

Proceedings

March 2017

Workshop on

***Effective and efficient realization of
the extensive bioenergy resources of India***

Organized by

The Energy and Resources Institute (TERI)

New Delhi, India



Supported by

Niti Aayog

Government of India



नीति आयोग



The Energy and Resources Institute

*Creating Innovative Solutions
for a Sustainable Future*

Date: March 7, 2017

Venue: TERI, India Habitat Centre, Lodhi Road, New Delhi 110003

Time	Panel Sessions/Events
09:30-10:00	Registration
10:00-10:30	<p>Inauguration</p> <p>Welcome Address – Dr Ajay Mathur, Director-General, TERI</p> <p>Opening Remarks – Mr Anil Kumar Jain, Additional Secretary, NITI Aayog</p> <p>Inaugural Address – Prof Ramesh Chand, Member, NITI Aayog</p>
10:30-12:00	<p>Potential, Opportunities and Challenges</p> <p>The session would focus on taking stock of the full range of bioenergy feedstocks, biomass inventory, mapping feedstocks with applications and how to make full use of the various feedstocks. Further it would focus on steps needed to realize various bioenergy applications/technologies and the challenges that need to be addressed.</p> <ol style="list-style-type: none"> 1. Mr Anil Kumar Jain, Additional Secretary, NITI Aayog - Moderator 2. Lt. Col. (Retd.) Monish Ahuja, Managing Director, Punjab Renewable Energy Systems Pvt. Ltd., Navi Mumbai 3. Mr Amit Bhattacharya, Vice President, Research and Insights, Dharma Life, New Delhi 4. Mr Sunil Dhingra, Senior Fellow, TERI, New Delhi 5. Dr D K Tuli, Head, DBT-IOC Centre for Advanced Bioenergy Research, IndianOil Corporation R&D Centre, Faridabad 6. Mr Vandit Vijay, Center for Rural Development and Technology, IIT Delhi, New Delhi 7. Dr Prashant Gargava, Additional Director & Head, Air Quality Management Division, Central Pollution Control Board, Ministry of Environment, Forest & Climate Change, Government of India, New Delhi 8. Dr Piyali Das, Senior Fellow, TERI, New Delhi
12:00-12:15	Tea
12:15-13:45	<p>Business Models and Financial Instruments</p> <p>This session would focus on specific case studies and business models which could serve as inspiration and lessons going forward. It would delve upon financial</p>

Time	Panel Sessions/Events
	<p>instruments that have to be in place to facilitate commercial initiatives. The discussions are expected to point towards useful cues and key pointers for extended applications in future.</p> <ol style="list-style-type: none"> 1. Mr Sunil Dhingra, Senior Fellow, TERI, New Delhi - Moderator 2. Ms Nidhi Sarin, Technical Expert, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, New Delhi 3. Mr Shailesh Pisalkar, Secretary, Bhartiya Dhyanpith Bahuuddeshiya Gramin Vikas Sanstha, Wadgaon, Maharashtra 4. Mr Bharat Sharma, Chairman, Pellet Energy Systems Private Limited, New Delhi 5. Mr Amitabh Tandon, Director, Transtech Green Power Private Limited, Jaipur and Secretary, Indian Biomass Power Association 6. Mr Dinesh Chander Pant, Fellow, TERI, New Delhi 7. Mr Atul Mulay, President, Praj Industries, Pune 8. Dr Laveesh Bhandari, Director, Indicus Centre for Financial Inclusion, New Delhi
13:45-14:45	Lunch
14:45-16:00	<p>Policy Interventions and Regulations This session would focus on specific policy interventions that would help in implementation and realization of bioenergy applications</p> <ol style="list-style-type: none"> 1. Dr Vibha Dhawan, Distinguished Fellow & Senior Director, TERI - Moderator 2. Dr Sangita Kasture, Joint Director, Department of Biotechnology, Government of India, New Delhi 3. Dr S N Srinivas, Program Officer, United Nations Development Programme (UNDP), New Delhi 4. Dr Arindam Datta, Fellow, TERI, New Delhi 5. Mr Amit Mehta, Executive Director, Mozo Bamboo Group, Hyderabad 6. Dr Shilpi Kapur, Fellow, TERI, New Delhi
16:00-16:10	<p>Vote of Thanks Mr Shirish Garud, Director, TERI</p>
16:10-16:20	Tea

BACKGROUND

A workshop was planned to be organized to stress the importance of bioenergy and biofuels from biomass, to streamline bioenergy options from various feedstocks and to facilitate effective and sustainable utilization of bioresources for energy. The workshop was aimed at facilitating policy framework that would help realize the bioenergy potential of India in an organized and accelerated mode.

