610	16,292	2,070	5,816	52,788
> 250 and <500 MW	–	5,350	3,850	20,810	30,010

500 MW and above	5,500	9,500	5,980	82,814	1,03,794
Total	34,110	31,142	11,900	1,09,440	1,86,592

The units installed until December, 2016 have been allowed to emit higher levels of SO_2 (up to 600 mg/Nm^3 for smaller units and 200 mg/Nm^3 for units of 500 MW and above) in comparison with the limits prescribed for the newer plants (100 mg/Nm^3). This fails to take into account that existing TPPs with a capacity of 500 MW and above that received environmental clearance from 2003 onwards, were also required by the MoEFCC to allocate space for Flue Gas Desulphurisation ('FGD') for controlling SO_2 emissions. Such existing plants—installed between 2004 and 2016 with a total capacity of 88794 MW)—therefore have the capability to install technologies to reduce SO_2 emissions. The new emission standards, however, do not reflect this capability. Ideally, all such plants ought to be required to install FGD units and correspondingly reduce SO_2 emissions.

(ii) Environmental Clearances

All coal-based TPPs of capacity ≥ 50 MW need to go through an Environment Impact Assessment ('EIA') in accordance with the Environment Impact Assessment Notification, 2006 (EIA Notification', issued under the Environment Protection Act, 1986 ('EPA'). The final environmental clearance certificate usually proposes measures for reducing emissions based on the impact assessment of the particular project. However, impact studies are usually assessed for one season and only up to a 10-15 km radius around the project. As impact assessments are done over a short time and for a relatively small area, the safeguards that are proposed also keep in mind only the effects of emissions on the local environment.

If the more long-term and long-distance impact of emissions from TPPs were considered by the assessing authorities, then appropriate conditions such as tall stack height and the beneficiation of coal could also be required for the dispersal of pollutants such as SO2 and NOx. This might even rule out the need for advanced technologies such as FGD or Selective Catalytic Reduction ('SCR'). Currently, however, the MOEFCC only prescribes the installation of ESPs to control PM emissions, as a condition for granting environmental clearances to TPPs. It is entirely a matter of discretion for the MOEFCC to recommend the installation of FGD and SCR as conditions attached to the grant of such clearances.

(iii) Siting Guidelines

According to the MOEF's Environmental Guidelines for Thermal Power Plants, 1987, TPPs should not be situated within 25 km of the outer peripheries of metropolitan cities and natural places.[6] Had the guidelines been published before commissioning the Badarpur TPP in 1973, the said project

[6] Ministry of Environment & Forests, 'Environmental Guidelines for Thermal Power Plants', <http://ercindia.org/files/guidelines/Environmental%20Guidelines%20for%20Thermal%20Power%20Plants%20(Rare%20Document).pdf> accessed on 14 March, 2017

would never have existed in its present location. Now, the power plant is a major polluting source in Delhi. Moreover, even these guidelines are inadequate, given that the impact area of emissions from TPPs is far beyond the 25-km radius. These siting guidelines ought to be revised to reduce the impact that emissions from new TPPs will have on human health.

(b) *Weak Implementation*

(i) Compliance with Environmental Safeguards

The EIA Notification requires every TPP proponent to submit bi-annual compliance reports on each condition listed in the environmental clearance certificate to the MOEFCC, Central Pollution Control Board ('CPCB') and State Pollution Control Boards ('SPCBs'). Since there is self-reporting of compliance with these conditions, including emissions data, there is potential for such data to be tampered with, allowing project proponents to under-report emissions in order to demonstrate compliance.[7] In most cases, the MOEFCC empowers its Regional Offices to monitor compliance with environmental clearance conditions, but as a recent report on environmental clearances by the Comptroller and Auditor General ('CAG') of India demonstrates, this monitoring is very poor.[8]

The Graded Action Plan also suggests stringent enforcement of pollution control in TPPs through monitoring by Pollution Control Boards. However, for such enforcement to be effective, clearer monitoring mechanisms, along the lines recommended in Section 3 are proposed.

(ii) Compliance with Fly Ash Notification

The Fly Ash Notification, 2009, issued under the EPA makes it mandatory for all TPP operators to utilise 100% of all fly ash at the plant within 5 years of its generation.[9] This fly ash could be supplied to manufacturing units within a 100-km radius of the plant that produce fly ash-based products for use in construction activities. In 2016, the 100-km radius was increased by the MOEFCC to 300 km.[10] Details of the fly ash utilized in Delhi and its surrounding States, according to data released by the CPCB in 2015-16 is set out below:

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[7] Chandra Bhushan, Sanjeev Kumar Kanchan, Soundaram Ramanathan, Angeline Sangeetha Suresh, Priyavrat Bhati, N Sai Siddhartha, and Abhishek Rudra, 'Coal Toll', *Down to earth* (28th February 2015), <http://www.downtoearth.org.in/coverage/coal-toll-48581> accessed on March 14, 2017

[8] Indian Audit and Accounts Department, Government of India, 'Report of the Comptroller and Auditor General of India on Environmental Clearance and Post Clearance Monitoring', Performance Audit 39 of 2016, <http://www.cag.gov.in/sites/default/files/audit_report_files/Union_Government_Report_39_of_2016_PA.pdf> accessed on 15 March, 2017

[9] Ministry of Environment, Forests & Climate Change, 'Fly Ash Notification, 2009', <http://dste.puducherry.gov.in/Flyash_notification2009.pdf> accessed on 14 March, 2017

[10] Ministry of Environment, Forests & Climate Change, 'Amendment to Fly Ash Notification, 2016', <http://www.moef.nic.in/sites/default/files/fly%20ash%20amendment%202016.pdf> accessed on 14 March, 2017

Table 4: Percentage of Utilisation of Fly Ash in Delhi and surrounding States (Source: CPCB[11])

S.No.	States	Utilization (%) of Fly Ash
1.	Delhi	130.45
2.	Haryana	110.52
3.	Punjab	85.04
4.	Uttar Pradesh	47.9

This demonstrates that the fly ash utilization program has been successful in Delhi and Haryana. However, Punjab and Uttar Pradesh are yet to achieve their 100% fly ash utilization target, with Uttar Pradesh failing to utilise even 50% of the fly ash generated.

3. Proposed Solutions

While resolving the problems presented by TPPs, it is imperative that a balanced approach is adopted, keeping in mind energy needs as well as public health concerns. We suggest the following solutions to strengthen the emission control and monitoring framework, to be applied uniformly across all States.

(a) *Amendment to existing laws*

(i) Environment (Protection) Rules, 1986

The pollution levels from TPPs can be effectively reduced by targeting the emission of key pollutants such as SO_2 and NOx. To control SO_2, the installation of FGDs ought to be required in all TPPs, and should be made mandatory in all older units where the space for FGD already exists. Where the installation is not feasible due to space constraints, other technical measures such as

[11] Central Pollution Control Board, Pollution Control Implementation Division-II, 'Environmental Regulations Coal Based Thermal Power Plants', <http://www.cpcb.nic.in/divisionsofheadoffice/pci2/ThermalpowerPlants.pdf> accessed on 14 March, 2017.

'Spray Dry Scrubber' and 'Sea Water Scrubbing' must be mandated as suggested in the Draft National Electricity Plan, 2016[12] ('CEA, 2016') as well as in the IIT Kanpur Report. Similarly, to control the emission of NOx, SCR technology ought to be made mandatory for all TPPs. The installation of such technology may be made a legally binding requirement by amending the Environment (Protection) Rules, 1986.

The impact of the implementation of such pollution control technology on the tariff rates of electricity also ought to be assessed by the Central Electricity Regulatory Commission ('CERC') in a time-bound manner to regulate the pricing of electricity appropriately.

(ii) EIA Notification, 2006

The EIA studies required of TPPs should be based on air quality monitoring data collected over an entire year. The impact of emissions from each power plant should also be assessed up to 300 kilometres. In addition, the installation of FGD and SCR should be made a condition for granting environmental clearance to new TPPs. These measures will require the amendment of the EIA Notification, 2006.

(b) *Strengthen Monitoring*

(i) Develop a Continuous Online Emission Monitoring System

We propose the creation of a Continuous Online Emission Monitoring System ('COEMS'), a national level uniform system of sampling, conditioning, and analytical components and software designed to provide direct, real-time, continuous measurements of pollutant concentrations by analysing representative samples of the flue gas. Given that China faces similar demographic and budgetary constraints as India, a good model is the three-tier Continuous Emission Monitoring System ('CEMS') for TPPs adopted there. The first tier corresponds to the national Automatic Monitoring and Control ('AMC') centre established within the environmental supervision bureau of the Ministry of Environmental Protection ('MEP') and the five AMC centres within the regional environmental supervision centres of MEP; the second tier refers to the AMC centres established at the provincial Environmental Protection Bureaus ('EPBs'); the third tier refers to the AMC centres established at municipal EPBs. Most of the CEMS are operated and maintained by third party certified vendors who are required to comply with regulations and technical guidelines published by the MEP.[13]

The CPCB has already asked for the installation of 'Online Continuous Stack Emission Monitoring Systems ('OCSEMS') in 17 categories[14] of highly polluting industries located in the Ganga basin area.

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[12] Central Electricity Authority, Ministry of Power, Government of India, 'Draft National Electricity Plan', Volume 1, <http://www.cea.nic.in/reports/committee/nep/nep_dec.pdf> accessed on 14 March, 2017

[13] Zhang X and Schreifels J, 'Continuous Emission Monitoring Systems at Power Plants in China: Improving SO2 Emission Measurement' (2011) 39 ENERGY POLICY 7432.

[14] Central Pollution Control Board, 'List of Industries for Online Monitoring of Industrial Emission and Effluent', <http://cpcb.nic.in/Online_Monitoring_Clarification.php> accessed on 23 March, 2017

However, this has not been effectively implemented despite several efforts made by SPCBs.[15] The Online CEMS Data Submission Procedure[16] available on the CPCB website unclear regarding the procedures and scientific guidelines for monitoring. For instance, the CPCB does not clarify whether the real-time data that is supposed to be collected at 15 minute intervals ought to be directly reported to the CPCB server or filtered through the instrument supplier's website. The portals (http://182.71.8.74/air_quality/ and http://assetlogiciq.com/) where the monitoring information is required to be uploaded by the industry/instrument supplier are not accessible by the general public and therefore, do not constitute a transparent system of monitoring.

Instead, it is recommended that real-time emission data be reported directly to CPCB servers and simultaneously be displayed live on a national level GIS portal like SAFAR[17] or BHUVAN[18] for public information.

(ii) Introduce Standardised Procedures and Accreditation for Monitoring

Studies have shown that a continuous emission monitoring system like CEMS can provide the most accurate and consistent data set that is necessary for assessing compliance with emission control requirements. However, such systems must be properly designed, installed, operated, maintained, quality assured, and inspected to ensure compliance.[19] The standardisation of all emission control and monitoring equipment is the first step towards this process. The CEA and CPCB ought to work together to notify standard procedures and technical manuals for such equipment in TPPs. Such manuals ought to clearly specify the procedure related to the installation, calibration, sampling, conditioning, etc. of the equipment. Similar guidelines for TPPs published by the CEA have not specifically addressed this aspect of emission control monitoring. The MoEFCC, on the advice of the CPCB, may then consider incorporating such procedures and manuals into its regulatory framework.

It is equally critical that the persons involved in air pollution data collection are well-trained. Only trained professionals should be engaged in the operation and maintenance of air pollution monitoring equipment. An accreditation program must be launched by the Ministry of Power and MOEFCC to certify professionals and companies that may be engaged for operating the COEMS

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[15] Central Pollution Control Board, 'Directions under Section 18(1)(b) of the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981 in the matter of pollution control in 17 categories of highly polluting industries and ROG- Regarding Self Monitoring of Compliance', <http://cpcb.nic.in/Directions_all_SPCBs_09.02.17.pdf> accessed on 23 March, 2017

[16] Central Pollution Control Board, 'Online CEMS Data Submission Procedure at CPCB', <http://cpcb.nic.in/Online/Procdure_data-submission_CPCB.pdf> accessed on 23 March, 2017

[17] Website of SAFAR – India: System of Air Quality and Weather Forecasting and Research, Ministry of Earth Science, Government of India, and Indian Institute of Tropical Meteorology, Pune, <http://safar.tropmet.res.in> accessed on 23 March, 2017.

[18] Website of Bhuvan: Indian Geo-Platform of Indian Space Research Organisation, <http://bhuvan.nrsc.gov.in> accessed on 23 March, 2017.

[19] Schakenbach J, Vollaro R and Forte R, 'Fundamentals of Successful Monitoring, Reporting, and Verification under a Cap-and-Trade Program' (2006) 56 JOURNAL OF THE AIR & WASTE MANAGEMENT ASSOCIATION 1576.

initiative. The professionals accredited under COEMS ought to be accountable to government authorities only. The contracts for maintenance and operation of COEMS should be the responsibility of SPCBs and supervised by the Regional Offices of MOEFCC. To operationalise and maintain the COEMS, thermal power companies could deposit a fixed monetary amount with the MoEFCC. The estimated costs and budgets involved in this process ought to be estimated by the CEA and the Ministry of Power. The MOEFCC could then independently commission accredited COEMS consultants through its Regional Offices and SPCBs using online tenders.

(c) *Phasing out Smaller and Inefficient Units*

The relatively old units with production capacity of less than 500 MW pose a grave problem, not only because of their low efficiency and shorter stack heights, but also because of their significantly higher contribution towards air pollution. The latest pollution control technologies are incompatible with such units and the alternative measures are too expensive for power generation to be economically feasible for such units.

According to CSE, up until August 2016, the combined capacity of all thermal power units that completed 25 years of their operation was over 34,000 MW. As per the Draft Electricity Plan, 2016, power projects with a capacity of approximately 50,025 MW are currently under different stages of construction and are likely to yield benefits during the period 2017-22. The report reveals that no coal-based capacity addition may be required during this period. Additionally, to accommodate Renewable Energy Sources ('RES') into the grid, TPPs may have to run at a low Plant Load Factor ('PLF') in the future. Many plants may get partial/nil schedule of generation. The report also shows that the national average PLF of coal-based power generating stations has decreased from 78.9% in 2007-08 to 62.0% in 2015-16. Thus, it is reasonable to infer that phasing out 34,000 MW of older inefficient units will not have a significant impact on power production.

The PLF of existing power plants can be increased to compensate the deficit. Furthermore, there is additional capacity of approximately 50,000 MW which will be operationalised with new power plant projects that are currently underway. A district-wise list of all TPPs ought to be prepared, classifying them in terms of their efficiency of operation as well as respective PLFs. The least efficient thermal power units must be the first category of units to be phased out followed by other lesser efficient units which have completed their designed life.

(d) *Fly Ash Management*

The Graded Action Plan recommended watering the fly ash every alternate day during March-May as a short-term measure. We recommend that until the individual TPPs achieve 100% utilization of fly ash, the ash dumping sites should be under continuous monitoring and the watering should not be limited only to alternate days. During summers, temperatures in Delhi and surrounding areas frequently cross 40° Celsius, requiring the frequency of watering to be increased.

An amendment to the Fly Ash Notification in 2016 states that it is the duty of State authorities involved in approving construction projects to ensure that the utilisation of fly ash is arranged

through an MoU and other arrangements between construction agencies and TPPs. For States which showed poor utilization of fly ash such as Uttar Pradesh, the State government ought to prepare a district-wise fly ash utilization inventory and analyse the reasons for such poor implementation. Based on this, further steps could be taken to ensure that targets of fly ash utilization are achieved more promptly.

