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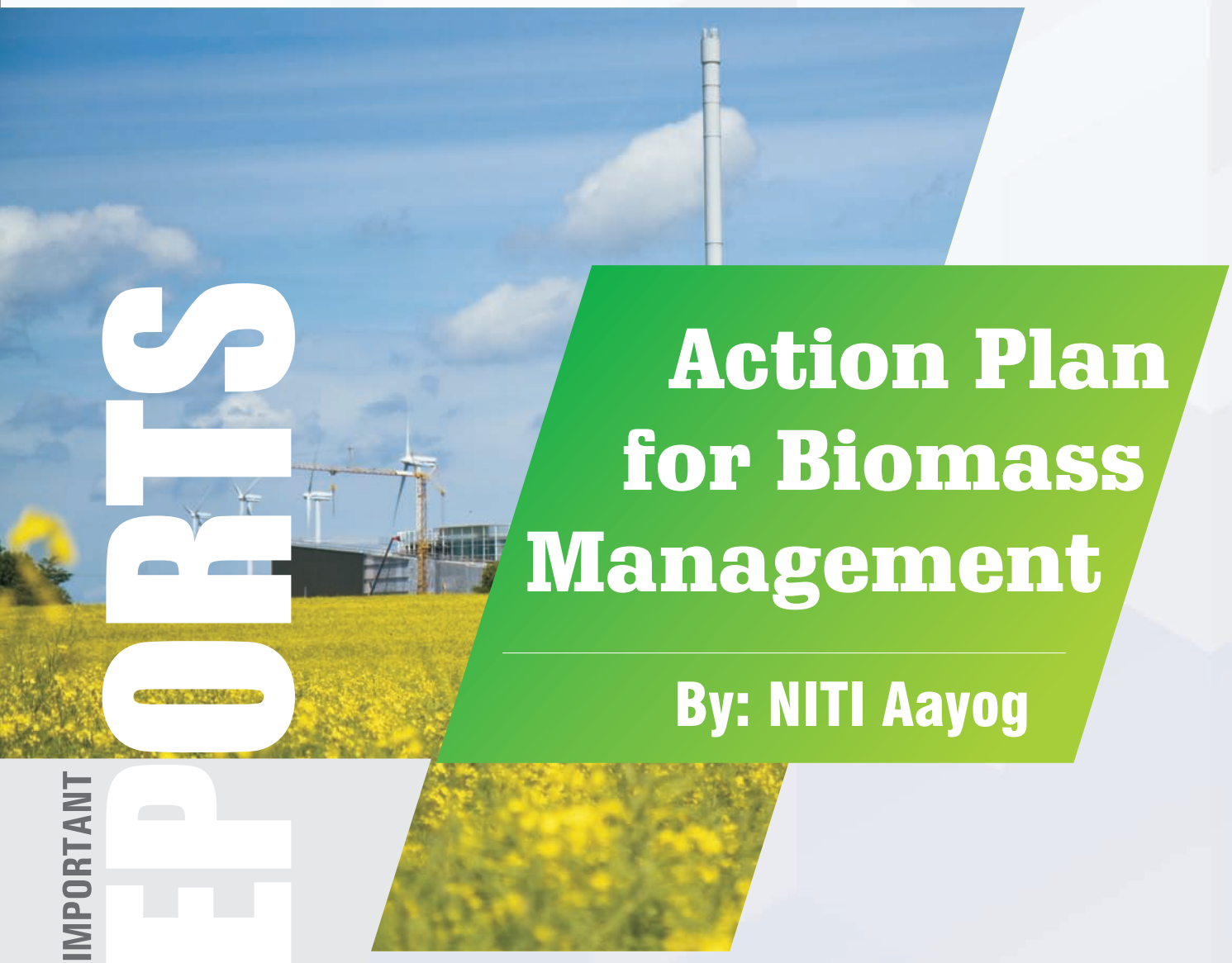

GIST OF IMPORTANT

REPORTS

Action Plan for Biomass Management

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For Civil Services Examination

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ACTION PLAN FOR BIOMASS MANAGEMENT

Air quality in Delhi and National Capital Region (NCR) has been a prime concern for its severe health impact on general public, especially the children and senior citizens. Over past couple of years, there have been episodic incidents of air quality dipping to alarming levels across Delhi-NCR. The farm burning, specific to the paddy-wheat cultivation cycle in the rural regions of Northern and North-Westerns states of India, has been identified as a major source of air pollution. It not only affects the air-quality in rural areas but also causes an episodic rise in air-pollution during October and November in Delhi-NCR.

Hence NITI Aayog task force on biomass management has designed an Action Plan for Biomass Management. Hereby, providing the gist of it.

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ACTION PLAN FOR BIOMASS MANAGEMENT

Introduction

Air pollution is one of the major man-made environmental risks to the health of general public. The release of various gaseous emissions and particulate matter in the air has been on the rise due to rampant anthropogenic emissions of various kinds being pumped into the atmosphere. It serves as a prominent global threat to environment human health in many ways.

One of the major sources of air quality deterioration in Delhi in the months of October and November is burning of agricultural biomass residue, or Crop Residue Burning (CRB) in the neighboring states of NCR.

Farmers turn to residue burning on account of shortened cropping intervals given a very short window of about 10–15 days between subsequent cropping seasons. They do not have enough time to prepare for next crop or use other methods of removal of farm stubble. Burning of crop residues leads to release of soot particles and smoke causing human health problems; emission of greenhouse gases (GHGs); loss of plant nutrients and; adverse impacts on soil properties.

The task force has suggested a two-pronged approach to tackle the issue:

a) Ploughing the residue back into the field and;

b) Extraction and usage for other purposes.

Task Force report identifies the actions and associated plan of implementation involving all relevant stakeholders, hence hereby discussing that in detail.

Recommended Action Plan

As per the agricultural statistics, roughly 2.98 million ha area in Punjab, 1.35 million ha area in Haryana was under paddy cultivation in 2015-16. Another neighbouring state of NCR, Uttar Pradesh (UP) is a major rice producer in the country and uses 5.87 million ha for rice cultivation. Rice cultivation is insignificant in Rajasthan compared to other states. Although, Punjab utilises a smaller area for rice cultivation compared to other states, it is the third largest rice producing state in the country after West Bengal and UP, and generates nearly 19.7 mt of paddy straw annually (Punjab Government 2017). Out of this, only 4.3 mt is utilised for animal fodder, industry, mulching over soil and in-situ incorporation. Rest 15.4 mt is reportedly burnt in the fields. Growth of straw to be managed in future is greatly dependent on the technological breakthroughs for crop-varieties with shorter maturation times, lower straw-to-paddy ratio including crop diversification.

Over the last decade, crop harvesting has been substantially mechanised. Combine harvesting, which is the most commonly utilised harvesting technology, leaves unevenly spread crop-residue and the standing stubble in the field.

Burning of this crop-residue to prepare the field for next sowing season has become a common practice across states. Farm burning practice is especially prevalent in the Wheat Rice Crop (WRC) system where the window for harvesting rice and sowing wheat crop is very small (15-20 days).

Most of the times, wind from the North West enters Delhi, before blowing over Punjab and Haryana bringing the pollutants from crop burning in these states and adversely affecting air-quality during winters in Delhi.

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In-situ Methods for Treatment

- **Utilisation of crop residue for soil management:** In-situ utilisation or soil incorporation of crop-residue (that remains standing in the field after combine harvesting) needs to be prioritised and popularised among the farmers. This is important, not only to ensure that crops are not burnt but for long-term conservation of micro nutrients in the soil

  Apart from directly ploughing and mixing (mulching) the residues back into the soil, on-farm management techniques (composting, pyrolysis or bio-char) are effective in bringing the nutrients back to the soil which are otherwise lost during burning or transporting the residues for use outside the farm. There is increasing evidence that soil incorporation has long-term benefits for improving the quality of soil, increasing water-use efficiency and reducing the intensity of fertilizers being used.

- **Utilisation of crop residue for fuel:** Enhancing the value of paddy-straw as a raw material for energy extraction or similar products is another important aspect of the solution. Solutions for pyrolysis (bio-char), Biomethanation (biogas), conversion to bio fuels (such as briquettes, pellets, Bio-CNG, and biodiesel), need to be explored.

Ex-situ Methods for Treatment

- **Pyrolysis (Biochar):** Conversion of Biomass to Biochar is a simple solution which is not technology-intensive. Biomass is converted to biochar by pyrolysis (burning in the complete absence or limited presence of air) of paddy straw in a brick kiln that can be designed at site.

  Benefits:

  a) The biochar enhances carbon content in soil and returns nutrients back to the soil.

  b) Bio-remediation of degraded soils.

  c) Renewable incense sticks

  d) De-odorizer: It absorbs pungent organic substance from air rather than masking it.

- **Briquetting:** Biomass can be transformed into briquettes of regular shape. Briquettes are easier to use, convenient to transport and store, and have higher calorific value (heat value).

  Briquette is compressed bio-mass in nearly 6:1 ratio. Compression is done through mechanical or hydraulic pressing machines. The loose biomass is converted to compressed briquettes which are 3-4 inch long cylinders. Various shapes can be produced by changing the dye. The combustion of briquette in a controlled environment in presence of ample oxygen at high temperature generates low emissions.

  Briquettes find application as fuel in gasification furnace, heaters, hot-water boilers, industrial boilers. It is a very good substitute for furnace oil, coal or direct wood.

- **Pelletisation:** Pellets find application as fuel in cooking stoves and heating applications in domestic sector as well as industries. It could be a good substitute for coal or direct wood when used in properly designed cookstove for the purpose.

- **BioCNG:** BioCNG (Compressed Bio Methane) is produced in the bio-digestion process.

  Applications: Commercial–hotels, canteens, bakeries, resorts, residential clusters. Industrial-glass and ceramic, cement, metal process, textiles, food processing, Automotive-public transport vehicles, commercial and private CNG fitted vehicles. sludge can be dried and packed in bags and transported to fields as fertilizers.

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- **Liquid fuels from biomass:** Conversion of biomass to liquid fuels is in its nascent stage and the technology is currently being explored in India by a few private players. One of the technologies used to convert biomass is through a continuous catalytic thermo-chemical process which produces cost-effective fungible hydrocarbon transportation fuels from agricultural, forest and sorted municipal residues.
- **Dry fermentation biogas plant for anaerobic digestion of paddy straw:** Paddy can be utilized as energy source (biogas) by anaerobic digestion of paddy straw through Dry Fermentation batch process. Depending on the plant capacity, once the digester is loaded and activated, it would produce sufficient gas for a period of 3-4 months.

Recommendations of the Task Force

a) Provide financial Support

- Paddy-straw has low calorific value and high silica 9 content compared to other crop-residues. This limits utilisation of paddy-straw in different applications such as animal fodder, energy conversion etc. As an immediate measure, to curb episodic rise in air pollution in approaching winters, it is imperative that individual farmers are provided with financial support for implementing some of the in-situ and on-farm straw management techniques. It can be credited to farmer's account in the subsequent cropping season after a verification that farmer has not burnt his/her crop-residues.
- Existing monitoring system (monitoring by district and block level public enforcement agencies and help line for reporting) can be strengthened with an Appbased platform for reporting the farm fire incidents. Any complaint against the concerned farmer would make him/her ineligible for the benefit.
- Awareness campaigns should be conducted to raise farmer's awareness and educate them on viable options for either utilising the farm residue in-situ or convert it into other useful products using on-farm management techniques.
- Training modules can be designed to be implemented by Krishi Vigyan Kendra (KVK) and Block Development Officers (BDOs) in rural areas.

b) Impact fund for air-pollution

- It is observed that there are projects with wide ranging social-economic benefits but they require consistent financial support for commercial viability. For instance, the 'Paddy-straw to bio-ethanol' has the potential to achieve zero-burning in rural areas and contribute to availability of cleaner fuels in urban areas.
- Independent assessment of such estimations would be required to validate the quantum of financial support required for Viability Gap Funding.
- Subsidies are not the advisable economic instruments to promote and ensure viability of business models. Rather than subsidies or tax exemptions from Government of India, it is recommended that impact fund could be created (with a dedicated fund manager) for promoting future investments in clean technologies. Impact funds lower financial risks compared to debt markets and make Return of Investment (RoI) viable for projects with longer gestation period. The aforesaid impact fund is recommended to receive financial resource from the National Clean Energy Fund (NCEF).

c) Upscaling of technologies for crop harvesting and utilisation of farm residue

- Farmers need for affordable and efficient agri-services can be met through shared infrastructure for farm machinery.

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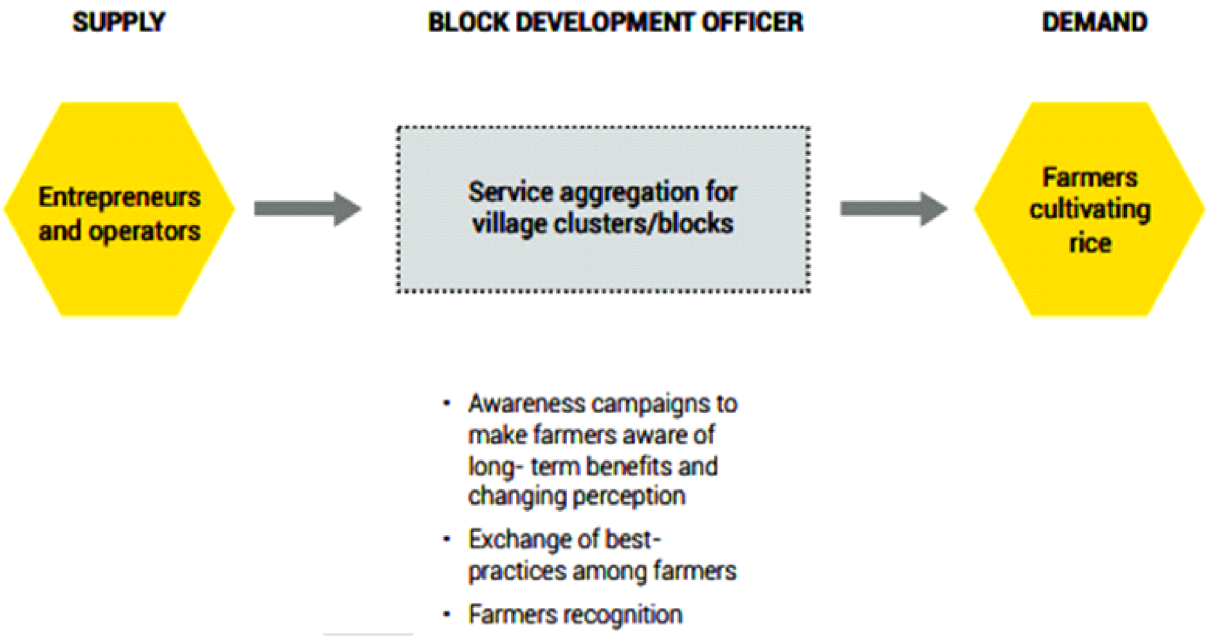
- State governments have been promoting technologies by providing capital subsidies on purchase of equipment/machineries. As per the action plan of Government of Punjab, an amount of INR 2,265 Crore is required to meet 50% capital subsidy towards various farm machinery. There is need of an assessment for effective utilisation of capital infrastructure subsidised by the government. It should also prioritise key technologies to be eligible for subsidy.

d) Support service-based shared infrastructure

- The government can bring out a support scheme for entrepreneurs interested in owning the farm implements and providing service to the farmers at a reasonable rate.
- For such business model to be viable, 50% capital subsidy can be provided to entrepreneurs in short-term but for long term sustenance of business model.

Proposed business model for service-based shared infrastructure



e) Provide Performance-based incentives for entrepreneurs

- Performance-based incentive should be provided to entrepreneurs or service providers based on the field area covered in the intermittent time period between two cropping seasons (15-20 days). These act as a supporting scheme to earlier recommendation, motivating entrepreneurs for better asset utilisation and offering in-situ soil incorporation services at a price that is affordable to farmers.

f) Reward scheme for village panchayats with zero-burning

- A reward scheme needs to be designed for the villages which do not burn their waste and become a role model for other villages.
- The eligibility criteria for choosing a village will be a sound track record with no incidence of farm fires. It is recommended that a single case of fire incident should make the village disqualify for the reward. This reward can be seen as a seed funding for the panchayat to implement a decentralised

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management of crop-residue at a village scale which could potentially include facilities such as paddy straw based biogas plant, briquetting plant, pyrolysis for biochar, composting etc.

g) Monitoring mechanism for farm fires

- A reliable monitoring needs to be ensured so that the farm fires can be tracked at the block and the village level. The network of Indian Remote Sensing Agency and State Level Remote sensing stations have the capabilities to provide the evidence for the purpose. This monitoring mechanism is especially relevant for validating the zero-burning villages in order to reward them.

h) Directive for power plants to procure paddy-straw briquette/pellet

- It is recommended that power utilities should invite expression of interest akin to National Thermal Power Corporation (NTPC). In April 2017, NTPC invited expressions of interest for supplying 850-1000 tonne briquettes/pellets from paddy straw through a single party or combination of parties, with at least 50 tonnes per day (TPD) established capacity (NTPC 2017). NTPC would use these pellet/briquettes as secondary fuel in limited quantity at the coal power plants to replace 5- 10% of its daily coal consumption. It is suggested that carbon credits for using a renewable energy source can be sought by utilities to source the viability gap funding.

i) Plan awareness campaigns for farmers

- Awareness campaigns for farmers through printmedia, radio, television and workshops involving local farmers at panchayat or block level should be planned to correct their perception about in-situ treatment and onfarm management practices. Also farmers need to be made aware on the benefits of increased yield and income as a result of in-situ treatment.

j) Farmer recognition programme

- Recognise farmers, who have been following strict practices of not burning their crop-residue, giving them appropriate recognition for their efforts. During the interaction with such farmers, it was found that such recognition scheme, which is not in the form of any monetary benefits, but rather showcases their efforts can go a long way in ensuring a long term success of zero farm burning practices.

k) Design information tools for in-situ mulching and on-farm management

- Information tools should ideally be designed in multiple forms including videos, information booklets/manuals and other interactive ways of sharing information (such as mobile apps) with translation of material into local languages.

Area	Action	Implementation agency	Status
Subsidy on various Technologies for In-situ mulching and residue collection under the shared service model and Roll out the scheme for financial support the farmers and financial reward to panchayats for no-burning in farm fields.	50% capital subsidy on targeted farm implements for residue collection and in-situ treatment under the shared service model	Minstry of Agriculture & Farmer's Welfare (McAFW), RKVY, Department of Agriculture (Sates)	Subsidies are not disbursed to farmers on time and subsides assests are under utilised
	Provide financial support to farmers and financial rewards to Panchayats (INR 1.0 La per panchayat) for ensuring no-burning in their fields.	MoAFW; RKVY, Department of Agriculture (States)	

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Monitoring and verification mechanism	Devise mechanism for monitoring farm fires through remote sensing data Development of App based platform for reporting by general public	State Remote Sensing Centres, District Collectors and BDOs, State Pollution Control Boards and Central Pollution Control Boards and Central Pollution Control Board, Department of Agriculture and KVKs	
Fiscal interventions by the government	Process-based incentive for entrepreneurs Accelerated depreciation for farm implements under the service based shared infrastructure model. Set up an Impact fund air-pollution and link it with the NCEF	MoAFW; RkKVY, Department of Agriculture (States), Ministry of Finance (MoF)	
Regulatory support to business models for crop residue utilisation	Re-assess the fuel quality criteria for briquettes/ pellets made out of crop residue	central Pollution Control Board (CPCB) and respective State Pollution Control Boards (SPCBs)	
	Directive for power plants to procure paddy-straw briquette/pellet	Ministry of Power (MoP), Thermal Utilities	
	Remove the size limitation for Bio-power captive generation	Ministry of New and Renewable Energy (MNRE) Ministry of Finance (MoF)	
Awareness campaigns and information tools for emphasing strong soil management practices	Awareness campaigns for farmers-media (print/ radio/TV) and local workshops. Create Brand ambassadors from the farmer community who are using in-situ/ex-situ use of farm residue.	Ministry of Agriculture* Farmers's Welfare (MoAFW), Department of Agriculture (Sates), KVKs, Agricultural Universities	
	Manual/information tools on in-situ mulching	Ministry of Agriculture* Farmers's Welfare (MoAFW), Department of Agriculture (Sates), KVKs, Agricultural Universities	
	Manual/information tools for on-farm management	Ministry of Agriculture* Farmers's Welfare (MoAFW), Department of Agriculture (Sates), KVKs, Agricultural Universities	

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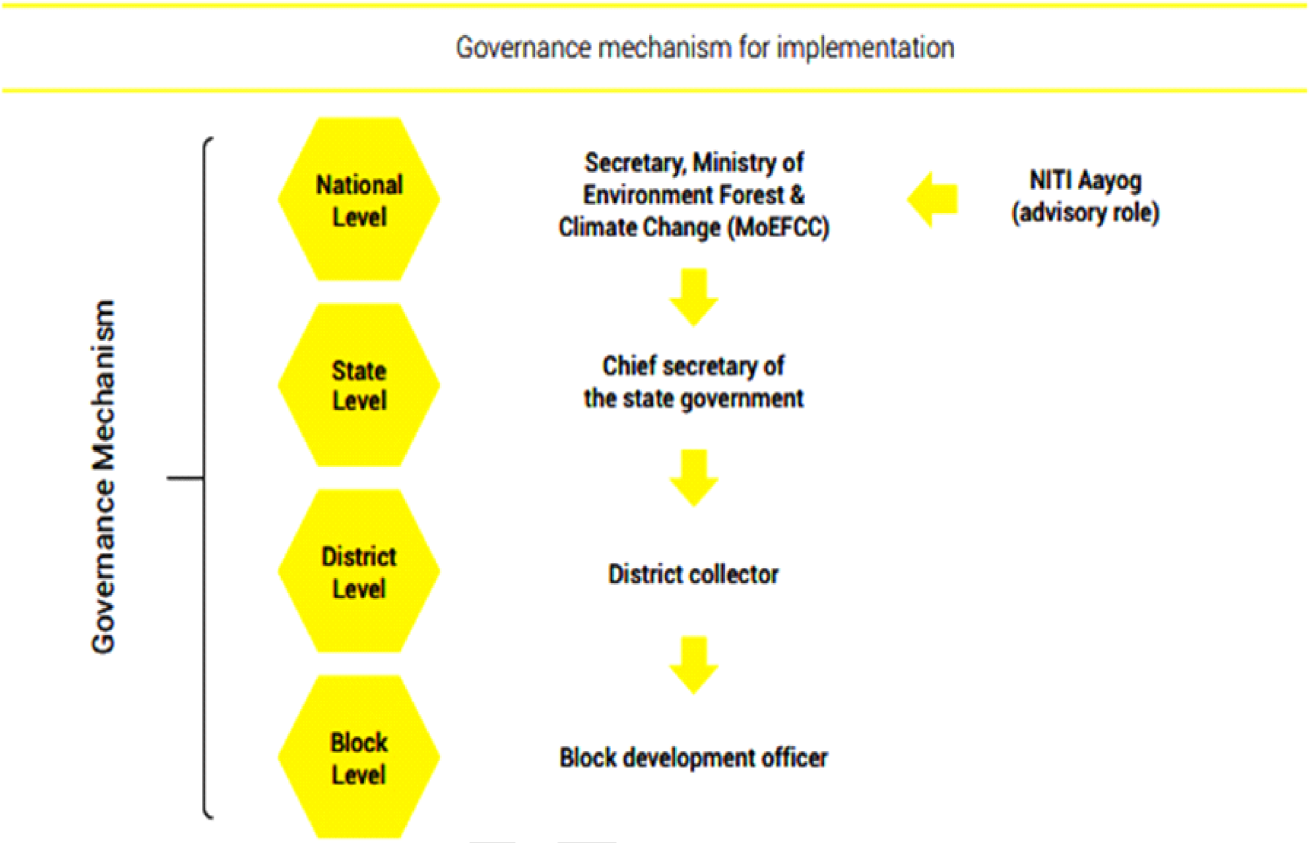
Governance Mechanism for Implementation



The recommendations shall be governed through following process and identified actors:

a) National level: The Ministry of Environment, Forests and Climate Change (MoEFCC), Government of India shall be the national focal point for implementation of suggested recommendations with NITI Aayog in the advisory role. The role and responsibilities of MoEFCC are detailed below:

- Secretary, MoEFCC shall be the national nodal officer for implementation of the recommended actions.
- The Ministry shall be coordinating with all state governments for implementation of the recommended actions.
- The Ministry shall review the state action plan which would also include recommendations under this report, and advise the state governments on any additional actions specific to particular state.
- The Ministry shall review the existing regulations considering the recommended actions and would notify new regulations or amend existing ones, if required.
- Progress report about the implementation of recommendations, from all the states shall be submitted to MoEFCC and all the analytics would be undertaken by Central Pollution Control Board on behalf of MoEFCC.
- Before the crop harvesting season, the status report of implementation at National Level (primarily focusing on Delhi-NCR) would be released by MoEFCC at a weekly basis.
- During crop harvesting season, the aforesaid reporting would be on a daily basis.

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b) **State level:** The state governments of Delhi, Punjab, Haryana, Rajasthan and Uttar Pradesh have been identified as key actors for implementation of action plan. Their roles and responsibilities are provided below:

- Chief Secretary of the state government shall be the state nodal officer for implementation of recommended actions.
- State level action plans for improvement in the ambient air quality are being prepared with various state governments. In view of the identified actions under this report, the state action plans shall be revised by respective state governments.
- State level schemes for disbursement of financial support to create machineries/ infrastructure shall be reviewed in light of the findings of this report and more targeted approach shall be adopted.
- State governments shall leverage existing network of farmers outreach for communicating about uses of farm stubble (in-situ and ex-situ) and increasing their income.
- Progress report about the implementation of recommendations, from all the states shall be submitted by Chief Secretary, respective states to MoEFCC with a copy to respective central pollution control board.
- Before the crop harvesting season, the frequency of reporting by state to MoEFCC would be on a weekly basis.
- During crop harvesting season, the aforesaid reporting would be on a daily basis.

c) **District level:** The District Collector shall be the nodal officer for preparing a district level action plan customised to the needs of residents, currently available infrastructure and future requirements along with technological options to utilise the farm residue, best suited for particular district. Key responsibilities of district collector (DC) for implementation of the action plan are provided below:

- The district collector shall prepare a district plan of action on air pollution considering aforesaid aspects.
- The district level plan shall have a roadmap for ensuring sufficient capacity of farming and harvesting infrastructure in their jurisdiction, for farm collection straw either for ex-situ uses or in-situ soil mulching.
- The plan shall also include the strategy for awareness creation amongst the farmers to utilise the farm stubble/straw for any other use/economic activity which would help them increase their farm income.
- The district collector shall be the nodal officer for verification of any complaints related to farm fields burnings. The decision shall be based on technological evidence such as satellite imagery or and government may provide mobile applications capable of registering location details while recording the incident.
- Progress report about the implementation of recommendations, from all the DCs shall be submitted to chief secretary of respective states with a copy to member secretary of respective state pollution control boards.
- Before the crop harvesting season, the frequency of reporting would be on a weekly basis.
- During crop harvesting season, the aforesaid reporting would be on a daily basis.

d) **Block level:** All the actions for stopping the burning of farm waste would be implemented and monitored by the officers at block/village level. The block development officer shall be the nodal officer and shall have following key responsibilities:

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- The BDO shall estimate the requirements of block/village level infrastructure required for utilisation of farm residue/stubble (for both in-situ and ex-situ).
- The BDO shall be estimating the demand and supply of farm equipment for in-situ mulching of farm stubble and connect entrepreneurs with the farmers.
- The BDO shall prepare a block level action plan to stop the burning of farm stubble in the fields and utilisation of farm straw in economically profitable options for the farmers.
- The BDO shall be the interface with respective panchayats for implementation of incentive schemes for no-burning of farm waste.
- The BDO shall be the nodal officer for identifying the techno-commercially viable options for farming and utilisation of farm straw.
- On-ground verification of any incidence of farm waste burning shall be undertaken by BDO in presence of the members of respective panchayat and report shall be submitted to DC.
- Progress report about the implementation of recommendations, from all the BDOs shall be submitted to DCs, with a copy to regional officer of respective state pollution control boards.
- Before the crop harvesting season, the frequency of reporting would be on a weekly basis.
- During crop harvesting season, the aforesaid reporting would be on a daily basis.

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