India has an annual agricultural residue production of about 619 million tons, out of which an estimated 214 million tons is classified as being utilized for bioenergy applications (70% household cooking, 7% power generation, 23% other energy applications). 180-200 million tons/year of fuelwood from forest is rated to be the potential for cooking supply. More could be realized out of this resource through the significant potential in efficiency improvement and recovering those residues that are wasted due to lack of proper collection mechanisms.

The most basic and wide application of biomass is for cooking particularly in rural households. The potential and share of agricultural residue and firewood for household cooking, feasibility and implications of alternate cooking fuels in rural household, and the requirements of improved efficiency utilization of biomass for cooking were to be examined. The possibilities and implications of pelletization and briquetting of biomass for cooking and industrial use were to be discussed in the Indian context. When it comes to transport fuel production from agricultural residue, the contrasting features of various fuel forms and conversion technologies (biochemical and thermochemical / second generation) need to be compared and suitable guidelines need to be adopted for effective utilization of the biomass resource. Collection logistics and supply chain has been a key challenge in the development of any technology aiming to utilize biomass to be collected from the fields. In terms of value from final products, transport fuel, industrial fuel, power generation and cooking fuel could be ranked in said order while in terms of the present status of technology the ranking is seen to be the opposite. Possible effects of catering to cooking and power through non-biomass fuel forms were to be discussed in terms of biomass availability and pricing for other applications.

While several advancements have been made in technology development, there are issues that still need to be addressed. The key challenges for mainstreaming bioenergy systems are multi-fold. To cite a few, some common challenges to consider are: feedstock supply and management; environmental performance of technology; rising feedstock cost; adequate policy support for growth of this sector.

A National Policy on Biofuels was adopted in 2009. But it has not been expanded to more advanced fuel options and roadmap details since then. Bioenergy covers much broader applications than the transport fuel applications of biofuels. Hence a comprehensive national policy on bioenergy is required.

Presently the biomass power target of India is 10 GW by 2022. However studies such as those undertaken by the India Energy Security Scenarios 2047 indicate that targets in the range of 18 GW by 2022 and 32 GW by 2030 are possible. The potential of second generation biofuels is estimated to be 40-60 mtoe/year. Bioenergy through its various forms combined (cooking, power, liquid fuels, heating) could contribute to about 400 TWh/year of energy or 100 GW equivalent by 2022 and 800 TWh/year or 200 GW equivalent by 2030.

Prominent players involved in bioenergy applications were invited for participation in the workshop. These include field experts, entrepreneurs, farmers, bioenergy/biofuel researchers and policy-makers. The workshop was designed in the form of interactive panel sessions. The participation was kept to qualified and selective delegates to facilitate thorough interaction and working on the topic of the workshop.

INAUGURAL SESSION

Bioenergy accounts for 23% of primary energy production in India, but when it comes to final energy applications it is only 2-3%. There is a lot of scope for improvement in the utilization of the bioenergy resources. This gap needs to be analysed so that bioenergy activities can be streamlined. The purpose of this workshop is to use the knowledge gained here and come out with a holistic approach to frame a national level policy on bioenergy utilization.

During his Welcome Address, Dr Ajay Mathur, DG, TERI mentioned that a solution must be facilitated through policy for the inefficient burning of biomass for cooking that causes indoor pollution and that commercial cooking and industrial energy applications may be better suited for such biomass. He stressed on a study on the emission characteristics of pelletized biomass burning to evaluate its improvement. He pointed out that a workshop of this nature to facilitate policy framework as initiated by NITI Aayog was much needed and expressed that it would be good to have a platform such as a forum where this topic could be discussed in a continuous and regular fashion.

Mr Anil Jain, Additional Secretary, NITI mentioned during his Opening Remarks that the idea to have a discussion on a national policy on bioenergy originated from his interaction with

the TERI team on bioenergy topic during India Energy Security Scenarios 2047 modeling exercise and his discussions with Prof Ramesh Chand, Member, NITI Aayog about the extensive biomass resources that lie unutilized (the example of poplar plantation in Punjab) and the air pollution arising out of wasteful burning agricultural residue. He remarked that the aforementioned model indicated that if biomass was utilized in an improved and efficient way, even the increased population in 20-30 years would require biomass that is less than what is being used presently for its cooking needs. He claimed that this workshop can pave the way for pushing a new national bioenergy policy because it comprises of experts from industries, entrepreneurs, scientists, academicians and policy makers. A challenge has been that biomass has been looked at only in bits and pieces. The National Biofuel Policy of 2009 targeted 20% blending by 2020 and we couldn't be further away from such a target because of gaps in knowledge and implementation scenarios. This has led to reluctance in further improvement in biomass policies by the government. He also pointed out that wood is a significant part of renewable energy in many European countries. He requested the delegates to guide NITI Aayog so that a national level policy on bioenergy could be formulated.

Prof Ramesh Chand, Member, NITI Aayog during his Inaugural Address pointed out that while India is making leaps and bounds in solar and wind energy we don't see bioenergy growing or even being talked about. He mentioned that bioenergy could address environmental pollution arising out of residue burning and could be an important alternative source of renewable energy to replace fossil fuels. He stressed the need to increase forestry biomass production by increasing the density of forests in existing lands, marginal lands and other degraded lands. He said that India imports a significant fraction of its wood needs and this could be met by improving the forest cover in India. One third of such forestry biomass could cater to bioenergy while the remaining two-thirds could be utilized for other applications. With respect to agri-residue that are wasted by burning, Prof Chand pointed out that giving some financial incentive to farmers would convince them to provide their residue biomass for industrial energy recovery purposes. He mentioned that there are technological challenges in treating biomass to energy applications as the commercial conversion plants that have been set up so far haven't been replicated extensively. He indicated that there is a need to have a relook at the biogas program in India given its potential and evaluate if modern solutions could be found for the traditional maintenance issues associated with the family-size digesters or if there are serious limitations that may forbid pursuing this any further. He stressed that it is important to involve industries and private sector in the bioenergy field and that we to think about how to make them interested and facilitate their engagement. If they are successful, it would have multiple dividends – viable new technologies, farm economy, carbon sequestration and employment opportunities. He emphasized the need for innovative thoughts to use biomass on a community or cluster basis and the involvement of entrepreneurs in this field along with policy push in this area.





Inaugural Session of the Workshop

SESSION 1: POTENTIAL, OPPORTUNITIES AND CHALLENGES

The session focussed on taking stock of the full range of bioenergy feedstocks and steps needed to realize various bioenergy applications/technologies along with the challenges that need to be addressed. We have 200-300 million tons/year of agricultural residue available for bioenergy application, 150- 200 million tons/year of forestry residue for energy production and 9 million tons/year of methane potential. Thus there is a lot of potential in this sector and the session discussed the utilization of this potential.

Mr Anil Kumar Jain moderated the session. He highlighted that there have been multiple 'waves' of bioenergy in the past but nothing has managed to make a huge change. But at present the government is refocusing on projects such as gobar gas (among other bioenergy techniques) to address energy access. For example Champaran has been identified for 100% saturation in energy market with gobar gas through the support of NITI Aayog and MNRE in

this direction. According to India Energy Security Scenarios 2047, developed by NITI Aayog, bioenergy can meet 20% of the primary energy requirement in 2047. Bioenergy could reduce 750 million tons of CO_{2eq} emissions /year with the total emissions being around 4500 million tons of CO_{2eq} /year.

Lt. Col. (Retd.) Monish Ahuja, Managing Director, Punjab Renewable Energy Systems Pvt Ltd said that biomass transportation beyond a particular geographical boundary, especially agro residues, is a major hindrance for effective utilization of this resource. 50% cost for the in its 20 year life cycle would be in supply chain management. This would place the onus on the method in which biomass can be transported. Modelling regarding type of biomass will help establish biomass supply chain. Agro residue is not used efficiently today though available in abundance. The key aspect is investment in equipment. Someone has to invest to aid farmers in collection and initiate supply chain creation through them in a 50-100 km radius. Hand in hand building up of demand and supply needed. For a reasonable size of plant to come up, average of 10,000 tons per month of biomass needs to be available and depending on the nature of biomass the baling, briquetting, and pelleting can be done. This cost has to be included in the supply chain management.

He pointed out that biomass industries haven't come up in the past four years and the government is also not looking at creation of demand via industries. For instance, in NTPC it was proposed to use biomass for co-firing. Such ideas can lead to creation of demand. Further, creation of localized demand by reducing use of fossils in kilns and heat generation units can help increase demand as well as entrepreneurship. A working capital is needed to ensure that the biomass generated can be aggregated and stored for a duration of 6 months to a year. Though working capital is provided to industries it is not typically provided to farmers. Providing the biomass for the industry would require financial support. But on the plus side, the aggregation of 100,000 tons of biomass would lead to creation of at least a 1000 jobs. This would also reduce the health and environmental cost. The cess collected on coal plants can be diverted to improve biomass sector.

He mentioned that governmental agencies such as MNRE, IREDA can provide the working capital to support the farmers thus creating a demand for the resource. Unless the work is done on a mission mode, the push can't be generated. Unfortunately, biomass is a least priority sector and post April there is a lot of uncertainty regarding the impact of GST on biomass sector. While India is pushing biofuels, there are 80 industries in the world related to biomass which can be included in the biomass sector. Looking at more resources such as lignin and hemicellulose rather than just cellulose as a source for industries is important.

Col. Ahuja added that with proper infrastructure and supply chain in place, his initiatives have indicated that paddy straw and cotton stalk could be supplied to a power plant at a cost of Rs 2500/ton and Rs 3000/ton while the regulator price for 2017-18 is about Rs 3600/ton. That is how he has been able to establish long term business association with

biomass suppliers and power-generating end-users, particularly given his even lower landed cost of biomass. His case study of 360 tons/day biomass supply chain activity (paddy straw) indicates that 740 green jobs are created, an annual income of about Rs. 1.71 lakhs per person was generated and a total benefit of Rs 12.7 crore to the rural community. A similar 450 tons/day cotton stalk case study relates to 1421 green jobs, Rs 65,000 per person per annum and Rs 9.2 crore total benefit to the rural community.

Mr Vandit Vijay, Center for Rural Development and Technology, IIT Delhi mentioned that their center headed by Prof V K Vijay is engaged in trying to create energy independence in villages using local resources such as biomass for synthesis of biogas and cooking fuel. He added that resource availability needs to be assessed based on when it is available, how much is available and the quality available. He said that the village Lamba Kangdi (Dist: Hoshiarpur) in Punjab has switched from LPG to gobar gas because they have developed a cooperative society which can effectively manage the gobar generated for gas production. The same system is used for management of rest of the waste generated in the household.

Mr Vijay went on to say that while current push in urban areas is on incineration, it is only a short term goal. The waste should be recycled as a source for energy generation. Segregation of waste on source can help effectively synthesize bio-CNG. IIT Delhi has developed a mobile unit trolley that can go to biogas plant and convert it to bio-CNG. He referred to using GIS as an assessment technique for resource assessment to have a wholesome repository of data. He pointed out that to help rural areas adopt biomass related technologies such as biogas units or cookstoves, success of mechanisms such as Krishi Vigyan Kendras can be looked at.

Mr Amit Bhattacharya, Vice President, Research and Insights, Dharma Life mentioned that his organization works on distribution of clean cookstoves in rural areas. He reported that in a recent project, cooking device using pellets was found to be successful in terms emissions, combustion properties and heat generated. However, the unavailability of pellets at regional level was the biggest challenge. Pellets, although a more efficient cooking fuel, cost almost 40-50% more than the loose biomass. There are only a handful of pellet manufacturers because the logistics add to the economics on the last mile. He said that countering the seasonal variation in production of biomass would be important for use of this resource because they influence availability and thus pricing. Due diligence has been done for development of a briquetting-based cooking system. It poses lesser challenge than pellets because they are more widely known and already adapted in certain areas.

Mr Sunil Dhingra, Senior Fellow, TERI reiterated that waste is a resource for the energy sector but is becoming an environmental and social problem such as the burning of the Bellandur Lake near Bangalore and the visible pollution in Delhi in November-December every year. He listed four big challenges in biomass use as: technical, social, environmental and economic. He enumerated different residues such as: agro residues, agro processing

residues, forestry waste, organic waste from municipal solid waste. The waste streams of municipal solid waste have to be segregated and prioritized because processing technologies vary widely. He mentioned that community level/ decentralized aggregation mechanism will prove critical to counter the logistics of transport to create value chain, especially for farmers. He stressed that we need to internalize the environmental and health costs to include in the supply chain. He pitched for targeting polygeneration technologies to address multiple requirements. He said that land use pattern has to be studied to maximize production of biomass from a policy perspective.

Dr D K Tuli, Head, DBT-IOC Centre for Advanced Bioenergy Research, IndianOil Corporation R&D Centre briefed that biomass has a very essential role in energy scenario— liquid transport fuels; whether by blending or substitution of fossil fuels, value for stakeholders or from an environmental perspective. He remarked that fuel prices are fixed and subsidies are a backward way of promoting a technology so a reverse analysis has to be done for ensuring that every member in the supply chain is benefitted. Saying that bioenergy is GHG neutral is wrong because it depends on source and product. For instance ethanol from corn leads to only 20% GHG reduction but from molasses it leads to 50% reduction.

He stated that it is essential to identify every possible supply chain (for multi-feed plants) needed for making alternate fuels. Farmers, collectors, industries all have to make money out of the process. Life Cycle Analysis (LCA), developing models for identifying feed compositions, sensitivity analysis of established plants, etc. will give a truer picture of technology applicability.

Dr Tuli urged to avoid using ballpark figures as they don't give a clear picture. It will be like the estimations made for Jatropha in the past decade. For example, if we claim that two thirds of biomass is left after crop production it leads to gross overestimation of the amount of biomass for energy because it can't be utilized in its entirety. Region specific biomass availability is needed so that industry can target those areas which are fruitful. A business model can then be made from such analysis to identify hot spots for industries.

Dr Prashant Gargava, Additional Director & Head, Air Quality Management Division, Central Pollution Control Board said that Delhi gets heavily polluted due to stubble burning in agricultural lands surrounding Delhi during winters but this biomass is a wasted resource. He added that simple banning of stubble burning is not going to be effective unless accompanied with incentivized supply of biomass for other applications. He stressed that the scope of using segregated municipal solid waste has to be increased in urban areas.

Dr Piyali Das, Senior Fellow, TERI stated that biomass is an essential source for biofuels and the potential exists to meet the challenges of increasing fuel demand. Biomass has consistently failed to meet the targets set by policies because of limitation in the feedstocks and products that can be synthesized. (Eg.: National Biofuel Policy concentrates majorly on

bio-ethanol and diesel only). To make 20% biofuel blending target possible, India needs to tap all the existing surplus biomass and convert it to biofuels through appropriate technological routes – including synthetic fuel routes (such as syngas to liquid, pyrolysis) along with the existing ones like bio ethanol (by fermentation) and bio diesel (by transesterification of seed oils).

She pitched for strong research focus to explore the 2nd and 3rd generation biofuels via syngas to liquid conversion and thermo chemical conversion to use major agro residues available which are otherwise not suitable for bio ethanol and bio diesel production. She added that to encourage the evolution of more environmental friendly process (complete value chain from feedstocks to products for every technology) for biofuels, different price models for different fuels should be allowed. The learning can be taken from Renewable Identification Number (RIN) that the US has followed to give more price credits to the technologies which were greener as compared to other.

Some of the key points of the discussions were:

- Biomass holds a huge potential to substitute energy demands of the present
- While various technologies for utilization of biomass exist— gasification, pyrolysis (thermal routes especially for dry biomass like agro residues) methanation, anaerobic digestion (primarily for wet biomass, sewage sludge, food wastes, dung etc.), a systematic value chain is needed to maximize both the economic and environmental the benefits
- Overall land use and sustainability has to be looked at
- More varieties of biomass feedstock should be included under the umbrella of biomass available
- Policy should be technology agnostic and promote solutions relevant to Indian scenario rather than emulation of models used by developed countries.

SESSION 2: BUSINESS MODELS AND FINANCIAL INSTRUMENTS

The session was moderated by Mr Sunil Dhingra, Senior Fellow, TERI. Ms Nidhi Sarin, Technical Expert, GIZ informed that GIZ works with the IGEN-Access team for improving energy access in rural areas and provide conducive environment for private sector. She stated that they are technology agnostic and work across sectors such as solar, bioenergy, micro-hydro and clean cooking. GIZ works in identification of gaps in logistical chain and works on different business models. Skill building for making cleaner products like pellets and briquettes is also undertaken by their team. Ms Sarin elaborated on the upcoming funding opportunities in bioenergy that would be undertaken by GIZ such as standards

setting for large biogas plants and models for reducing dependence on fuels in north-east India. She pitched for fuel staking to be promoted along with LPG promotion programs so that the consumers are able to adopt LPG as one of their cooking fuel along with firewood.

Mr Shailash Pisalkar, