

Management of Crop Residue in North India

Government Scheme & Industry Viewpoint

Burning crop residue causes phenomenal air pollution problems, and huge nutritional loss and physical health deterioration to the soil. The burning of one ton of paddy straw releases 3 kg of Particulate Matter, 60 kg of CO, 1,460 kg of CO₂, 199 kg of Ash and 2 kg of SO₂. These gases affect human health due to general degradation in air quality resulting in aggravation of eye and skin diseases. Fine particles can also aggravate chronic heart and lung diseases.

One ton of paddy straw contains approximately 5.5 kg N, 2.3 kg P₂O₅, 25 kg K₂O, 1.2 kg S, 50-70% of micro-nutrients absorbed by rice and 400 kg of Carbon, which are lost due to burning of paddy straw. Apart from loss of nutrients, some of the soil properties like soil temperature, pH, moisture, available Phosphorus and soil organic matter are greatly affected due to burning.

Nonetheless, the time available between rice harvesting and wheat sowing is in the range of 20-30 days. So, appropriate strategies for in-situ crop residue management are necessary to enable zero burning. Various equipment such as Super Straw Management Systems (SMS) attached with an existing combine

harvester, Happy Seeder, straw chopper/mulcher, rotary slasher, reversible MB (Mould Board) plough, rotavator, etc. have been developed and successfully demonstrated in the farmer's fields.

Further to the Orders of National Green Tribunal

(NGT), funds have been released from within the sanctioned budget for the Sub-Mission on Agricultural Mechanization (SMAM), which is implemented on a 60:40 sharing pattern between Centre and State. However, it has been noticed that interventions through SMAM are inadequate and need to be augmented through a separate scheme.

Accordingly, the "National Policy for Management of Crop Residue (NPMCR)" was announced by the Ministry of Agriculture Department of Agriculture & Cooperation (Natural Resource Management Division) in November 2014, with the following major objectives:

- Control of burning of crop residue to prevent environmental degradation and loss of soil nutrients and minerals by promotion of in-situ management (incorporation in soil, mulching, baling/binding for use as domestic/industrial fuel, fodder) of crop residue;
- Diversified use of crop residue for various purposes like charcoal gasification, power generation, as industrial raw material for production of bio-ethanol, packing material, paper/board/panel industry, composting and mushroom cultivation, etc.;
- Capacity building and awareness about ill-effects of crop residue burning and its effective utilization and management; and
- Formulation and implementation of suitable law and legislative/policy measures to curb burning of crop residue.

But this obviously did not produce the desired results because the burning of paddy continued unheeded and led to public outcry in the winter of 2017-18 in north India. The reasons for the failure of this scheme to produce sustainable alternatives to stop stubble burning were due to the poor management of the demand-side supply even though humongous quantities of paddy straw were available in the fields of Punjab and Haryana.

Government and private projects for the utilization of paddy straw are yet to move ahead. The much-acclaimed project from NTPC to utilize rice straw pellets has also not moved ahead and as of date, no capacity has come up for the manufacture of pellets. NTPC's price of off-take has also been a point of concern for the industry and not much participation has taken place for the NTPC tenders. NTPC has now floated tenders for various plant locations like Dadri, Mouda, Assam, Unchahar and Solapur, and up to 10% replacement of coal by biomass pellets (torrified/non-torrified) is being looked into by PSUs.

It is important to be able to put a 'Health Cost', 'Environment Cost', and 'Medical Health Cost' to the entire process, and then evaluate the financial loss which India is experiencing by means of the paddy straw burning in the open fields.

According to a 2019 study by the International Food Policy Research Institute USA, burning of crop residue or stubble remains a key contributor to air pollution over northern India, despite a ban by the National Green



Burning of crop residue/rice straw causes severe pollution of land and water on local as well as regional and global levels



Tribunal (NGT) in November 2015, and will cost the country,

- Over Rs 2 lakh crore annually,
- Three times India's central health budget,
- Rs 13 lakh crore over five years – equal to 1.7% of India's GDP, and
- Enough, as we said, to build 700 AIIMS hospitals.

A study by IIT Bombay found that air pollution cost Mumbai and Delhi was approximately Rs 70,000 crore in 2015. According to a 2017 study by British medical journal Lancet, pollution can bring down economic output by as much as 2 per cent annually in less-developed countries. Pollution is responsible for 7% of annual healthcare spending in middle-income countries that are heavily polluted and rapidly developing. Rising air pollution is also likely to impact rainfall patterns in the country and decrease the monsoons, which can cause extensive financial losses.

Therefore, in pursuance to the Budget 2018 announcement regarding a special scheme to support the efforts of the governments of Haryana, Punjab, Uttar Pradesh and the NCT of Delhi to address air pollution and to subsidize machinery required for in-situ management of crop residue, in January 2018, a Central Sector scheme was announced by the Ministry of Agriculture & Farmers Welfare, Department of Agriculture, Cooperation & Farmers Welfare (Mechanization & Technology Division) for the 'Promotion of Agricultural Mechanization for In-Situ Management of Crop Residue in the States of Punjab, Haryana, Uttar Pradesh and NCT of Delhi' for the period of 2018-19 to 2019-20.

The scheme's objectives also included the promotion of Farm Machinery Banks for custom hiring of in-situ crop residue management machinery to offset the adverse economies of scale arising due to small landholdings and high cost of individual ownership, and awareness creation among stakeholders through demonstration, capacity building activities and differentiated Information, Education and Communication (IEC) strategies for effective utilization and management of crop residue.

Financial assistance is being offered to farmers, co-operative societies of farmers, self-help groups, private entrepreneurs, etc. for machines/equipment, etc., and to the State Governments, institutions, public sector units, etc. for the activities to be undertaken towards effective IEC strategies. Also, for effective planning, implementation and monitoring, the scheme involves a High-Level Monitoring Committee comprising of various

stakeholders to formulate policies and provide overall direction and guidance, and monitor and review its progress and performance. Similarly, committees will be set up at the state, district and panchayat level to accelerate implementation.

This scheme is a positive step in the flagship program of enhancing farmer income, as this is a prudent way of creating wealth from farm waste and the financial numbers are actually mind-boggling. The state governments (for example, <http://agriharyana.gov.in/index.php?r=site%2Findividualfarmer>) have announced this scheme in local languages.

Industry Response

Approximately 400 million MT of Agri-farm waste are being burnt across India at a nominal value of about Rs 2,000 per MT, amounting to a whopping Rs 800,000 million or US\$ 12,300 million going back into the rural economy. This should create a new business line in India for the farming sector and utilize a renewable source of energy year on year.

An important point to be flagged is: Why is the scheme only for the four states of North India? Similar in-field burning happens across other states as well and for many other agri-residues besides rice paddy straw. Did the air pollution effect on Delhi trigger off this financial package? It is time for the other states and the farming sector to raise this issue to propose a solution across India.

Currently, there are two main operatives of this scheme:

- Removal of crop residue
- In-situ crop management



Removal of Crop Residue

The government support for equipment to remove crop residues is an incentive to not burn it in open fields. So, whosoever claims the fiscal benefits must not burn it, and this needs to be monitored at micro-management levels, including use of technology interventions like satellite mapping, etc.

The question yet to be answered is what is to be done with the residues, once removed? Normally the farmer removes the wheat straw, which is available in the same fields, and utilizes it as fodder.

The key is to create a market for utilization of these agri-residues. A price mechanism for the agri-residues will



have to be established and market dynamics will need to be created.

Biomass power and bio-ethanol refinery projects in North India are a long way away, say around 3 to 5 years, for which the quantity of agri-residues required will be around 2.0 million MT at the maximum. But the quantity being burnt is close to 40 million MT. Hence, on the demand side, only 5% of the usage is being planned.

If storage is planned, farmers will need land to store these crop residues and find a market for it before the next season of crop residues, which will come in a year's time or earlier in a few areas. 1,000 MT of baled rice straw requires 1 acre of land for storage. With demand of close to 2.0 million MT being planned, this requires 2,000 acres of land for storage, which has to be in small land parcels of 10 to 15 acres each. Hence, close to 150 to 200 storage centers/depots need to be planned within the next 8 months. Delegating responsibility for this and detailing of the scheme implementation will be crucial.

There is a huge requirement of working capital in a short period of 60 days to be able to remove, aggregate, transport and store this agri-residue biomass. Financial institutions need to be sensitized to this new business model and come forward to support this working capital requirement, and government agencies could help ensure financial inclusion for this scheme.

Also, the following additional equipment needs to be covered under this scheme – Balers, Rakers, Cutters, Trolleys (to be manufactured specially for optimal transportation), Tractors, Chippers, Weigh Bridges, Fire Fighting Equipment, and Lightning Arrestors.

In-situ Crop Management

Equipment such as the 'Happy Seeder' has been developed for in-situ crop residue management and scientific results have been encouraging. Developed in synergy with Germany and Indian collaboration, many

In light of the above, the Cogeneration Association of India would like to thank all the stakeholders for tackling this issue, and requests them, particularly the Ministry of New and Renewable Energy (MNRE) to focus on the biomass power sector in India, which gives more, and reliable power per rupee invested capital than any other renewable source of power.

This power is much more beneficial to the rural populace and has far-reaching socio-economic and environmental benefits to all the stakeholders and the country.

Government Initiatives (2018-19)

- The Ministries of Petroleum and Natural Gas & Skill Development and Entrepreneurship kicked off an innovative initiative called SATAT (Sustainable Alternative Towards Affordable Transportation) in October 2018, with OMCs (IOC, BPCL and HPCL) inviting Expressions of Interest from potential entrepreneurs to set up Compressed Bio-Gas (CBG) production plants for use in automotive fuels. This significant move has the potential to boost availability of more affordable transport fuels, better use of agricultural residue, cattle dung and municipal solid waste, as well as to provide an additional revenue source to farmers.
- The Government is also planning to come up with 12 bio-refineries with an investment of INR 100 Billion. These will be owned by state-run companies like HPCL (four), IOCL (three), BPCL (three), MRPL (one) and Numaligarh refinery (one). Each bio-refinery will utilize 200,000 MT of biomass and would be producing 49,000 MT of ethanol annually, for blending with petrol and diesel.
- Biomass Supply Chain Management has got recognized by MNRE and Government Financial Institutes like IREDA.
- Large-scale partnerships are underway between Developers, Financial Institutes, Technology Providers and Supply Chain Management Companies with the support of Central and State government to scale up the utilization of biomass in IPPs, Cogeneration projects, Solar-Biomass Hybrid projects, Bio-CNG, Bio-Ethanol and other biomass-based Bio-energy projects in India.
- NPA (Non-Performing Asset) Power Projects based on biomass are being aggressively looked at and tender process has started through the National Company Law Tribunal.

papers have been published regarding the plough back of the rice straw residue in the fields and the next crop sowing (wheat) with no effect on the production quantum.

But on-ground feedback regarding the use of the Happy Seeder has been mixed. Since the government is already providing financial support for its purchase, more



awareness creation is required regarding the benefits of using this equipment for further propagation.

Approximately 5 to 7 MT of agri-residues are generated per Ha of land. In-situ tilling of this large quantum of agri-residues and such a large volume of agri-residues should bio-degrade within a quick time period for the next crop to not get affected. Its effects should be studied over a period of time, for which soil and agriculture experts need to get involved. Statistical data over a few years will be able to provide creditable answers to this point.

The government is also propagating and advocating the use of agri-residues for commercial utilization in large-scale projects by public and private companies. The energy value of these agri-residues is well known. But long-term availability of such biomass is based on studies and assumptions of long-term availability of crop agri-residues. If in-situ crop management is being done

in these areas, then where is the agri-residue biomass to support such large investment?

Finally, the implementation in letter and spirit of this scheme should be under one nodal agency akin to many other Central schemes, to help India embark on a self-reliant "Bioenergy Economy".

The complete scheme can be viewed at: http://agricoop.nic.in/sites/default/files/NPMCR_1.pdf (for 2014) and [https://farmech.dac.gov.in/revised/1.1.2018/Guidelines%20\(Amended\)%20of%20Straw%20Management%20Scheme.pdf](https://farmech.dac.gov.in/revised/1.1.2018/Guidelines%20(Amended)%20of%20Straw%20Management%20Scheme.pdf) (2018)

For further details regarding the Viewpoint Article with respect to the Government Scheme, please contact Lt. Col. Monish Ahuja (Retd.) at monishahuja@prespl.com