4. Summary of Action points

Table 5: Implementation Action Plan for emissions from Coal-Fired Power Plants

Proposed Measures	Targets	Responsible Authority	Implementation Route	Timeline
Phasing Out Older and Inefficient Units	Make district-wise inventory of all thermal power units, categorised according to efficiency and PLF. Distinctions ought to be made between 'least efficient', 'less efficient' and 'efficient' units, with a similar categorisation for PLF	CEA	Through a policy document and action plan/roadmap on phasing out TPPs	3 months
	Issue a phase-wise closure notice, with the least efficient being closed first	Ministry of Power, in consultation with State authorities and the MoEFCC[20]	Ditto	+6 months onwards

[20] Shreya Jai, 'Power Ministry to Shut Down 6,000 MW Thermal Capacity', *Business Standard* (7 September 2016), <https://www.pressreader.com/india/business-standard/20160907/281487865794030> accessed on 3 April, 2017.

Revision of emission limits for older TPPs and the compulsory installation of De-Sox and De-Nox technology	Issue draft standards/limits Notify new standards/limits after receiving comments from stakeholders	MOEFCC, with technical assistance from the CPCB	Amendment of the Environment (Protection) Rules, 1986	6-12 months to notify
Enforce installation of FGD/SCR	Begin process of monitoring compliance with revised standards (mentioned above) once the time for installation of technology has passed Undertake periodic check-ups to ensure compliance	SPCBs/DPCC	Through inspections and surprise-checks by SPCBs/DPCC officials	Monitoring ought to begin immediately after notification
		Regional Office, MOEFCC	Through analyses of monthly compliance reports submitted to the MoEFCC	Action to be taken on receipt of compliance report
Assess the impact of installation of pollution control technology on electricity tariffs		CERC	Through a technical study	3 months

Introduce and institutionalise the COEMS framework	Develop standard procedures and technical manuals for emission control and monitoring equipment Draw up budget	CEA	Notification of standards and manuals once developed	6-12 months
	Institute a training and accreditation programme	MoEFCC and Ministry of Power, with the technical assistance of the CPCB and SPCBs/DPCC	Details of the programme may be released through circulars/office memoranda	Programme ought to commence once standards and manuals have been finalised

B. Vehicular Pollution

1. Contribution of Pollution

Vehicular pollution is the second largest source of air pollution in Delhi.[21] According to the IIT Kanpur Report, vehicular pollution is the cause of 83% CO emissions, 36% of NOx emissions, 20% of $PM_{2.5}$ and 9% of PM_{10}.[22] It is also a cause of secondary particulates which further pollute the air, especially in the formation of nitrates.[23] While vehicles consistently contribute to $PM_{2.5}$ and PM_{10} throughout the year, there is a seasonal variation in the percentage of contribution i.e. in winter, vehicles contribute 20-25% to particulate pollution but only 6-9% in the summers.[24]

There is a correlation between the increase in the number of vehicles and the increase in pollution in Delhi. Since 2000, vehicles have increased by 97%, while particulate matter has increased by 75%.[25] NOx has increased by 30% between 2002 and 2014.[26]

2. Reasons for the problem

The current legal framework on vehicles regulates specific aspects of each vehicle. For example, there are rules on the emission standards that vehicles need to comply with,[27] the tax that needs to be paid to ply a vehicle,[28] rules on registering a vehicle[29] and conducting regular pollution checks[30]. However, there is no coherent policy on how to address vehicular pollution as a source of air pollution in Delhi. The measures that have been implemented up till now are limited to temporary directions such as the odd-even policy or poorly implemented orders such as the phasing out of old vehicles. Consequently, there is a need to have a holistic policy to address vehicular pollution in Delhi.

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[21] IIT Kanpur Report (n 3).

[22] IIT Kanpur Report (n 3).

[23] IIT Kanpur Report (n 3).

[24] IIT Kanpur Report (n 3).

[25] Centre for Science and Environment, 'Short and medium term measures to clean up the air of Delhi' (December 2015), <http://cseindia.org/userfiles/Report-on-status-of-pollution.pdf> accessed on 2 February, 2017; Centre for Science and Environment, 'Delhi Clean-Air Action Plan' (2014), <http://www.cseindia.org/userfiles/DelhiCleanAirActionPlan.pdf> accessed on 2 February, 2017.

[26] *Ibid* at Delhi Clean-Air Action Plan.

[27] Central Motor Vehicles Rules 1989, Rule 115.

[28] Delhi Motor Vehicles Taxation Act 1962, Section 3.

[29] Delhi Motor Vehicles Act 1988, Sections 39-43.

[30] Central Motor Vehicles Rules 1989, Rule 115(7).

The policy must have a multi-pronged approach through which public transport can be strengthened and private transport can be made more environmentally friendly. There is no dearth of policy recommendations with respect to public transport,[31] with the Delhi government taking steps to strengthen the public transport infrastructure[32] and improve last mile connectivity.[33] However, the same level of resources has not been devoted to improving the efficiency of private means of transport. Therefore, this report is restricted to the measures necessary for reducing emissions from private transport. However, a key caveat for the success of these recommendations is that they will not be wholly effective if public transport is not a viable alternative for commuters. The three problem areas related to private transport are-

(a) *Low Cost of Private Transport*

The private ownership of vehicles is an unaddressed aspect of vehicular pollution in Delhi. After Delhi was declared to be the World's Most Polluted Major City[34] in 2015 by the World Health Organisation ('WHO')[35] the number of cars and jeeps bought increased from 27,90,566 in 2014-15 to 29,86,579 in 2015-16; at the same time, the number of two-wheelers increased from 56,81,265 to 61,04,070. Thus, Delhi saw a record 9.93% increase in vehicle registration, after its declaration as the World's Most Polluted Major City.[36] This is not only problematic in the context of air pollution, but also in the context of urban infrastructure, as the limited road space cannot support the unchecked rise of private vehicles in Delhi.[37]

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[31] Transport Department, Government of NCT of Delhi, 'Tackling Urban Transport- Operating Plan for Delhi' (October 2002), <http://tripp.iitd.ac.in/delhibrts/brts/hcbs/hcbs/gnctpress1.htm> accessed on 2 February, 2017; National Transport Development Policy Committee, 'Urban Transport' (2014), <http://planningcommission.nic.in/sectors/NTDPC/voulme3_p2/urban_v3_p2.pdf> accessed on 2 February, 2017.

[32] 'Delhi budget aims to address air pollution with transport reforms', *Down to Earth* (26 June 2015), <http://www.downtoearth.org.in/news/delhi-budget-aims-to-address-air-pollution-with-transport-reforms-50345> accessed on 2 February, 2017.

[33] Sidhartha Roy & Jatin Anand, 'Delhi's public transport: Last-mile connectivity continues to be a problem', *The Hindu* (11 February 2016), <http://www.thehindu.com/news/cities/Delhi/delhis-public-transport-lastmile-connectivity-continues-to-be-a-problem/article8220965.ece> accessed on 2 February, 2017.

[34] Anu Anand, 'Breathing poison in the world's most polluted city', *BBC* (19 April 2015), <http://www.bbc.com/news/magazine-32352722> accessed on 2 February, 2017.

[35] A dubious distinction which we have since relinquished, *see* 'Delhi second-most polluted major city in the world, says WHO study', *The Indian Express* (28 September 2016), <http://indianexpress.com/article/india/india-news-india/delhi-pollution-traffic-air-quality-second-most-polluted-city-who-3053607/> accessed on 2 February, 2017.

[36] 'At 10 million, Delhi hits record number of vehicles; air pollution up too', *Hindustan Times* (30 December 2016), <http://www.hindustantimes.com/delhi/at-10mn-delhi-hits-record-number-of-vehicles-air-pollution-numbers-also-up/story-PggGsRBPIrB6gxKOoZukOL.html> accessed on 2 February, 2017; Directorate of Economics & Statistics, Government of NCT of Delhi, 'Delhi Statistical Hand Book' (2016) 211 <http://www.delhi.gov.in/wps/wcm/connect/ab16f8004f8106d58588ddd87adfa114/Delhi+Statistical+Hand+Book+2016.ps++dt.09-12-2016.pdf?MOD=AJPERES&lmod=1240964727&CACHEID=ab16f8004f8106d58588ddd87adfa114> accessed on 2 February, 2017.

[37] O.P. Agarwal, 'Urban Transport' in Anupam Rastogi (mng. ed.), *India Infrastructure Report* (OUP, 2006).

Apart from the low road tax rates that this reflects, low parking charges and the availability of free parking in residential areas also make the private ownership of vehicles very attractive for Delhi's residents. The Graded Action Plan lays down a 3-4 times increase in parking charges when pollution levels are 'very poor'. However, parking prices can also be used more generally as an economic disincentive to own a private vehicle.

(b) *Unchecked Plying of High Polluting Vehicles*

The Ministry of Road, Transport and Highways ('MoRTH'), under rule 115 of the Central Motor Vehicles Act, 1989, lays down emission standards for vehicles in the form of Bharat Stage emission levels ('BS'). BS has specifications on various factors that affect the level of pollution from a vehicle i.e. engine design, fuel characteristics etc.[38] India follows a staggered implementation of BS levels as shown in the table below.

Table 6: Implementation of Bharat Stage Norms in India [Source: Society of Indian Automobile Manufacturers]

S.No.	Standard	Date of Implementation	Region
1.	**India 2000**	2000	Nationwide
2.	**Bharat Stage II**	2001	NCR, Mumbai, Kolkata, Chennai
		2003.04	NCR, Mumbai, Kolkata, Chennai, Bangalore, Hyderabad, Secunderabad, Ahmedabad, Pune, Surat, Kanpur and Agra
		2005.04	Nationwide
3.	**Bharat Stage III**	2005.04	NCR, Mumbai, Kolkata, Chennai, Bangalore, Hyderabad, Secunderabad, Ahmedabad, Pune, Surat, Kanpur and Agra
		2010.04	Nationwide [It also ought to be noted that the Supreme Court has banned the registration and sale of BS-III fuel compliant vehicles from 1 April, 2017, when the BS-IV fuel standards are set to be enforced]

[38] Auto Fuel Vision and Policy 2025, Report of the Expert Committee, Government of India (2014), <http://petroleum.nic.in/docs/autopol.pdf> accessed on 2 February, 2017.

4.	**Bharat Stage IV**	2010.04	NCR*, Mumbai, Kolkata, Chennai, Bangalore, Hyderabad, Secunderabad, Ahmedabad, Pune, Surat, Kanpur, Agra, Solapur and Lucknow
		2017.04	Nationwide
5.	**Bharat Stage V**	n/a	
6.	**Bharat Stage VI**	2020.04	Nationwide

Source: http://www.siamindia.com/technical-regulation.aspx?mpgid=31&pgidtrail=33

According to MoRTH, BS-IV will be implemented nationwide from April, 2017, whereas India will leapfrog to BS VI by April 2020.[39] However, the impact of advancing to BS VI in 3 years is limited because the yardstick used to stop old vehicles from plying in India is age. As per the order of the National Green Tribunal ('NGT') in *Vardhaman Kaushik v. Union of India,* the life of a vehicle in Delhi is 15 years for petrol vehicles and 10 years for diesel vehicles.[40] This implies that BS II compliant vehicles can ply in Delhi till 2020, BS III vehicles till 2025 and BS IV vehicles till 2032. However, as mentioned earlier, the Supreme Court order imposing a freeze on the registration and sale of BS III vehicles from 1 April 2017 changes this.

Given that with every BS, the level of pollutants emitted by a vehicle significantly reduces[41] and that vehicles that are older than 10 years are the most severe polluters (as they emit 10 to 12 times more pollutants than a new vehicle[42]), there is a need to re-examine the rules and incentives for phasing out old vehicles.

Additionally, the poor penetration of BS standards is also because of a lack of coordination in relation to economic incentives. For instance, the Indian Auto Fuel Policy 2025 ('Auto Fuel Policy')[43] cites the availability of cheaper BS III fuel in areas on the periphery of designated BS IV

[39] Draft Central Motor Vehicles (Amendment) Rules, 2016, Ministry of Road Transport and Highways, Government of India, <http://egazette.nic.in/WriteReadData/2016/168300.pdf> accessed on 2 February, 2017.

[40] *Vardhaman Kaushik v. Union of India*, OA No. 21 &95 of 2014, National Green Tribunal (7 April 2015).

[41] For example- technologies required by Euro IV (BS IV equivalent) can reduce $PM_{2.5}$ emissions of diesel commercial vehicles by over 75% from Euro III levels (BS III equivalent)- The International Council on Clean Transport, 'The Impact of Stringent Fuel and Vehicle Standards on Premature Mortality and Emissions: Placing India within the Global Context' (September 2013), <http://www.theicct.org/sites/default/files/publications/ICCT_Briefing_IndiaHealth_20130926.pdf> accessed on 2 February, 2017.

[42] Ministry of Road, Transport and Highways, Government of India, 'Concept Note: Voluntary Vehicle Fleet Modernisation Programme' (26th May 2016), <http://morth.nic.in/showfile.asp?lid=2144> accessed on 2 February, 2017.

[43] Auto Fuel Vision and Policy 2025 (n 38).

cities as a reason for the low penetration of BS IV fuel.[44] If BS IV fuel was available in such areas or the price of BS III and BS IV fuel was equalized, there would be no difference in economic incentives.

Another area of focus is incentivising cleaner fuel. Globally, there is a move to phase out vehicles that run on fossil fuels and move to low carbon emitting vehicles. For instance, countries such as Norway[45] and Germany[46] have committed to banning diesel and petrol cars by 2025 and 2030 respectively. London, Mexico, Madrid and Athens have committed to banning diesel vehicles.[47] The Auto Fuel Policy also highlights the benefits of alternative fuels and recommends measures to develop the infrastructure to move to low carbon emitting vehicles.[48]

However, a more immediate step would be to rationalise the price of diesel. This is because diesel is known to be a higher polluting fuel, emitting 4 to 9 times more deadly $PM_{2.5}$ than other fuels.[49] The higher levels of pollutants emitted by diesel also have serious health implications with the WHO declaring diesel as a carcinogen.[50]

Currently, the Central and State taxes impose a lower rate of tax on diesel as compared to petrol. For example, as of May 2016, the Value-Added Tax ('VAT') applied on diesel was 16.75%, and on petrol was 25%.[51] Similar variations exist in excise and custom duties also. This has resulted in diesel being a more lucrative fuel for vehicles. While the biggest consumers of diesel are commercial trucks and buses (40.80%), the second biggest users are cars and utility vehicles (25.42%).[52] Particularly, in the north zone, Delhi was found to have the highest usage of diesel by

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[44] Auto Fuel Vision and Policy 2025 (n 38).

[45] Jess Staufenberg, 'Norway to 'completely ban petrol powered cars by 2025', *Independent* (4 June 2016), <http://www.independent.co.uk/environment/climate-change/norway-to-ban-the-sale-of-all-fossil-fuel-based-cars-by-2025-and-replace-with-electric-vehicles-a7065616.html> accessed on 2 February, 2017.

[46] Bertel Schmitt, 'Germany's Bundesrat Resolves End of Internal Combustion Engine', *Forbes* (8 October 2016), <http://www.forbes.com/sites/bertelschmitt/2016/10/08/germanys-bundesrat-resolves-end-of-internal-combustion-engine/#1b39635731d9> accessed on 2 February, 2017.

[47] Matt McGrath, 'Four major cities move to ban diesel vehicles by 2025', *BBC* (2 December 2016), <http://www.bbc.com/news/science-environment-38170794> accessed on 2 February, 2017.

[48] IIT Kanpur Report (n 3).

[49] Environment Committee, 'Driving away from Diesel Reducing Air Pollution from Diesel Vehicles', (14th July 2015), <https://www.london.gov.uk/sites/default/files/Driving%20Away%20from%20Diesel%20final%20report.pdf> accessed on 2 February, 2017.

[50] International Agency for Research on Cancer, 'Diesel Engine Exhaust Carcinogenic', Press Release (June 2012), <https://www.iarc.fr/en/media-centre/pr/2012/pdfs/pr213_E.pdf> accessed on 2 February, 2017

[51] Notification No. F.3(10)/Fin(Rev-I)/2015-2016/DS-VI/547, dated 15th July, 2015, Finance (Revenue-1) Department, Delhi Secretariat, and Notification. No. F.3(2)/Fin(Rev-I)/2016-2017/dsvi/141, dated 6 May, 2016, Finance (Revenue-1) Department, Delhi Secretariat.

[52] Petroleum Planning and Analysis Cell, 'All India Study on Sectoral Demand of Diesel & Petrol' (2013), <http://ppac.org.in/WriteReadData/Reports/201411110329450069740AllIndiaStudyonSectoralDemandofDiesel.pdf> accessed on 2 February, 2017.

private cars and utility vehicles at 34.7%.[53] Consequently, steps need to be taken to check the increase of diesel vehicles in Delhi.

(c) *Poor Implementation of Existing Rules and Regulations*

However, the recommendations to address the above problems will be ineffective if steps are not taken to strengthen the enforcement of rules. Already existing rules to address air pollution are not effectively implemented as illustrated below:

- In 1998, the Supreme Court[54] ordered that commercial vehicles that were more than 15 years old would not be allowed to ply in Delhi. Almost two decades later, this direction is yet to be effectively implemented. A study undertaken by the UNEP in December 2015[55] documented the entry of 44 commercial vehicles that were more than 15 years old, over a 72-hour period.
- BS IV standards were meant to be introduced in metropolitan cities in April 2010. However, four years after the stipulated implementation date, penetration of BS IV gasoline was found to be only 24% and that for BS IV diesel only 16%.[56]

The enforcement body for many of these regulations, including the one relating to the assessment of age limits of vehicles, is the Delhi Traffic Police. One of the reasons for the poor enforcement by them is the multiplicity of authorities in control.[57] While the Delhi Transport Department lays down the rules and regulations, the enforcement of the same is undertaken by the traffic police which is controlled by the Ministry of Home Affairs. This leads to a situation where the lack of enforcement is blamed by one authority on the other. Additionally, the increase in vehicular traffic and the complexities of vehicular pollution are not matched by a proportional increase in the resources available to the enforcing authority.

Therefore, there is a need for coordination between different stakeholders in order to ensure that the existing standards are effectively implemented. The Graded Action Plan recommends the setting up of a two-tier structure with a Task Force at the Central level (comprising representatives from the CPCB, DPCC, Indian Meteorological Department and health experts) and a Monitoring Committee at the State level (responsible for implementation and to be

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[53] *Ibid*; Also see, 'All India Study on Sectoral Demand of Diesel & Petrol' (2013), <http://ppac.org.in/WriteReadData/Reports/201411110329450069740AllIndiaStudyonSectoralDemandofDiesel.pdf> accessed on 2 February, 2017.

[54] *M.C. Mehta v. Union of India*, AIR 1998 SC 2963.

[55] United Nations Environment Programme, 'Promoting Low Carbon Transport in India' (December 2015), <www.unep.org/transport/lowcarbon/> accessed on 2 February, 2017.

[56] Auto Fuel Vision and Policy 2025 (n 38).

[57] Standing Committee Report on Transport, Tourism and Culture, 'Report on Management of Road Transport in National Capital Region: Issues and Challenges' (27 August 2013) <http://164.100.47.5/newcommittee/reports/EnglishCommittees/Committee%20on%20Transport,%20Tourism%20and%20Culture/198.pdf > accessed on 2 February, 2017.

headed by a Chief Secretary).[58] However, this two-tier structure does not address the problem of coordination between the standard-setting bodies and the implementing authorities. This is evident from the implementation of the age, as opposed to emission standard-based, cut-offs for commercial vehicles by the Delhi Traffic Police.

3. Proposed Solutions

Based on the problems illustrated above, this section details certain measures that reduce the reliance on private transport, phase out the highest polluting vehicles from Delhi streets and strengthen implementation of rules for the better regulation of vehicular traffic and, by extension, vehicular pollution.

This section predominantly draws on the policies adopted by cities in China such as Beijing, Shanghai and Shenzhen in tackling vehicular pollution. The experiences of these Chinese cities are particularly important for recommendations on Delhi's air pollution as similar conditions exist between these cities i.e. high populations, burgeoning vehicular growth, similar congestion levels and dangerous levels of air pollution.[59] In the recommendations for reducing reliance on private vehicles, the policies of Singapore and Japan are also referred to, where their policies are similar to those of the Chinese cities.

(a) *Increase the cost of private vehicles*

(i) Increase in Road Tax Rates

Other countries have also experienced the problems of increasing vehicle fleet, high congestion on roads and severe air pollution crises. A step taken by some countries to check the growth of vehicles is to have a limited quota on the number of private vehicles that can be registered each year. Beijing follows this system, where the limited license plates are distributed through a lottery system.[60] Shanghai[61] and Singapore[62] have similar caps which are distributed through auctions.

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[58] Graded Response Plan (n 2).

[59] John Pucher *et al*, 'Urban Transport Trends and Policies in China and India: Impacts of Rapid Economic Growth' (July 2007) 27(4) TRANSPORT REVIEW 379, 380.

[60] The International Council on Clean Transportation, 'Review of Beijing's Comprehensive Motor Vehicle Emission Programmes' (October 2015), <http://www.theicct.org/sites/default/files/publications/Beijing_Emission_Control_Programs_201511%20.pdf > accessed on 2 February, 2017.

[61] United Nations Environmental Programme, 'UNEP Environmental Assessment Expo 2010 Shanghai, China' (2010), <https://wedocs.unep.org/rest/bitstreams/11896/retrieve> accessed on 2 February, 2017.

[62] Lye Lin Heng, 'Transport Based Air Pollution Management: The Singapore Experience' (2001) 6 ASIA PACIFIC JOURNAL OF ENVIRONMENTAL LAW 333, 340.

These caps have been successful in checking the growth of private vehicles in their respective cities—new car registrations dropped by 75% between 2010 and 2011 in Beijing,[63] Shanghai controlled its growth rate to below 10%[64] and Singapore controlled its vehicle growth rate to 0.5%.[65] However, these distribution systems have also led to rent-seeking behaviour. For example, the distribution of licenses has resulted in a black market for number plates in Beijing[66] and criticism in Shanghai and Singapore that the auction is skewed in favour of the rich.[67]

Moreover, an analogous cap might be seen to be inequitable in India with vehicle ownership seen as an aspiration. However, there is still scope to use economic tools as a disincentive to new vehicle ownership. In India, at the time of registering a vehicle, there are various charges that need to be paid such as registration charge (to process the application), parking charge (collected by the municipal authority) and road tax (imposed by the State Government).[68]

According to Section 3 of the Delhi Motor Vehicle Taxation Act, 1962, the Delhi Government imposes a one-time road tax on vehicles that are registered in the State as per the table below.

Table 7: Road Tax as a Percentage of Vehicle Cost Price

S.No.	Description of Motor Vehicle	Amount
1.	Two wheelers costing up to Rs. 25,000/-	2% of the cost price
2.	Two wheelers costing above Rs. 25,000/- and up to Rs. 40,000/-	4% of the cost price

[63] Jun Yang *et al*, 'A Review of Beijing's Vehicle Lottery', (January 2014), <http://www.rff.org/files/sharepoint/WorkImages/Download/EfD-DP-14-01.pdf> accessed on 2 February, 2017.

[64] Chen T & Zhao J, 'Bidding to Drive: Car License Auction Policy in Shanghai and Its Public Acceptance' (2013) 27 TRANSPORT POLICY 39, 40.

[65] Ma Jun, *The Economics of Air Pollution in China: Achieving Better and Cleaner Growth*, pg. 161 (Columbia University Press 2017).

[66] Review of Beijing's Vehicle Lottery (n 63); Owen Guo, 'Want to Drive in Beijing? Good Luck in the License Plate Lottery', *The New York Times* (Beijing, 28 July 2016), <https://www.nytimes.com/2016/07/29/world/asia/china-beijing-traffic-pollution.html> accessed on 2 February, 2017.

[67] Bidding to Drive (n 64); Rowena Michaels, 'Where on earth would a family car cost you £88,000?', *The Telegraph* (9 October 2013), <http://www.telegraph.co.uk/expat/10366160/Where-on-earth-would-a-family-car-cost-you-88000.html> accessed on 2 February, 2017.

[68] FAQ Regarding Vehicle Registration, Website of the Government of NCT of Delhi, <http://www.delhi.gov.in/wps/wcm/connect/doit_transport/Transport/Home/Vehicle+Registration/> accessed on 2 February, 2017.

3.	Two wheelers costing above Rs. 40,000/- and up to Rs. 60,000/-	6% of the cost price
4.	Two wheelers costing above Rs. 60,000/-	8% of the cost price
5.	Four wheeled and more than four wheeled motor vehicles costing up to Rs. 6 lakhs	4% of the cost price
6.	Four wheeled and more than four wheeled vehicles costing above Rs. 6 lakhs and up to Rs. 10 lakhs.	7% of the cost price
7.	Four wheeled and more than four wheeled vehicles costing above Rs. 10 lakhs	10% of the cost price

As is evident, the current road tax is a fraction of the cost price of the vehicle and does not reflect the true cost of owning a private vehicle in Delhi. The current slabs were last revised in 2010 for private vehicles.[69] Consequently, an increase in road tax will somewhat disincentivise new ownership of vehicles. This increase can also be implemented through systems that already exist for registering vehicles. Therefore, it will eliminate the need to expend time and money in designing and implementing a new quota system.

It is recommended that a sliding scale be adopted to determine road tax, where the rate of tax could be linked not only to the cost of the vehicle, but also to the fuel it runs on and the size of the vehicle. The Central Government already differentiates between diesel, and petrol and high capacity cars and the size of the vehicle in imposing different rates of infrastructure cesses during the purchase of vehicles.[70] This differentiation should be included at the State level also, via the road tax. This scale will not only disincentivise the purchase of private vehicles, but also incentivise the buying of low polluting vehicles. Ultimately, the Government should develop a sophisticated system, where the rate of road tax is determined by the level of pollution a vehicle emits.[71]

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[69] Notification No. F19(52)/Tpt./Sectt/2010/2502, dated 9th June, 2010, <http://it.delhigovt.nic.in/writereaddata/Odr2010759.pdf> accessed on 7 February, 2017.

[70] 'Budget 2016: Cars to become costly as Arun Jaitley proposes 4% cess on SUVs', *The Indian Express* (29 February 2016), <http://indianexpress.com/article/business/budget/budget-2016-cars-set-to-become-costly-jaitley-proposes-4-cess-on-suvs/> accessed on 7 February, 2017.

[71] For an example of a sliding scale model for diesel vehicles, *see* Green Budget Europe, 'Tackling air pollution from diesel cars through tax: options for the UK' (2016), <http://green-budget.eu/wp-

(ii) Regularisation of Parking Spaces

Another practice that has proven to reduce car usage significantly is appropriately priced parking. The rationale behind this is that an increase in parking charges results in reduction in parking demand. This is beneficial as it reduces the number of vehicles plying and the congestion on roads, which in turn results in lower pollution. For example, in Shenzhen, an increase in parking fees led to a 30% drop in parking demand.[72] In Japan, the enforcement of illegal parking rules and increased parking rates led to an estimated 15.2 thousand tonnes/year reduction in CO2 emissions.[73] Studies have also shown that if linked to a complementary increase in public transport, adopting higher parking rates can reduce the number of automobiles commuting by 10-30%.[74]

Currently in Delhi, on-street parking is ubiquitous in residential areas. Furthermore, parking charges do not reflect the true price of the resources being used and free parking zones are common. To counter these issues, there is a need for a comprehensive parking policy for Delhi which is based on the principle that vehicles should pay the full cost of the ecological and social damage that they cause.[75] In furtherance of this, the following solutions are recommended-

- Prohibition of Free Parking- Areas such as government offices, several colony markets etc. are by default free parking zones. The responsible municipal authorities (MCD) need to conduct a survey to identify these free parking zones and then auction the area for levying parking charges. Moreover, there are several shopping areas, where parking is 'free' for customers with the association of shopkeepers paying a lump sum to the MCD. This should be discouraged as the burden of parking charges must be paid by the consumer in order to serve as an effective disincentive.
- Removal of Inefficient Parking-
    - While most existing regulated parking areas have adopted incremental pricing, the slabs are still fairly low, with one hour of parking costing merely Rs. 20.[76] Based on the study done by CSE[77], there should be parity in parking between surface and structured parking formats. As per this study, structured parking costs Rs. 39 per hour; consequently, the base rate of surface parking should also be the same.

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content/uploads/Tackling-air-pollution-from-diesel-cars-through-tax-options-for-the-UK-Full-Report-June-2016-Web.pdf> accessed on 7 February, 2017.

[72] Right to Clean Air Campaign, Centre for Science and Environment, 'Choc-A-Block: Parking Measures to Address Mobility Crisis' (2009), <http://www.cseindia.org/sites/default/files/parking.pdf> accessed on 2 February, 2017.

[73] *Ibid.*

[74] Choc-A-Block (n 72).

[75] Choc-A-Block (n 72).

[76] 'Roles and Responsibilities', Website of the New Delhi Municipal Council, <https://www.ndmc.gov.in/departments/enforcement_responsibilities.aspx> accessed on 2 February, 2017.

[77] Choc-A-Block (n 72).

- At the time of registration, MCD charges parking fees to be paid by vehicles as a charge to use MCD roads, parking spaces and public spaces. However, there is a difference in parking charges for personal and commercial vehicles, with personal vehicles paying a lower amount. Moreover, personal vehicles pay this charge as a one-time fee when registering, while commercial vehicles pay the amount annually. The subsidization of parking for personal vehicles in this manner should be discontinued. Personal vehicles must also pay the parking charge annually and the amount payable should equal the amount commercial vehicles pay.

➢ Regularisation of Parking Spaces in Residential Colonies- Parking in residential colonies is also by default, free. Regulation of parking in these areas will reduce congestion and control the unchecked increase of private vehicles.

- *New residential colonies*- the Master Plan of Delhi, 2021 ('MPD') prescribes the Equivalent Car Space ('ECS') for different sizes of residential plots.[78] These regulations need to be enforced and rules need to be evolved to charge for the parking space and to have a higher cost for a second/third parking space.
- *Existing residential colonies*- both the municipal authorities and the Resident Welfare Associations ('RWAs') need to coordinate to effectively implement this recommendation.
  - The municipal authority must draw up a policy granting RWAs the authority to regulate colony parking, subject to the rules stipulated by the policy.
  - The policy must specify the ratio of parking spots per residential plot/flat; issue guidelines for the allocation of parking spots; encourage off-street parking, where possible; and set the annual rate for licensing a parking spot.
  - The RWAs, with assistance from the MCD, should also conduct a survey of the colony to identify, mark and license various parking spots to residents as per the policy.
  - On street parking spots must have a per annum parking charge, with a higher price for more than one parking place.
  - Moreover, once parking places are licensed to residents, any vehicles parked in those areas which are not regularised by the MCD and RWA should be towed.
- Roads abutting these regularised on-street parking spaces shall also be subject to hourly parking charges during the day, with these spaces being no parking zones at night.

➢ Linking the Registration of Cars with Parking Space- Additionally, the registration of vehicles needs to be linked to proof of parking space in the vehicle owner's residential

[78] Delhi Development Authority, 'Master Plan for Delhi-2021' (7 February 2007), <http://dda.org.in/ddanew/pdf/Planning/reprint%20mpd2021.pdf> accessed on 2 February, 2017.

colony.[79] After parking spaces in residential colonies are effectively regularized, the Department of Transport must direct zonal offices to allow the registration of a new vehicle only if the owner can show proof of an unoccupied parking slot for it in their residential area.

The above recommendations aim to reflect the true cost of owning a vehicle at every stage of its use. It will prevent new vehicles from being bought if there are no designated parking areas for them and, at the same time, it will disincentivise the use of private vehicles through the removal of free parking zones and increase in parking charges.

In the long run, a limit needs to be placed on the total parking spaces in the city, as vehicular growth must match the availability of land. Delhi already allocates a high percentage of its land to vehicles. For example, in 2009, Delhi had 115 cars per 1000 people and allowed 3 ECS/100 sqm in commercial areas. In contrast, Tokyo which had nearly 400 cars per 1000 persons only allowed 0.5 ECS/100 sqm in commercial areas.[80] Consequently, once the above recommendations are implemented, the government must consider capping the number of parking spaces.

(b) *Removal of higher polluting vehicles*

(i) Incentivising the Phasing out of Vehicles older than 10 Years

In addition to regulating the growth of private vehicles and increasing the cost of using private vehicles through parking charges, a reduction in vehicular pollution will also require the worst polluting vehicles to be removed from the road.

Vehicles that are older than 10 years are the most severe polluters as they emit 10 to 12 times more pollutants than a new vehicle.[81] This is because older vehicles comply with lower BS standards. Consequently, critical to reduction of vehicular pollution is the removal of old vehicles through a concerted phasing out scheme.[82]

As of December 2016, the MoRTH was formulating a Voluntary Vehicle Fleet Modernisation Programme ('VVFMP') to phase out old, polluting vehicles.[83] The specifics of the programme are still being ironed out, but as per a press release, incentives are to be given in the form of 'scrap value of the vehicle', 'incentives from Original Equipment Manufacturers ('OEMs') and incentives from government.'

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[79] *Ibid.*

[80] Centre for Science and Environment, 'Parking Policy in India: Getting the principles right' (2011), <http://www.cseindia.org/userfiles/briefing_note(2).pdf> accessed on 2 February, 2017.

[81] Concept note: Voluntary Vehicle Fleet Modernisation Programme (n 42).

[82] Review of Beijing's Comprehensive Motor Vehicle Emission Programmes (n 60).

[83] 'Phasing out old Vehicles', Ministry of Road Transport & Highways, Government of India, *Press Information Bureau* (15 December 2016), <http://pib.nic.in/newsite/PrintRelease.aspx?relid=155461> accessed on 2 February, 2017.

While the original concept note in May 2016 stipulated that this would be aimed at *all* vehicles, which were more than 10 years old, reports since then have mentioned that the scheme is to be restricted to Medium and Heavy Commercial Vehicles ('MHCVs') of more than 15 years of age.[84] Moreover, this scheme will run for 2 years; after which a progressive capping of the life of MHCVs will be introduced. The limit as of April 1, 2018 will be 18 years, as of April 1, 2019 will be 16 years and as of April 1, 2020 will be 15 years.[85] While MHCVs of more than 15 years are high polluting and should be phased out, the current form of the scheme is problematic for the following reasons-

- **Violates a court order on the life of vehicles**- in Delhi's context, this scheme and the progressive time limits that it proposes violates the Supreme Court order in *M.C. Mehta v. Union of India*[86] where the life of commercial vehicles was mandated to be 15 years. Consequently, classifying this programme as 'voluntary' is deeply problematic. MHCVs of more than 15 years of age must be *mandatorily* phased out.
- **Limited in Scope**- a *voluntary* phasing out programme for old vehicles should target those vehicles which are legally allowed to ply but which are heavy polluting vehicles due to their age. As mentioned in the previous paragraph, MHCVs of more than 15 years of age are illegal in Delhi. Moreover, the Ministry's own concept note states that vehicles that are more than 10 years old are heavy polluters. It estimates that extending this programme to vehicles that are more than 10 years old will reduce PM, CO, HC + NOx by 25-30%.[87] Therefore, the incentives that the VVFMP scheme will offer must not be limited to MHCVS of more than 15 years as it currently is, but must target vehicles that are 10-15 years old.[88] For vehicles older than 15 years, they ought to be taken off the roads immediately by undertaking a drive to this end.

Additionally, the incentives evolved by the government must contain a direct cash transaction to vehicle owners to effectively incentivise them to retire their vehicles. For example, China substituted approximately 2.7 million cars by offering rebates of $450-900.[89] The Union Minister for Road, Transport and Highways had initially stipulated that the scheme would offer a

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[84] *Ibid*; Amitav Ranjan, 'Scrapping 15-yr-old vehicles: Plan is to exempt cars, phase out buses, trucks', *The Indian Express* (4 January 2017), <http://indianexpress.com/article/india/scrapping-15-yr-old-vehicles-plan-is-to-exempt-cars-phase-out-buses-trucks-pollution-emission-control-4429410/> accessed on 2 February, 2017; Dipak K Dashi, 'Ten lakh trucks over 15 years old likely to be taken off roads soon', *The Times of India* (15 December 2016), <http://timesofindia.indiatimes.com/india/ten-lakh-trucks-over-15-years-old-likely-to-be-taken-off-roads-soon/articleshow/55990690.cms> accessed on 2 February, 2017.

[85] Amitav Ranjan, 'Scrapping 15-yr-old vehicles: Plan is to exempt cars, phase out buses, trucks', *The Indian Express* (4 January 2017), <http://indianexpress.com/article/india/scrapping-15-yr-old-vehicles-plan-is-to-exempt-cars-phase-out-buses-trucks-pollution-emission-control-4429410/> accessed on 2 February, 2017.

[86] *M.C. Mehta v. Union of India* (n 54).

[87] Concept note: Voluntary Vehicle Fleet Modernisation Programme (n 42).

[88] While the NGT order in 2015 bans all diesel vehicles of more than 10 years; since this is a recent order- incentives can be extended to diesel vehicles of 10-15 years for a limited period of 2 years.

[89] Sindhu Bhattacharya, 'In a battle against rising pollution, govt's vehicle scrapping policy looks laborious', *Firstpost* (30 May 2016), <http://www.firstpost.com/business/pollution-vehcile-scrapping-policy-siam-mhcvs-passenger-vehicles-2805710.html> accessed on 7 February, 2017.

discount of up to Rs. 50,000.[90] It is recommended that at least this sum, if not more, should be offered to vehicle owners in cash, at the time of retiring their vehicle.

Alternatively, the cost of Rs. 50,000 can be shared by the government and the automobile manufacturers equally. This would be a two-step process, where at the time of retiring the vehicle, the owner will receive half the amount i.e. Rs. 25,000 in cash by the government. The remaining amount will be given in the form of a discount to the owner at the time of buying the new car by the automobile manufacturer. The VVFMP concept note estimates that there are approximately 28 million vehicles that have been bought on or before 31st March 2005 nationwide.[91] The cost of the incentive can be recovered by the government through the recycling of the scrap value of the vehicles.

(ii) Taxing Higher Polluting Fuel

Currently customs tax, excise duty and VAT are imposed on the purchase of fuel. Preferential tax rates are adopted under all three heads for diesel over petrol. As mentioned in section 2(b), the VAT imposed on diesel was 16.75% and on petrol was 25% as of May 2016.[92] The resultant differential pricing of all taxes has resulted in an increase in the percentage of diesel cars in new car sales from 4% in 2000 to 50% in 2014.[93] Given the significantly adverse impact of diesel on air pollution and public health, it has been singled out for a higher tax rate.

While excise and custom duties will be subsumed into the GST, the State-levied VAT will continue to apply. Post-GST, the Delhi VAT rate can be used to incentivise petrol over diesel by changing the tax rate in order to ensure that the selling price of the two fuels are equal or that of petrol is cheaper than diesel. This change in tax rate is aimed at disincentivising the private ownership of diesel vehicles. Any adverse impact on commercial vehicles can be addressed by giving notice sufficiently in advance, enabling them to refuel outside the NCR. In any event, the increase in tax rate is meant to be a temporary measure, till adequate infrastructure is put in place to move away from fossil based fuels.

(iii) Disincentivising Non-Destined Trucks by Equalising Toll Taxes

An avoidable factor contributing to vehicular pollution is the plying of commercial trucks through Delhi even though their destination is not in Delhi. This is problematic because-

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[90] 'Cash for clunkers in India too? Soon you may be able to turn in your old car and get up to Rs 1.5 lakh', *Firstpost* (15 August 2015), <http://www.firstpost.com/business/cash-clunkers-india-soon-may-able-turn-old-car-get-rs-1-5-lakh-2392412.html> accessed on 7 February, 2017.

[91] Concept note: Voluntary Vehicle Fleet Modernisation Programme (n 42).

[92] Notification No. F.3(10)/Fin(Rev-I)/2015-2016/DS-VI/547, and Notification. No. F.3(2)/Fin(Rev-I)/2016-2017/dsvi/141 (n 51).

[93] Environmental Pollution Control Authority, 'Report on Priority Measures to Reduce Air Pollution and Protect Public Health' (February 2014), <http://cseindia.org/userfiles/EPCA_report.pdf> accessed on 2 February, 2017.

- Due to the staggered implementation of BS standards, trucks not registered in Delhi follow lower emission standards than local vehicles. Consequently, they are higher polluting vehicles.
- Commercial trucks run on diesel, which emits higher amounts of NOx[94] and SOx[95]. As mentioned above, the $PM_{2.5}$ emitted by diesel is very high and has been declared as a carcinogen.[96]

This is an avoidable problem. While Delhi bypasses are in the pipeline, their tentative date of completion is July 2018.[97] Thus, more immediate action is needed. One way of disincentivising non-destined trucks from going through Delhi is by rationalising the different toll taxes imposed by the Municipal Corporation of Delhi ('MCD') and the National Highways Authority of India ('NHAI'). MCD lays down the tax rates at entry points to Delhi, whereas NHAI is the authority for the surrounding national highways. As of now, MCD toll taxes are significantly lower than that of NHAI, making it economically attractive for trucks to go through Delhi, even when alternative routes to their destinations exist.

An EPCA report[98] indicates that for trucks traveling from North to South India, there is an alternative to traveling through Delhi i.e. NH71 and NH71A which connect Rewari and Rohtak to Panipat enable trucks to move from North to the South of Delhi and vice-versa. The difference in distance in minimal i.e. traveling through Delhi would be 163 km, whereas taking NH71 and NH71A would be 172 km. However, there is a significant difference in toll tax rates (as of October 2015).

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[94] The International Council on Clean Transportation, 'Impact of Improved Regulation of Real-World NOx Emissions from Diesel Passenger Cars in the EU, 2015-2030' (December 2016), <http://www.theicct.org/sites/default/files/publications/ICCT_real-world-NOX-RDE-2015-2030_dec2016.pdf> accessed on 2 February, 2017; Department for Environment Food & Rural Affairs, 'Draft Plans to improve air quality in the UK' (September 2015), <https://consult.defra.gov.uk/airquality/draft-aq-plans/supporting_documents/Draft%20plans%20to%20improve%20air%20quality%20in%20the%20UK%20%20Overview%20document%20September%202015%20final%20version%20folder.pdf> accessed on 2 February, 2017.

[95] Climate & Clean Air Coalition, 'Cleaning up the Global On-Road Diesel Fleet' (August 2016), <http://www.indiaenvironmentportal.org.in/files/file/global%20sulphur%20strategy.pdf> accessed on 2 February, 2017.

[96] Diesel Engine Exhaust Carcinogenic (n 50).

[97] Environment Pollution Control Authority, 'Report on strategies to reduce air pollution from trucks entering and leaving Delhi' (October 2015), <http://www.cseindia.org/userfiles/EPCA%20Report%20(October%202015).pdf> accessed on 2 February, 2017; Prabhu Razdan, 'Farmer protest hits work on ring expressway to decongest Delhi', *Hindustan Times* (30 November 2016), <http://www.hindustantimes.com/delhi/farmer-protest-hits-work-on-ring-expressway-to-decongest-delhi/story-rZEdH2guXJqpblTH1qFBGP.html> accessed on 2 February, 2017.

[98] *Ibid* at Report on strategies to reduce air pollution from trucks entering and leaving Delhi; Report on Priority Measures to Reduce Air Pollution and Protect Public Health (n 93).

Table 8: Differential Toll Tax Rates imposed by the MCD and the NHAI

	Length in Km	Toll Rate for 2 axle trucks	Toll Rate for 3 axle trucks	Toll Rate for 4 axle trucks and above	Toll Rate LGV
NH71-71A	172	930	1420	1550	450
Through Delhi	163	225	225	450	120

Hence, to effectively disincentivise the non-destined commercial truck drivers from entering Delhi, the MCD toll tax rates should be equal to the NHAI rates, if not higher. This would also require a reworking of the existing contracts between the MCD and third party contractors to reflect the dip in revenue for the toll collectors.[99]

(c) *Groundwork for the better regulation of vehicles*

(i) Vehicle Tag Policy

A major part of controlling vehicular pollution is the management of traffic flow, so as to not restrict public transport and reduce congestion, given that standing vehicles lead to more pollution. Essential to this is the need to differentiate vehicles based on emission standards they comply with. For example, Beijing identifies the emission standard compliance of vehicles through the colour of their license plates as shown in the Table below.

Table 9: Categorisation of Vehicles by Licence Plate Colour in China

Colour	Yellow	Blue	Green
Standard	Light duty vehicles which do not qualify for China 1 emission standards and heavy duty vehicles which do not qualify for China III emission standards	Vehicles meeting China 5/V emission standards	Vehicles in between the criteria for yellow and blue license plates

[99] Mayank Manohari, 'Toll collectors fail to follow SC order, Delhi chokes on foul air', *The Times of India* (November 2015), <http://timesofindia.indiatimes.com/city/delhi/Toll-collectors-fail-to-follow-SC-order-Delhi-chokes-on-foul-air/articleshow/49636746.cms> accessed on 2 February, 2017.

Within each label type, the shades of the label are used to differentiate various technologies and standards. Based on these license plates, old vehicles are phased out, vehicle scrappage and retro-fitting programmes are implemented, and yellow and some green plate vehicles are not allowed to enter the city centre, congested areas and inside certain ring roads. Similarly, it is important for Delhi to have such a drive as it will enable enforcement authorities to differentiate between vehicles based on their pollution standards. This will be beneficial as it will-

- allow Delhi to develop traffic congestion measures;
- enable more evidence-based policy making as there will be clarity on the number of vehicles adhering to different standards and their movement;
- allow for better enforcement;
- enable the government to design incentives to enable people to phase out old vehicles and use more eco-friendly vehicles. For instance, there can be differentiated parking charges for vehicles with different stickers, with the more environment friendly vehicles ('EFVs') receiving a substantial discount; the EFVs will also have discounted registration charges and be beneficiaries to limited exceptions such as the odd-even scheme etc.

To this end, the Delhi government needs to conduct a concentrated drive to label all vehicles registered in Delhi with a similar colour coded scheme. The scheme doesn't necessarily need to change the colour of the license plate; instead a more cost-effective way would be to add different colour stickers/ tamper-free tags to vehicles based on their different emission standard/age/technology/fuel.

These stickers should be made available by local zonal authorities. In addition to this, a drive should be carried out in the initial few months, where traffic police personnel can make this facility available at pollution checking centres, petrol pumps, parking lots etc. This drive could also install RFID tags on in-use vehicles, which will be helpful in monitoring traffic flow.

(ii) Enforcement Reforms

There needs to be better co-ordination between the norm-making bodies and the implementing bodies to effectively enforce existing rules and regulations and the above recommendations. As mentioned above, the Delhi Traffic Police does not come under the control of the Delhi government. Given the complexities of this structure, a statutory Green Police force should be set up and designated to tackle air pollution in Delhi. This force will have personnel across different responsible authorities such as Delhi Police, Delhi Traffic Police, Department of Transport of Delhi, Ministry of Home Affairs and other stakeholders. The responsibility of this force will include-

- Implementation of the BS standards- check stock with vehicle dealers; coordination with local zonal offices on the removal of deregistered vehicles from the roads
- Policing of illegal parking spaces and the newly regulated parking areas

- Implementation of vehicle tag policy
- Implementation of the Training Manual on Air Pollution for Traffic Policemen (see below)
- Enforcement of increase in toll taxes
- Spot checks at the Pollution Under Control Certificate Issuing Authorities
- Enforcement of the various measures specified in the Graded Action Plan

The Green Police will ensure the smooth coordination of responsibilities between standard-setting and implementing authorities. Moreover, for better enforcement of existing rules and regulations, the following procedures should be put in place-

- The Traffic Police needs to be constantly updated regarding all the new regulations relating to pollution control.

- While issuing a *challan* to vehicles for traffic violations, all pollution-related checkboxes should be examined. For example- the pollution certificate and emission standards of the vehicle must be mandatorily checked. On-spot pollution checks should also be conducted.

- Checks on pollution levels and emission standard norms must also be done at all entry points to Delhi for commercial and private vehicles.

- Pollution drives must be conducted periodically to ensure that all vehicles are complying with the current standards especially with respect to (i) pollution levels and (ii) age of vehicles allowed to ply.

Better coordination and information will not be sufficient, if the number of police personnel in the Delhi Traffic Police is not increased. As per information received from the Public Information Officer, Traffic (Delhi) through an RTI application, the number of traffic police personnel in Delhi as of 31 December 2016, is-

Table 10: Strength of Traffic Police Personnel in Delhi

Rank	Strength
Spl. CP/T	1
Jt. CP/T	2
Addl. CP/T	4
DCP/T	7

ACP/T	17
Insprs.	83
SIs	268
ASIs	399
HC(Min.)	30
ASI (SGD)	894
W/ASI (SGD)	05
ASI (Dvr.) (SGD)	15
H.Const.	271
H.Const.(DVR)	32
W/H. Const.	07
H.Const. (SGD)	434
H.Const. (DVR (SGD))	1
W/H. Const. (SGD)	6
Const.	2902
Const. (Dvr.)	61
W/Const.	190
Total	5629

Given that the population of Delhi is 16,787,941, as per the 2011 census, the ratio of traffic policemen to the population is as low as 0.0003353. The above recommendations and any other solution to vehicular pollution will only be successful if the implementing body has the strength to enforce vehicular rules and regulations effectively.

4. Summary of Action points

Table 11: Implementation Action Plan for emissions from Private Vehicles

Proposed Measure	Responsible Authorities	Implementation Route	Timeline
Short Term			6 months
Equalise the parking rates for structured and surface parking	MCD	1. Revision of surface parking rates through a resolution 2. Issue direction with the revised rates to third party contractors	
Increase the parking charges for personal vehicles	MCD Department of Transport, Government of NCT of Delhi	1. Revision of rates of personal vehicles through a resolution 2. Issue direction to local zonal officers to collect parking fees annually	
Develop a Traffic Police Manual on Air Pollution	Delhi Police, Department of Transport, Government of NCT of Delhi	Design a vehicular pollution protocol for the traffic police officers to follow	Develop a Traffic Police Manual on Air Pollution
Change the tax rate of diesel	Government of NCT of Delhi	Through a notification, since the tax rate is proposed to be changed within the same bracket	Post-GST
Long term			**6 months - 1 year**

Increase Road Tax and adopt a sliding scale to determine the rate of road tax	Amending authority: Government of NCT of Delhi Implementing authority: Department of Transport	Through an amendment of Schedule 1 read with section 3 of the Delhi Motor Vehicles Taxation Act, 1962	
Prohibit Free Parking	MCD	1. Conduct a survey to identify free parking zones 2. Auction new zones to third parties to collect parking charges	
Regularise Parking Spaces in Residential Colonies	MCD and RWAs	1. Through a policy setting out the rules for on-street parking in residential colonies 2. Through an amendment of the Memoranda of Association of RWAs, including the regulation of parking spaces within their objective 2. Through a drive to identify, mark and license parking spots	
Link the Registration of vehicles with Proof of Parking Space	Department of Transport, Government of NCT of Delhi	Through an order to local zonal offices	
Uniformise toll taxes between the MCD and NHAI	Amending Authority: Municipal Corporation of Delhi; Government of NCT of Delhi Implementing authority: third party contractor to whom MCD outsources toll collection	Through an amendment of the toll tax bye laws by the MCD. See section 113(2) read with section 150 of the Delhi Municipal Corporation Act, 1957	
Change the focus of the VVFMP to all	Ministry of Road, Transport and Highways and	1. Through a policy document	

vehicles above 10 years old and include a direct cash incentive in the scheme	Automobile Manufactures	to this effect 2. Through the allocation of funds for the direct cash incentive	
Conduct a Vehicle Tag Drive extending benefits to environment friendly tags	Department of Transport, Government of NCT of Delhi Implementing bodies: Traffic Police and local zonal offices	1. Through a policy document setting the criteria for different colour tags 2. Through an implementation drive	
Set up a Green Police Force for metropolitan cities	Ministry of Environment and Forests, Ministry of Home Affairs, Government of India	Through the enactment of a Central statute	

C. Burning of Crop Residue by Farmers

1. Contribution to Pollution

According to the IIT Kanpur Report, crop residue burning contributes approximately 140 µg/m3 towards PM_{10} and 120 µg/m3 towards $PM_{2.5}$.[100] The Report finds Uttar Pradesh (60 Mt) to be the largest generator of crop residue each year, followed by Punjab (51 Mt) and Haryana (28 Mt). Out of the 500-550 million tons (Mt) of crop residue produced annually, cereals were found to generate the maximum amount of residue (352 Mt), followed by fibres (66 Mt), oilseeds (29 Mt), pulses (13 Mt) and sugarcane (12 Mt).[101] Among cereals, rice was found to generate the maximum amount of crop residue (34% of the total cereal residue), followed by wheat (22% of the total cereal residue). Similarly, among fibrous crops, cotton was found to generate the maximum amount of residue (53 Mt), followed by coconut (12 Mt).[102] Each year, approximately 21.92 Mt of crop residue was found to have been burnt in Uttar Pradesh, followed by 19.62 Mt in Punjab and 9.06 Mt in Haryana.[103]

2. Reasons for the Problem

(a) *Alternatives to burning are not easily available*

The burning of crop residue is something of a tradition among farmers, who believe that the practice helps control diseases and pests in crops, and promotes crop propagation and rotation.[104] However, the adverse effects of burning outweigh the promised benefits.[105] Scientists are of the opinion that the burning of crop residue actually results in the loss of fertility and essential micronutrients within the soil.[106] Nevertheless, farmers continue to follow the practice, believing it to be a cheap and effective farming technique.

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[100] IIT Kanpur Report (n 3).

[101] Indian Agricultural Research Institute, 'Crop Residues Management with Conservation Agriculture: Potential, Constraints and Policy Needs' (October 2012) <http://www.iari.res.in/files/Important_Publications-2012-13.pdf> accessed on 20 March, 2017.

[102] *Ibid.*

[103] Indian Agricultural Research Institute (n 101).

[104] M.M. Lal, 'An Overview to Agricultural Waste Burning', *Indian Journal of Air Pollution Control*, Vol VIII, No. 1 (March 2008), pp 48-50, <http://re.indiaenvironmentportal.org.in/files/An%20over%20view%20to%20agricultural%20waste%20burning.pdf> accessed on 20 March, 2017.

[105] Niveta Jain, Arti Bhatia, and Himanshu Pathak, 'Emission of Air Pollutants from Crop Residue Burning in India', 14 AEROSOL AND AIR QUALITY RESEARCH 2014, pp 422-430, <http://aaqr.org/VOL14_No1_February2014/40_AAQR-13-01-OA-0031_422-430.pdf> accessed on 20 March, 2017.

[106] *Ibid.*

Besides burning, crop residue can be managed in several other ways which may be more advantageous for farmers and less toxic for the environment. These methods include the baling and removal of crop residue for utilisation *ex-situ*, incorporation of the crop residue back into the soil (*in-situ* utilisation), or the retention of crop residue *in-situ* as soil cover.[107] While crop residue can be retained as soil cover without the use of machines, baling and removal or the incorporation of such residue into the soil requires the use of machines, many of which farmers may procure under government schemes. The information on the machines required to treat crop residue is provided below: [108]

Table 12: Machines for the Treatment of Crop Residue and Financing Mechanisms for their Utilisation

S.No.	Machines	Gross return to farmer (Rs per ha)[109]	Cost of operation to government (Rs per ha)	Cost per unit (in lakhs)	Subsidies available for SC, ST, Small & Marginal Farmers, Women and NE States' beneficiaries under government schemes (approx.)	Subsidies available for other beneficiaries under government schemes (approx.)
For baling and removal (ex-situ utilisation)						
1.	Straw baler + Straw chopper	3750	2350	0.5 + 1.75	Pattern of assistance may be up to 50% of the cost of each machine.	Pattern of assistance may be up to 40% of the cost of each machine.
2.	Straw baler + Straw	3750	1960	0.5 + 1.75	Pattern of assistance may be	Pattern of assistance

[107] Patrick C. Wall and Christian Thierfelder, 'Role and Importance of Residues', Food and Agriculture Organisation, <http://www.fao.org/ag/ca/Training_Materials/Leaflet_Residues.pdf> accessed on 20 March, 2017.

[108] N. K. Bansal and Anil Kumar, 'Role of Machinery for crop residue management', Department of Farm Machinery and Power Engineering, CCS Haryana Agricultural University, Hisar, <http://hau.ernet.in/research/pdf/lbansal.pdf> accessed on 20 March, 2017.

[109] We have assumed the average land holding to be 50 hectares.

	chopper + Hay rake			+ 0.035	up to 50% of the cost of each machine.	may be up to 40% of the cost of each machine.
3.	Straw combine	3000	800	2	Not part of any scheme	Not part of any scheme
4.	Self-propelled reaper/binder	6500	3750	2	Pattern of assistance may be up to 50% of the cost of each machine.	Pattern of assistance may be up to 40% of the cost of each machine.
For incorporating crop residue into the soil (in-situ utilisation)						
1.	Happy seeders + combine harvester	79588	38500	1.3 + 13	Pattern of assistance may be up to 50% of the cost of each machine.	Pattern of assistance may be up to 40% of the cost of each machine.
2.	Rotavators	5000	3875	1	Pattern of assistance may be up to 50% of the cost of the machine.	Pattern of assistance may be up to 40% of the cost of the machine.

Crop residue that has been baled and removed from the farm can be utilised in several ways. Some of these include (1) generation of power; (2) production of ethanol; (3) manufacture of paper/boards; (4) packaging; (5) production of fuel for brick kilns; and (6) fodder/bedding for animals. Despite the wide acceptance of these measures the world over, most Indian farmers continue to regard burning as the most feasible method for removing the residue of their crop.[110]

[110] Alexandra Bot and José Benites, *The Importance of Soil Organic Matter: Key to Drought-Resistant Soil and Sustained Food Production*, Food and Agriculture Organisation (2005), Chapter 4 on 'Practices that influence the amount of organic matter', <http://www.fao.org/docrep/009/a0100e/a0100e07.htm> accessed on 21 March, 2017; See also Chapter 7 on 'Use of Crop Residue and Straw', Report on Soil organic matter management across the EU – best practices, constraints and trade-offs', European Commission, DG

This may be attributed to the following reasons:

- alternate ways to use residue are unknown to farmers;[111]
- several farmers lack adequate resources and man-power to utilise large quantities of crop residue on the farm, or bale it for utilisation elsewhere;[112]
- the relatively short time lag between the end of the *kharif* season and the beginning of the *rabi* season (and *vice-versa*), typically 15-20 days, forces several farmers to burn the residue of their crop all at once.[113] Since farmers have less than half a month to get rid of large quantities of crop residue, along with preparing for the next crop season, they lack sufficient time to consider alternatives to burning.

Hence, unless alternatives to crop residue burning are available easily, quickly, and in sufficient quantities, farmers might find it very difficult to substitute burning of crop residue with other, less toxic practices.

(b) *Weak implementation of the ban on burning crop residue*

Section 19(5) of the Air (Prevention and Control of Pollution) Act, 1981 ('Air Act') permits the State Government to prohibit burning of any material in an air pollution control area, if the Government is of the opinion that such burning is likely to cause air pollution. The State Government has a duty to consult the SPCB/DPCC while arriving at its decision to prohibit the burning of any material.

In exercise of their power under Section 19(5) of the Air Act, the State Governments of Punjab,[114] Haryana,[115] and Uttar Pradesh[116] have issued blanket prohibitions on the burning of crop

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Environment (2011), <http://ec.europa.eu/environment/soil/pdf/som/Chapters7-10.pdf> accessed on 21 March, 2017.

[111] Anju Agnihotri Chaba, 'Burning paddy straw: Snuff it out with machines, stringent law, awareness', *The Indian Express* (10 October 2016), <http://indianexpress.com/article/india/india-news-india/stubble-paddy-burning-laws-pollution-punjab-haryana-machines-technology-agriculture-3074422/> accessed on 21 March, 2017; Gurpreet Singh Nibber, 'Stubble burning: Finding a way forward to end practice', *Hindustan Times* (8 November 2015), <http://www.hindustantimes.com/punjab/stubble-burning-finding-a-way-forward-to-end-practice/story-sERNdKuMPjvEYAdbTnpp9H.html> accessed on 21 March, 2017.

[112] *Ibid.*

[113] Polash Mukerjee, Shambhavi Shukla and Anisha Raman, 'Delhi faces its worst smog; CSE calls for emergency action', *Down to Earth* (1 November 2016), <http://www.downtoearth.org.in/coverage/delhi-air-pollution-56180> accessed on 21 March, 2017.

[114] Notification No. 3/162/2006-STE (4)/946, dated 22/10/2013, Department of Science, Technology and Environment, Government of Punjab, <http://www.ppcb.gov.in/Attachments/Notification%20and%20Office%20Orders/948officeorderpaddy.pdf> accessed on 21 March, 2017.

[115] 'Haryana adopts new strategy to check stubble burning', *The Pioneer* (8 October 2016), <http://www.dailypioneer.com/state-editions/haryana-adopts-new-strategy-to-check-stubble-burning.html> accessed on 21 March, 2017; Kumar Sambhav Shrivastava, 'Delhi haze: When farm fires poison the capital's air', Hindustan Times (5 October 2016), <http://www.hindustantimes.com/delhi/delhi-haze-when-farm-fires-poison-the-capital-s-air/story-KjM2LcvHDhJ2TLw52DCX0M.html> accessed on 21 March, 2017.

[116] Notification No. 2845/55-Parya./15-99 (Parya.)-13, dated 28/10/2015, Government of Uttar Pradesh, <http://upenvis.nic.in/WriteReadData/UserFiles/file/GO-21.pdf> accessed on 21 March, 2017.

residue within their jurisdictions. However, several farmers continue to burn crop residue within these States.[117]

Due to the persistence of the practice of burning crop residue in Punjab, Haryana and Uttar Pradesh, environmental activist, Vikrant Tongad filed an application before the NGT alleging widespread violations of the Air Act, and urging the NGT to direct Central and State Governments, along with other authorities to take swifter action against those burning crop residue.[118] Taking note of the appellant's claims and the growing problem of air pollution in Delhi, the NGT issued a number of important directions, which include:

- requiring the Central Government and the State Governments of Punjab, Haryana and Uttar Pradesh to ensure effective compliance of the ban by farmers;
- urging State Governments to create awareness amongst farmers about the long-term and far-reaching ramifications of burning crop residue, and to equip farmers with the necessary technical and financial means to utilise residue in alternate ways;
- instructing the Central and State Governments to dissuade farmers from burning crop residue, by making the practice more expensive and less beneficial. The NGT suggested the imposition of fines, depending upon the size of landholdings of farmers. By being forced to pay a fine for engaging in the practice, the NGT was of the opinion that farmers would be forced to switch to alternatives to burning;
- instructing the Central Government to implement the Draft National Policy for Management of Crop Residues ('NPMCR'), which, among other things, suggests the use of satellite-based remote sensing technologies to monitor the burning of crop residue, with the active involvement of the National Remote Sensing Agency ('NRSA') and CPCB; and
- urging State Governments to use satellite data and state machinery for monitoring, preventing and controlling residue burning in fields, in coordination with CPCB and ISRO.[119]

While the NPMCR has not yet been brought into force, the Central and State Governments have taken several other follow-up steps to give effect to the NGT's directions. The Central Government, in conjunction with State Governments, has conducted awareness drives for promoting sustainable

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[117] Sameeksha Khare, 'Scientist Says Crop Burning Causes 70% of Delhi Pollution', *The Quint* (8 November 2016), <https://www.thequint.com/environment/2016/11/08/delhi-air-pollution-health-risks-smog-government-measures-odd-even-staff-crunch-factories-crop-burning-vehicles> accessed on 21 March, 2017; 'Delhi pollution: Centre summons 5 northern states on stubble burning ban', *LiveMint* (31 October 2016), <http://www.livemint.com/Politics/EB16QANTh01dg1vaL7A6gJ/Delhi-pollution-Centre-summons-5-northern-states-on-stubble.html> accessed on 21 March, 2017; Soumya Pillai and Vishal Rambani, 'Delhi chokes on smoke from neighbouring states', *Hindustan Times* (24 October 2016), <http://www.hindustantimes.com/delhi/delhi-chokes-on-smoke-from-neighbouring-states/story-zAkXkflle5MoUXLNYfZa0H.html> accessed on 21 March, 2017.

[118] *Vikrant Kumar Tongad v. Environment Pollution (Prevention & Control) Authority and Ors*, Application No. 118 of 2013, Judgement dated 10th December 2015.

[119] In addition to the national policy, the Government of Punjab has also made efforts to counteract the burning of paddy straw through its Draft Policy for Management and Utilization of Paddy Straw in Punjab, which is yet to be implemented.

crop residue management practices among farmers.[120] The Central Government has also put in place a mechanism to monitor the burning of crop residue through satellite imagery and geospatial information.[121]

The MOEFCC has also issued directions to State Governments, the CPCB and SPCBs to take stringent action against the burning of crop residue.[122] To give effect to these directions, the CPCB has issued instructions to various authorities, such as Municipal Commissioners, Financial Commissioners (Revenue), Director of Agriculture in the State Government Headquarters as well as State Level District Committees in all States, including in and around the NCT of Delhi, to enforce the ban on the burning of crop residue and take coercive/punitive action against defaulting farmers.[123]

The Financial Commissioners, Director of Agriculture and State Level District Committees have been asked to create an alert system for tracking crop residue burning. State Governments have been directed to establish real-time monitoring and communications mechanism to check burning, in close collaboration with ISRO, NRSA and the State Remote Sensing Agency. According to the CPCB, this will serve as a useful mechanism for tracking violations of the ban and alerting district-level functionaries to take appropriate action against defaulting farmers.

The effectiveness of all these measures in curbing the practice of burning crop residue is yet to be seen. The practice continues because of some of the following reasons:

- regulatory authorities lack adequate capacity and human resources to enforce the ban and keep track of individual violations of the ban;
- farmers have not been adequately incentivised, or disincentivised to not engage in the practice of burning crop residue. While there is a penalty for violating the ban, it is rarely ever enforced.[124] This encourages farmers not to comply with the ban. There are also no incentives provided to farmers to substitute burning with other, more sustainable crop residue management practices. Hence, farmers find it easier and cheaper to burn crop residue;

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[120] 'Promoting Conversion of Crop Residues into Biochar', Ministry of Agriculture, Government of India, *Press Information Bureau* (22 July 2015), <http://pib.nic.in/newsite/PrintRelease.aspx?relid=107183> accessed on 21 March, 2017.

[121] 'Satellites Designed for Benefit of Farmers', Department of Space, Government of India, *Press Information Bureau* (15 December 2016), <http://pib.nic.in/newsite/PrintRelease.aspx?relid=155408> accessed on 21 March, 2017; 'Satellites for Agri Purpose', Department of Space, Government of India, *Press Information Bureau* (9 December 2015), <http://pib.nic.in/newsite/PrintRelease.aspx?relid=132888> accessed on 21 March, 2017.

[122] 'Government Issues Directions for Pollution Control and Improving Ambient Air Quality in Delhi and NCR', Ministry of Environment and Forests, Government of India, *Press Information Bureau* (30 December 2015), <http://pib.nic.in/newsite/PrintRelease.aspx?relid=134044> accessed on 21 March, 2017.

[123] The ban on burning crop residue has been issued under Sections 5 and 18(1)(b) of the Environment Protection Act, 1986. All the orders of the Central Pollution Control Board can be found at <http://cpcb.nic.in/Directions.php> accessed on 21 March, 2017.

[124] Anju Agnihotri Chaba (n 111); Gurpreet Singh Nibber (n 111); Polash Mukerjee (n 113).

- farmers also lack adequate awareness regarding the existence of the ban and the consequences of its violation;
- there appears to be very little private and public investment towards the utilisation of crop residue for producing goods/generating power. This makes it very difficult for farmers to get rid of large quantities of baled crop residue easily.

(c) *Insufficient utilisation of benefits under policies*

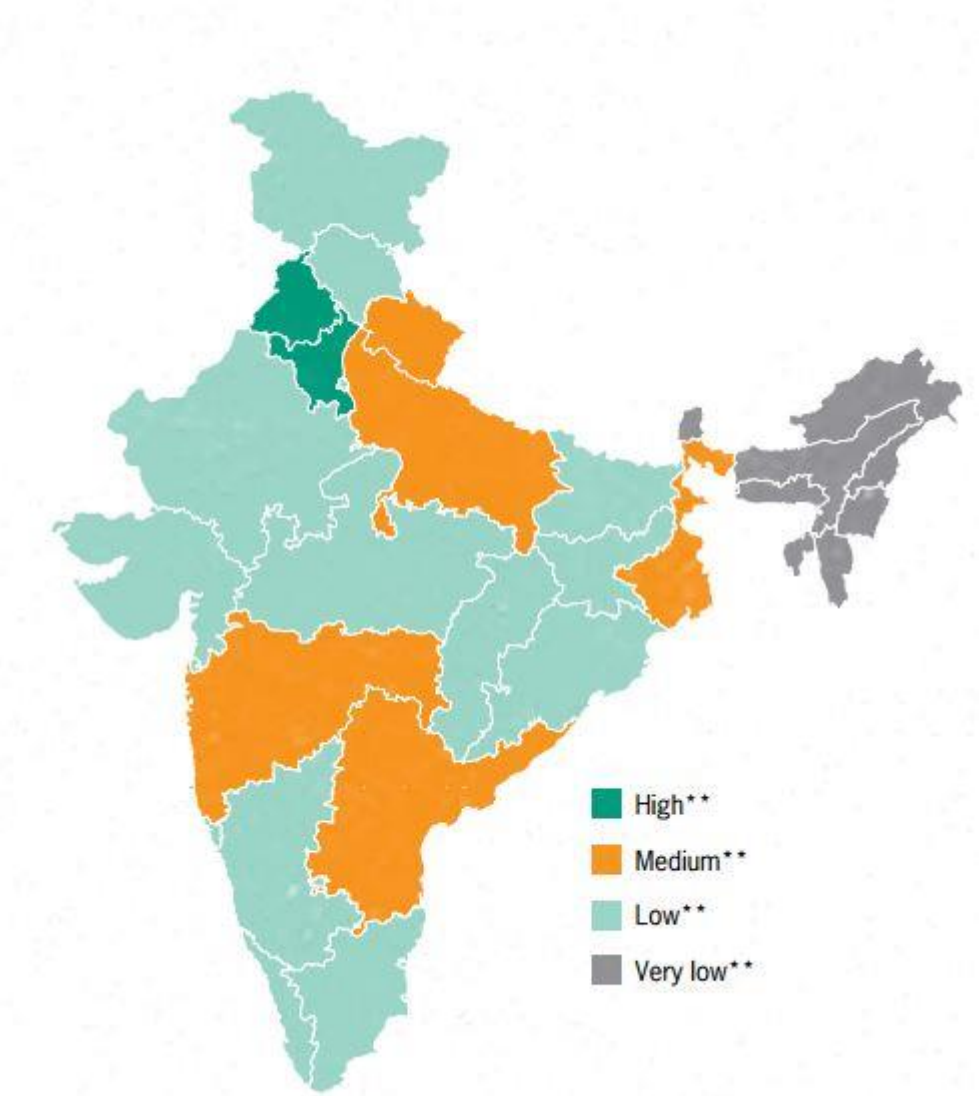
Machines and implements that are necessary for treating crop residue *in-situ* as well as *ex-situ* have also been made available to farmers under Central and State schemes that promote mechanisation in farming.[125] Farmers can either temporarily hire such machines from custom hiring centres, or purchase such machines through subsidies.[126] A knowledge paper on the Indian farm sector equipment published in 2015, collated information on the extent of agricultural mechanisation in various Indian States.[127] The figure below outlines the trends in agricultural mechanisation in various Indian States across India.

[125] Sub - Mission on Agricultural Mechanization (SMAM) under the National Food Security Mission, Mini Mission-I, II of National Mission of Oil Seeds and Oil Palm, and Mission for Integrated Development of Horticulture. Please see 'Take Steps to Promote use of Equipment for Crop Residue Management in a Big Way: Shri Radha Mohan Singh, State Governments should create massive awareness on crop stubble management: Shri Singh', Ministry of Agriculture, Government of India, *Press Information Bureau* (8 November 2016), <http://pib.nic.in/newsite/PrintRelease.aspx?relid=153397> accessed on 21 March, 2017.

[126] Custom hiring centres are primarily intended for farmers with small/marginal holdings, who, by virtue of their economic condition, are unable to own farm machinery on their own or through institutional credit. They are basically a unit comprising a set of farm machinery, implements and equipment meant for custom hiring by farmers.

[127] 'Transforming Agriculture Through Mechanisation: A Knowledge Paper on Indian farm equipment sector', Agriculture Division, The Federation of Indian Chambers of Commerce and Industry (2015), <http://ficci.in/spdocument/20682/agrimach.pdf> accessed on 21 March, 2017.

Figure 1: Extent of Agricultural Mechanisation in India



Source: State of Indian Agriculture, Department of Agriculture report, 2012-13

** Based on relative scale of farm power availability as shown in the report

According to the figure, Punjab, Haryana and Uttar Pradesh have high to medium level of agricultural mechanisation. This could be interpreted to mean that farmers in these States are not averse to substituting their traditional farm practices that rely on manual labour, with farm machinery. The table below enumerates the market share of some of the most popular farm machinery.[128] Rotavators, combine harvesters and self-propelled vertical conveyor reapers, all of which are used towards the management of crop residue, are also a part of the table.

[128] The annual market size refers to the number of units of the machinery sold annually.

Table 13: Market Share of Farm Machinery, including Crop Residue Management Implements

Equipment	Annual market size (units	Estimate year
Tractor	600,000-700,000	2014
Thresher	100,000	2014
Rotavator	60,000-80,000	2014
Power Tiller	50,000-60,000	2014
Zero-Till Seed Drill	25,000-30,000	2014
Power Weeder	25,000	2014
Combine Harvester	4,000-5,000	2014
Self-Propelled Vertical Conveyer Reaper	4,000-5,000	2014
Laser Land Leveller	3,000-4,000	2014
Rice Transplanter	1,500-1,600	2013
Multi-Crop Planter	1,000-2,000	2014
***Source**: Trend of agricultural mechanism in India, United Nations Economic and Social Commission for Asia and the Pacific, CSAM policy brief, June 2014 as mentioned in 'Transforming Agriculture Through Mechanisation: A Knowledge Paper on Indian farm equipment sector', FICCI*		

While several farmers appear to be inclined to buy machines such as rotavators, combine harvesters and self-propelled vertical conveyor reapers, several others continue to engage in the practice of burning without restraint. This may be gauged from the fact that crop residue burning continues to be a large contributor of particulate matter as of 2016.[129] This implies that there are still a large number of farmers who prefer to burn crop residue, rather than utilise it. Several farmers with small landholdings do not have adequate resources to purchase or even hire machinery for managing crop residue. Despite the availability of subsidies under various government schemes, farmers may also be inclined to purchase/rent more of those machines that appear to directly increase crop yield, rather than those that are necessary for processing crop residue.

3. Proposed Solutions

The recently released Graded Action Plan refers to the need for resolving the problem of burning of crop residue, but fails to propose solutions for reducing/curbing the problem. However, there are obvious solutions through which the aforementioned issues could be resolved. In addition to creating capacity within local bodies to ensure compliance with the ban, the Central and State Governments need to provide enough avenues to farmers to utilise crop residue *in-situ* as well as *ex-situ*. By creating such avenues as well as making alternative uses of crop residue profitable,

[129] IIT Kanpur Report (n 3)

farmers could be restrained from burning. The suggested plan for implementing both are outlined below:

(a) *Treatment of crop residue in-situ and ex-situ*

The State Governments should ensure that farmers can either purchase, or temporarily hire machines (mentioned in the table above), at the lowest possible cost, to treat crop residue. Farmers in other countries also use similar machines to ensure the utilisation of crop residue either on the farm, or outside the farm.[130] While farmers have access to subsidies under several government schemes to purchase as well as temporarily hire machinery for managing crop residue, *all* farmers do not avail of such benefits. Many farmers chose to purchase other, more popular machinery, rather than the one necessary for treating crop residue. To counter this issue, State Governments, in close conjunction with the Central Government, should make it mandatory for farmers to at least procure one machine for treating crop residue in-situ, either on a temporary, or permanent basis. As an immediate measure, funds should be arranged at the Central-level for giving out such machinery free-of-cost to all farmers within the States of Uttar Pradesh, Punjab and Haryana through awareness drives during change of crop season. The benefits of agriculture mechanisation have been summarised in the image below:

Table 14: Savings Produced by Agricultural Mechanisation (Source: Custom Hiring of Agricultural Machinery in India, Dr. Kanchan K. Singh)

Contribution of Agricultural Mechanization	
Benefits	**Value**
Saving in seed	15-20%
Saving in fertilizer	15-20%
Saving in time	20-30%
Reduction in labour	20-30%
Increase in cropping intensity	5-20%
Higher productivity	10-15%
→ *Reduction in drudgery of farm workers especially that of women workers*	

(b) *Use of crop residue for the production of goods or the generation of energy*

The large amount of crop residue generated every year could either be used to produce marketable goods, or to generate bio-mass energy. While the latter is easy to implement, it is not eco-friendly; the former requires greater investment and the use of new technologies. Regardless, the Central and State Governments should put in place a comprehensive mechanism for collecting,

[130] Indian Agricultural Research Institute (n 101).

storing, transporting and selling crop residue, to enable farmers to give away the residue of their crop for utilisation elsewhere.

As an immediate measure, the Central and State Governments should establish government owned production units that use existing technological solutions to manufacture goods such as plyboards/paper out of crop residue. However, as a long-term measure, the Central as well as State Governments should encourage research and developments efforts in finding new and innovative ways to utilise crop residue for the production of a greater number of marketable goods.

The Central and State Governments should also promote bio-mass power generation through crop residue on a large scale. There are several biomass energy plants dotted all over Uttar Pradesh, Haryana and Punjab, which could utilise crop residue more effectively. According to the Biomass Knowledge Portal, the States of Haryana, Uttar Pradesh and Punjab have tremendous potential in generating energy through biomass plants. However, this potential seems to remain untapped, despite the existence of central financial assistance and fiscal incentives for private, public, joint and cooperative enterprises to set up biomass power plants.[131] This untapped potential is demonstrated in the table below.

Table 15: Untapped Potential of Bio-Mass Power Generation

Name of the State	Biomass power generation potential	Potential utilised	Untapped potential
Haryana	1456.9 MW[132]	52.30 MW[133]	1404.6 MW
Punjab	3172.1 MW[134]	140.50 MW - 155.5 MW[135]	3016.6 MW (approximately)

[131] It has not been possible to obtain accurate information regarding the number of bio-mass plants that are presently underway. For more information please see, 'Biomass Power and Cogeneration Programme', Ministry of New and Renewable Energy, Government of India, <http://mnre.gov.in/schemes/grid-connected/biomass-powercogen/> accessed on 22 March, 2017.

[132] 'Biomass resource potential in Haryana', Biomass Knowledge Portal, Clean Green and Sustainable Energy, Ministry of New and Renewable Energy, Government of India, <http://biomasspower.gov.in/haryana.php> accessed on 22 March, 2017.

[133] Biomass Power and Cogeneration Programme (n 131).

[134] 'Biomass resource potential in Punjab', Biomass Knowledge Portal, Clean Green and Sustainable Energy, Ministry of New and Renewable Energy, Government of India, <http://biomasspower.gov.in/punjab.php> accessed on 22 March, 2017.

[135] Biomass Power and Cogeneration Programme (n 131); 'Overview of biomass power sector in India', Biomass Knowledge Portal, Clean Green and Sustainable Energy, Ministry of New and Renewable Energy, Government of India, <http://biomasspower.gov.in/About-us-3-Biomass%20Energy%20scenario-4.php> accessed on 22 March, 2017.

Uttar Pradesh	1748.3 MW[136]	842 MW – 936.70 MW[137]	811.6 MW (approximately)

Hence, as a long-term measure, the Central and State Governments should also consider promoting more investment in biomass energy plants. The Make in India project which promotes investment in renewable energy could be used as a possible measure to encourage investment in the generation of bio-mass energy.[138]

(c) *Institutional mechanism for implementing (a) and (b)*

At present, the utilisation of crop residue and the ban against the burning of crop residue are two separate functions that are performed by a multiplicity of authorities. The authorities promoting bio-mass energy generation or the discovery of new technology for the production of goods out of crop residue are not also specifically entrusted with the task of ensuring that crop residue generated all over the country gets effectively utilised. Such authorities target the generation of bio-mass energy itself (either through agricultural residue or through forest waste), or the discovery of new technology as their primary goal. The utilisation of crop residue is only an ancillary aspect of this primary goal. As a result, there is an absence of a targeted approach towards the utilisation of the crop residue.

Furthermore, the authorities imposing the ban lack adequate man-power and resources to effectively monitor compliance of the ban by *all* farmers. There is also no uniform governmental policy on disincentivising farmers to burn crop residue, and incentivising them to utilise it in other ways (NPMCR is yet to be officially enforced). Consequently, there exists no linkage between compliance with the ban by farmers and the usage of crop residue on the farm or outside the farm. Due to the absence of this linkage, authorities have failed to ensure the effective management of crop residue.

For resolving the issues, it is recommended that a stand-alone institution should be created that not only targets crop residue management as its primary function, but also draws the much-needed link between compliance with the ban and the incentivisation of farmers to use crop residue in other ways. This stand-alone institution should be set-up as a Special Purpose Vehicle ('SPV'), and a suggested name for this is the Fasal Avshesh Upyog Nigam ('FAUN'). It should be set-up as a government owned, not-for-profit company under Section 8 of the Indian Companies Act, 2013, and should be administered under the aegis of the Department of Agriculture, Cooperation

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[136] 'Biomass resource potential in Uttar Pradesh', Biomass Knowledge Portal, Clean Green and Sustainable Energy, Ministry of New and Renewable Energy, Government of India, <http://biomasspower.gov.in/uttar-pradesh.php> accessed on 22 March, 2017.

[137] Biomass Power and Cogeneration Programme (n 131); Overview of biomass power sector in India (n 135).

[138] 'Renewable Energy', Make in India, <http://www.makeinindia.com/sector/renewable-energy> accessed on 22 March, 2017.

and Farmer's Welfare, Government of India (DACFW), which also implements schemes on agricultural mechanisation. FAUN should be allocated funds by the Central Government under the Union Budget.

There are several institutions such as the National Safai Karamcharis Finance & Development Corporation ('NSKFDC') and the National Minorities Development & Finance Corporation ('NMDFC') that have a similar organisational structure and perform welfare functions, including awareness and training programs. The NSKFDC provides financial assistance and training to *safai karamcharis* through State Channelising Agencies appointed by State Governments/ UTs, Regional Rural Banks and Nationalised Banks across the country.[139] The NMDFC provides financial concessions to minority communities for self-employment and income generation activities. Similarly, it is suggested that the primary functions of FAUN ought to include:

- As a long-term measure, encouraging farmers to avail of benefits under existing schemes on farm mechanisation and to purchase or temporarily hire machinery for treating crop residue;
- As a long-term measure, encouraging the establishment of more custom hiring centres all over India, and specifically in Haryana, Punjab and Uttar Pradesh, and supervising such centres across India;
- As a long-term measure, providing financial support to local bodies in creating capacity to monitor compliance with the ban;
- As a short-term measure, providing free-of-cost machinery and implements to farmers for treating crop residue *in-situ* as well as *ex-situ*. The machinery may be given to farmers through distribution drives at the end of a crop season. The initial cost of providing free machinery to farmers would amount to approximately Rs. 600 crores;[140]
- As a short-term measure, acquainting farmers with the disadvantages of burning and alternatives to burning crop residue during distribution drives;
- As a short-term measure, ensuring the collection, storage, transport and sale of crop residue from farmers to the production units through State-level nodal agencies. Additionally, the following measures could be implemented:
    - Institutes, NGOs, centres, trusts, and societies could be designated as nodal agencies upon completing a registration and verification process with State Governments and other local authorities.
    - Such agencies would not only ensure the collection, storage, transport and sale of crop residue, but would also administer training programs, distribute machinery free of cost, and transfer funds for the setting up of custom hiring

[139] 18th Annual Report 2014-2015, National Safai Karamcharis Finance & Development Corporation (NSKFDC), <http://nskfdc.nic.in/writereaddata/files/NSKFDC%20Annual%20Report.pdf> accessed on 22 March, 2017; See also 19th Annual Report 2015-2016, NSKFDC, <http://nskfdc.nic.in/writereaddata/files/Annual%20Report%2015-16.pdf> accessed on 22 March, 2017.

[140] To obtain the amount of funds required, we have first calculated the number of machinery required for Punjab, Haryana and UP by dividing the net area sown in these States with 100 hectares (assuming this to be the average landholding within all three States). Thereafter, we have multiplied the number of machinery required with the cost of each machine and added the figures for all the machines listed in the table.

centres.

- They would also be answerable to FAUN, and would be mandated to periodically submit their books of accounts to the Corporation.
- The State Channelising Agencies under the NSKFDC are also designated in a similar manner and perform training and money transfer functions.[141]

➢ As a short-term measure, setting up a subsidiary manufacturing company to manufacture goods/generate energy through crop residue. The subsidiary company could assist FAUN in generating more funds for crop residue management, and creating demand for goods/bio-mass energy. The cost of installing and running manufacturing units for other goods would depend upon the size of the plant, the technology employed, and the type of good produced. The costs of installing a bio-mass plant are more fixed—the capital cost is approximately Rs.4.5-5.0 Crore/MW and the cost of generating power from one plant is approximately Rs. 3.50-4.00/kwh.

➢ As a short-term measure, adequately paying farmers who give away their residue, through State-level agencies. The amount would be contingent upon the weight of the residue, thereby creating an incentive for farmers to sell it.

4. Summary of Action points

Table 16: Implementation Action Plan for emissions from Crop Residue Burning

Proposed Measure	Responsible Authority/Authorities	Implementation Route	Timeline
Short term measures			**1 - 6 months**
Provide machinery to farmers free-of-cost to treat crop residue for in-situ and ex-situ utilisation. Incentivise the use of custom hiring centres for farm machinery. Establish manufacturing units to produce goods from crop residue.	Set up a not for profit company—FAUN—under the Department of Agriculture, Cooperation and Farmer's Welfare, Government of India.	Through Cabinet approval under the Transaction of Business Rules of the Cabinet. Also, through an amendment of the Allocation of Business Rules of the Cabinet, FAUN could be established within the mandate of the Department of Agriculture, Cooperation and Farmer's Welfare.	

[141] 18th Annual Report 2014-2015, NSKFDC (n 139).

Long-term			**6 months - 1 year**
Encourage private investment in the production of biomass energy and goods manufactured from crop residue	Department of Industrial Policy and Promotion, Government of India/Departments of Commerce and Industry in the Governments of the NCT of Delhi, Punjab, Haryana and Uttar Pradesh Ministry of New and Renewable Energy, Government of India/Departments of Power in the Governments of NCT of Delhi, Punjab, Haryana and Uttar Pradesh	Through a policy document laying out how to incentivise private manufacturing units producing goods from crop residue Through the Make in India programme to create awareness about subsidies and financial assistance being provided to private investors to set up bio-mass plants	
Pay farmers fixed prices for crop residue, depending upon the weight of the residue	Public and private manufacturing units producing goods that use crop residue	Prices ought to be set through FAUN	
Provide local authorities with more funding to enforce compliance with the ban on burning crop residue	State Governments of the NCT of Delhi, Punjab, Haryana and Uttar Pradesh, in conjunction with Municipal Corporations and Panchayats		

D. Fly Ash from Ready-Mix Concrete Batching Plants

1. Contribution to Pollution

Ready-Mix Concrete mixture, which is used for construction activities, emits a large amount of fly ash that contributes to air pollution.[142] The mixture contains water, cement, sand (fine aggregate), coarse aggregate (gravel, crushed stone or iron blast furnace slag), and, sometimes, cementitious materials (i.e., mineral admixtures or pozzolan minerals).[143] While several Ready-Mix Concrete Batching Plants ('RMC Plants') are present within Delhi, there are also a number of RMC Plants that contribute to air pollution in Delhi, but are located outside the boundaries of Delhi. According to the IIT Kanpur Report, the total PM_{10} and $PM_{2.5}$ emissions from RMC Plants in Delhi is approximately 14.37 ton/day (10% of the total PM_{10} emissions) and 3.5 ton/day (6% of the total $PM_{2.5}$ emissions) respectively.[144]

2. Reasons for the Problem

(a) *Weak legal framework and implementation*

The MOEFCC introduced the categorisation of industries as "Red", "Orange", "Green" and "White" for the purpose of facilitating industrial siting decisions.[145] The CPCB has used this categorisation to prepare a comprehensive list of industries that are "Red", "Orange", "Green" and "White" and has directed all SPCBs to grant environmental permits on the basis of this list.[146] The CPCB has categorised RMC Plants as "Green" industries, implying a Pollution Index Score of 15-29 [*cumulative assessment of air (maximum score of 40) and water (maximum score of 40) pollution and hazardous waste management (maximum score of 20)*].[147] This implies that RMC plants within the NCT of Delhi must only obtain consent to establish and operate from the DPCC under the Air Act, Water Act and the Environment Protection Act for the purpose of commencing operations. The RMC Plants operators are exempt from obtaining environmental clearances under the EIA Notification, 2006.[148]

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[142] IIT Kanpur Report (n 3).

[143] IIT Kanpur Report (n 3).

[144] The IIT Kanpur Report collected information on number of buildings, roads and flyovers under construction information from DMRC, Public Works Department (PWD), Central Public Works Department (CPWD), and Delhi Development Authority websites and sites.

[145] 'Final Document on Revised Classification of Industrial Sectors under Red, Orange, Green and White Categories (February 29, 2016)', Central Pollution Control Board, <http://cpcb.nic.in/upload/Latest/Latest_118_Final_Directions.pdf> accessed on 22 March, 2017.

[146] *Ibid.*

[147] Final Document on Revised Classification of Industrial Sectors (n 145).

[148] For instance, please see 'Environmental Assessment (EA) & Environmental Management Framework for Bhaupur - Khurja Section of proposed Eastern Dedicated Freight Corridor', Dedicated Freight Corridor Corporation of India Limited, <http://dfccil.gov.in/upload/EMF-final.pdf> accessed on 22 March, 2017.

The DPCC consent policy provides guidance on the level of emissions that are permissible for cement-mixing plants, including RMC Plants. All industries holding consent certificates from the DPCC are required to comply with the emission standards laid down in the DPCC consent policy. If an RMC Plant operator violates the emission standards of the DPCC, he/she is liable to pay damages. The Government of the NCT of Delhi, in conjunction with the Transport Department, the Public Works Department, Health and Home Department, has also vested the DPCC with the function of reporting the number of RMC Plants operating in Delhi and inspecting them for dust control. However, none of the policies or notifications provide any guidance to RMC Plant operators on the specific measures that they should implement to reduce fly ash emissions. The DPCC also lacks enough resources to monitor emissions from each RMC Plant, making it easier for plant operators not to comply with emission standards.

In addition to the consent of the DPCC, the RMC Plants operators are also required to obtain two more approvals for running the plant - one is a no-objection certificate from the MCD for occupying land space; the other is an approval certificate for the siting of the plant by the Factories Inspector under the Indian Factories Act, 1950, read with the Delhi Factories Rules, 1950. Rule 17 of the Delhi Factories Rules specifically requires factory owners, including RMC Plant owners to put in place measures for treating waste and effluents generated out the factory, in accordance with the Air Act and the Water Act. However, dust emissions may not necessarily constitute waste or effluent. Hence, the emissions of RMC Plants are neither regulated by the MCD nor by the Factories Inspector.

3. Proposed Solutions

The recently released Graded Action Plan does not suggest specific measures for curbing fly ash, but suggests the shutting down of certain industries and plants during severe pollution, and the stringent enforcement of pollution control regulations over *all* industries, including RMC plants during moderate to high pollution levels. While these measures are useful, they do not attempt to resolve the root of the problem, i.e. measures for curbing emissions on site. In the specific context of RMC Plants, there are a number of concrete steps that can be taken to curb fly ash emissions. The IIT Kanpur Report suggests the installation of bag filters at silos, use of enclosures, hoods, curtains, telescopic chutes, cover over transfer points and wet suppression. The use of fabric filter, in particular, has been found to be very useful in reducing fly ash emissions considerably. There are several avenues through which RMC Plants operators could be made aware of these measures and be made to comply with them. These are listed below:

(a) *Role of State Pollution Control Boards*

While the DPCC has already issued detailed directions to builders for reducing dust at construction sites, similar directions have not been issued to RMC Plant operators. In exercise of its powers under Clause (1) read with Clause (2)(z) of Section 54 of the Air Act, along with Section 21(1) of the Water Act, the Maharashtra State Pollution Control Board has recently issued 'Guidelines for Ready Mix Concrete Plant for siting criteria of RMC Plant in the State of

Maharashtra'.[149] The guidelines describe the criteria for siting an RMC Plant, the storage capacity for the material handled at the plant, existence of a plan to control fugitive/dust emissions, the existence of a suppression system, and specific measures to control pollution, including air pollution.[150] The MPCB Guidelines are a good example of the manner in which RMC Plants could be regulated by the DPCC. It is pertinent to note that the Haryana State Pollution Control Board has also issued a notification outlining air pollution control measures that should be implemented at RMC Plants.[151] These examples attest to the power of SPCBs, including the DPCC to issue directions/guidelines to RMC Plant operators for undertaking air pollution control measures.

While formulating guidelines for RMC Plant operators, the DPCC should refer to the Standards on Ready-Mix Concrete Batching issued by the Indian Bureau of Standards, the Building Materials & Technology Promotion Council under the Ministry of Housing & Urban Poverty Alleviation, and the National Safety Council with the assistance of Ready-Mix Concrete Manufacturers Association.[152] The CPCB can also issue uniform emissions standards for RMC Plants by virtue of its powers under Section 16(2)(h) of the Air Act.

For ensuring compliance with its directions, the DPCC must also recruit more monitoring officers to effectively monitor RMC Plants on a periodic basis. By virtue of its powers under Clause (1)(a) read Clause (1)(c) of Section 17 of the Air Act, the DPCC should also conduct awareness programs for RMC Plant operators to equip them with the necessary knowledge for implementing air pollution control measures.

(b) *Role of the Municipal Corporation of Delhi*

The operation of an RMC Plant in Delhi can only begin after the MCD issues a no-objection certificate to the operator of the plant. While issuing this certificate, the MCD looks into the siting of the RMC plant and the manner of its operation. However, measures for controlling air pollution and fly ash are not examined by the MCD. To fill this void, the MCD should issue norms on fly ash control for RMC Plants. Among other things, such norms should direct plant operators to put in place certain key measures for reducing fly ash emissions from such plants. Norms of this nature

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[149] The Guidelines for Ready Mix Concrete Plant (RMC) for sitting criteria of RMC Plant in the State of Maharashtra, <http://mpcb.gov.in/consentmgt/pdf/RMC_Gazette_circular.pdf> accessed on 22 March, 2017.

[150] *Ibid.*

[151] 'Issue regarding requirement of air sampling in the Ready-Mix Concrete Plants', Haryana State Pollution Control Board, <http://hspcb.gov.in/procedure_24.12.2013.pdf> accessed on 22 March, 2017.

[152] Indian Standard 4926: Code of Practice Ready-Mixed Concrete, Second revision, 2003; 'Criteria for Production Control of Ready Mix Concrete for RMC Capability Certification under Ready Mix Concrete (RMC) Plant Certification Scheme (QCI)', Building Materials & Technology Promotion Council Ministry of Housing & Urban Poverty Alleviation Government of India (2013), <http://qcin.org/CAS/RMCPC/Criteria%20for%20Production%20Control%20of%20RMC.pdf> accessed on 22 March, 2017; 'Manual for Safety Rating of Ready Mixed Concrete Plants', National Safety Council and Ready Mixed Concrete Manufacturers' Association (2014-15), <http://www.rmcmaindia.org/NSC-SAFETY-RATING-RMC-MUMBAI-2014-15.pdf; IS 4926> accessed on 22 March, 2017.

have been issued to RMC Plants by the Municipal Corporation of Greater Mumbai,[153] suggesting that the MCD may also take similar action. Like the DPCC, the MCD should also recruit more monitoring officers to ensure that RMC Plant operators comply with its directions.

4. Action points

Table 17: Implementation Action Plan for emissions for Fly Ash from Ready-Mix Concrete Batching Plants

Proposed Measure	Responsible Authority/Authorities	Implementation Route	Timeline
Short-term			**Short-term** 1 – 6 months
Direct RMC Plants to take specific measures to curb air and water pollution	DPCC	Through the issue of Environmental Guidelines under Clause (1) read with Clause (2)(z) of Section 54 of the Air Act, along with Section 21(1) of the Water Act	
Direct RMC Plants to control fly ash emissions	Municipal Corporation of Delhi	Through the issue of norms under Sections 416, read with 417 of the Delhi Municipal Corporations Act, 1957	
Long-term			**Long-term** 6 months – 1 year
Conduct awareness programs for RMC Plant operators	DPCC	Through the DPCC's powers under Clause (1)(a) read Clause (1)(c) of Section 17 of the Air Act	

[153] 'Revised Basic Norms for Registration of RMC Plants', Municipal Corporation of Greater Mumbai (2011), <http://www.mcgm.gov.in/irj/portalapps/com.mcgm.atenders_overview/docs/RMC_Plants_norm_01071102.pdf> accessed on 22 March, 2017.

Recruit more monitoring officers for the DPCC	Government of NCT of Delhi	Through the allocation of more funding under the annual budget of the Government of the NCT of Delhi	
Recruit more monitoring officers for the MCD	Government of NCT of Delhi	Through the allocation of more funding under the annual budget of the Government of the NCT of Delhi	

E. Dust from Construction Sites

1. Contribution to Pollution

Due to the high urban agglomeration in Delhi, there are a number of construction and demolition activities taking place across the city. According to the IIT Kanpur Report, dust from construction sites contributes approximately 3.6% of the total emissions towards PM_{10} and 2.1% of the total emissions towards $PM_{2.5}$.[154]

2. Reasons for the Problem

(a) *Weak Legal Framework and Implementation*

The Unified Building Byelaws of the NCT of Delhi, 2016 ('UBBLD') impose duties upon builders to take measures to reduce dust at all construction sites (starting with those that have a minimum construction area of 5000 sqm), and upon local authorities to ensure conformity with such duties by all builders.[155] All buildings plans are to be submitted to the urban local bodies for authorisation. The sanctioning letter from the Delhi Development Authority, annexed to the UBBLD, imposes a duty upon builders to take measures to curb construction dust.[156] On a reading of the UBBLD, the MPD as well as the website of the MCD, no-objection certificates/sanctioning letters from the MCD also appear to impose similar duties upon builders.[157]

The UBBLD itself provides guidance on the measures that ought to be taken by builders with a minimum built up area of 500 sqm while applying for environmental clearance.[158] These include dust control measures. However, widespread litigation involving violations of the building byelaws and the MPD by builders also demonstrates a general lack of compliance by builders.[159]

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[154] IIT Kanpur Report (n 3).

[155] Byelaw 3.2 on 'Environmental conditions for sanctioning Building Plans', Unified Building Bye Laws for Delhi, 2016 ('UBBLD'), <http://www.indiaenvironmentportal.org.in/files/file/UBBL_Delhi%202016.pdf> accessed on 22 March, 2017.

[156] 'Grant/Refusal of Sanction', Form- B-1 (Chapter 2, Para 2.18.1, 2.19), UBBLD.

[157] Master Plan for Delhi – 2021 (n 78).

[158] Byelaw 3.2, UBBLD.

[159] Please see *M.C. Mehta v. Union of India (UOI) and Ors.*, (2004) 6 SCC 588, where the Supreme Court directed the closing down of unauthorised industrial activity that was in violation of the Master Plan and Zonal Plan of Delhi; Also see, *Anirudh Kumar v. Municipal Corporation of Delhi and Ors.*, (2015) 7 SCC 779, the Supreme Court ordered the shutting down of an establishment as it violated Delhi's Master Plan; *Anil Kumar Khurana v. Municipal Corporation of Delhi*, 1996 (36) DRJ 558, where the Delhi High Court ordered the demolition of buildings that violated sanctioned building plans and building byelaws of Delhi.

Under the EIA Notification, large construction projects (≥ 220000 sq. mtrs and <1,50, 000 sq. mtrs. of built-up area, or covering an area of ≥ 50 ha and or built up area ≥1,50,000 sq. mtrs ++) are required to obtain an environmental clearance before beginning operations.[160] Among other things, the conditions for compliance with the EIA Notification include measures for curbing the emission of dust from construction sites. In this regard, the Manual on Norms and Clearance of Large Construction Projects ('Manual'), which has been issued by the MOEFCC, provides guidance on the measures that builders ought to take to curb dust at construction sites.[161] However, the Manual is not binding, but only suggestive. Furthermore, relatively smaller construction projects, which may be smaller in size but more in number, are completely excluded from the application of the EIA Notification.

The builders are also required to also obtain approval from the SPCBs, before beginning construction activities. In the context of Delhi, the DPCC has issued a consent policy for issuing permits for construction activities. Among other things, the policy lays down standards on dust emissions and seeks to impose a penalty on builders for violating such standards.[162] The DPCC also issued detailed directions to private and public builders within and around Delhi on how to curb construction dust.[163] However, as noted in the previous section relating to the monitoring of RMC Plants, the DPCC lacks enough man-power to monitor compliance of its directions at every construction site within and around Delhi.

With the assistance of the Transport Department, PWD, Health and Home Department, the Delhi Government has also put in place the following measures:[164]

- All construction sites with a built-up area of at least 20,000 sq.mt. should be visited weekly by officers of the DPCC;
- Sub-Divisional Magistrates of Delhi ('SDMs') should submit Action Taken Reports on the inspections conducted for dust control at construction sites;
- The NGT may be requested to delegate the Government of Delhi with the power to constitute District-Wise Courts to decide on violations regarding dust control at

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[160] 'Guidelines for seeking Environmental Clearance for Construction Projects', Ministry of Environment and Forests, Government of India, <http://nromoef.gov.in/ECconstruction.pdf> accessed on 22 March, 2017.

[161] 'Manual on norms and standards for environment clearance of large construction projects', Ministry of Environment and Forests, Government of India, <http://envfor.nic.in/divisions/iass/Construction_Manual.pdf> accessed on 22 March, 2017.

[162] 'Consent Policy', Delhi Pollution Control Committee, <https://dpcc.delhigovt.nic.in/consent-policy.html> accessed on 22 March, 2017.

[163] 'Air Pollution of Dust from Construction and Demolition Activity', Delhi Pollution Control Committee (2015), <https://dpcc.delhigovt.nic.in/pdf/EIA_DOCUMENT.pdf> accessed on 22 March, 2017.

[164] 'Public transport augmentation and dust control measures announced', Directorate of Information and Publicity, Government of NCT of Delhi (December, 2015), <http://delhi.gov.in/wps/portal/!ut/p/c0/04_SB8K8xLLM9MSSzPy8xBz9CP0os3hvdxMXExdTEwMDXzNzA09_YyOPEHcnAwMLQ_2CbEdFAIa72s0!/?WCM_PORTLET=PC_7_KG4D4D5400M670IO32HTGB0046_WCM&WCM_GLOBAL_CONTEXT=/wps/wcm/connect/doit_publicity/Information+and+Publicity/Press+Release/Chief+Minister/Public+transport+augmentation+and+dust+control+measures+announced%2C+10th+December+2015> accessed on 22 March, 2017.

construction sites; and

- The Department of Revenue, the Municipal Corporations of Delhi, the PWD and the DPCC have been entrusted with the power not only to conduct inspections at construction sites, but also to issue *challans* to those builders who do not comply with dust-control measures.[165]

While these measures are intended to reduce the emission of dust, local authorities such as the SDMs, and the MCD lack adequate capacity, like the DPCC, to monitor compliance with these measures.

3. Proposed Solutions

The Graded Action Plan directs Police Commissioners or Officers in charge of Police Departments in Delhi and NCR towns to strictly enforce dust control rules at construction sites and order the closure of non-complying construction sites during moderate to high pollution levels. It also directs the DPCC, the MCD and the Municipal Corporations of other cities around Delhi to order the closure of construction sites during severe/emergency pollution levels. For controlling dust at construction sites, the Manual released by the MoEFCC refers to certain key measures that may be helpful in reducing the emission of dust at construction sites. The IIT Kanpur Report also reiterates some of those measures and proposes a number of additional measures for curbing construction dust. These include vertical cover over the construction area with fine screens, handling and storage of raw material (completely cover the material), use of water spray and wind breakers. These measures can be implemented through the following avenues:

(a) *Role of State Pollution Control Boards*

For ensuring that builders comply with dust control measures proposed under the UBBLD or by the MOEFCC as well as the Delhi Government, the DPCC should recruit more officers who can effectively and periodically monitor *all* construction sites. By virtue of its power under Clause (1)(a) read with Clause (1)(c) of Section 17 of the Air Act, the DPCC should also conduct awareness programs for builders to acquaint them with the measures that are necessary for curbing dust at construction sites.

(b) *Residents' Welfare Associations to monitor construction sites*

The RWAs play an important role in regulating activities within and around residential colonies. RWAs are constituted under the Societies Registration Act, 1850, and perform a number of social, religious and charitable functions.[166] The Delhi Government has also released a Model Memorandum

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[165] 'Crackdown on construction sites causing air pollution in Delhi, Over Rs one crore fine collected for violation of dust control measures at construction sites', Government of NCT of Delhi, <http://delhi.gov.in/wps/wcm/connect/e9fea7804ce028c48e318e3db38b51c0/environment+meeting.pdf?MOD=AJPERES&lmod=-518663074> accessed on 22 March, 2017.

[166] 'Guidelines and procedure for seeking registration of a Society under the Societies Registration Act, 1860', Office of the Commissioner of Industries, Government of NCT of Delhi, <http://www.delhi.gov.in/wps/wcm/connect/98f8250046a2ddbd902e915d9d3d91ee/Registration+of+Societies.pdf?MOD=AJPERES&lmod=92948193> accessed on 22 March, 2017.

of Association ('MOA') of RWAs, which provides guidance on some of the specific functions that RWAs ought to perform. [167]

To counter dust at construction sites, it is recommended that the Model MOA be amended to specifically entrust RWAs with the task of monitoring the implementation of air pollution-control measures at construction sites, at least in and around residential colonies. Alternatively, the Municipal Corporation of Delhi or Department of Environment within the Delhi Government should issue directions to RWAs to monitor dust emissions at construction sites. By virtue of this delegation of monitoring functions to RWAs, the issue of capacity could be resolved. The *Bhagidari* scheme, which seeks to involve RWAs in civic functions, could be a possible avenue through which the MCD or the Department of Environment could issue such directions.[168]

(c) *Role of Grievance Redressal Committees*

The Grievance Redressal Committees set-up by virtue of clauses 1.5.4 and 1.8 of the UBBLD should be allowed to hear complaints regarding non-compliance of dust control measures at construction sites and take necessary action to ensure compliance. If a construction site is found to be in violation of dust control norms, the Grievance Committee should also be able to cancel the sanctioning letter given to such site. For this purpose, the Delhi Government, or the DDA should issue a notification amending Clauses 1.5.4 and 1.8 of the UBBLD to expressly allow the Grievance Redressal Committees to exercise these functions.

(d) *Unique ways of monitoring*

An effort should be made to explore other unique ways to monitor compliance with air pollution control measures by builders. The Graded Action Plan also refers to the use of social media and phone applications to enable citizens to report violations of pollution control norms. The Delhi Government also recently suggested that the Swachh Delhi Application on phones be modified to allow people to register complaints regarding dust at construction sites.[169] However, the Swacch Delhi Application does not provide for this function at the moment.[170]

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[167] *Ibid.*

[168] 'Bhagidari', Government of NCT of Delhi, <http://delhigovt.nic.in/newdelhi/bhagi.asp> accessed on 22 March, 2017; Page on 'Bhagidari', Deputy Commissioner (North), Government of NCT of Delhi, <http://www.delhi.gov.in/wps/wcm/connect/doit_dcnorth/dcnorth/Home/Bhagidari> accessed on 22 March, 2017.

[169] 'Government announces raft of measures to tackle Delhi air pollution', *The New India Express* (1 November 2016), <http://www.newindianexpress.com/cities/delhi/2016/nov/01/government-announces-raft-of-measures-to-tackle-delhi-air-pollution-1533900--1.html> accessed on 22 March, 2017.

[170] *Ibid.*

4. Summary of Action points

Table 18: Implementation Action Plan for emissions from Construction Sites

Proposed Measure	Responsible Authority/Authorities	Implementation Route	Timeline
Short-term			**Short-term** 1 – 6 months
Empower RWAs to monitor construction activities	Government of NCT of Delhi	Through a modification of the Draft MOA for RWAs	
	Municipal Corporation of Delhi/Department of Environment, Government of NCT of Delhi	Through directions to RWAs under the *Bhagidari* Scheme of the NCT of Delhi	
Empower Grievance Redressal Committees to cancel no-objection certificates for non-compliance with dust-control norms	Government of NCT of Delhi	Through a notification amending Clauses 1.5.4 and 1.8 of the UBBLD	
Allow people to register complaints regarding dust at construction sites through their phones	Ministry of Urban Development, Government of India	Through updating the Swacch Delhi App to allow dust-related complaints	

Long-term			**Long-term** 6 months – 1 year
Conduct awareness programmes for builders	DPCC	Through the DPCC's powers under Clause (1)(a) read Clause (1)(c) of Section 17 of the Air Act	
Recruit more monitoring officers for the DPCC	Government of NCT of Delhi	Through the allocation of funds in the annual budget	

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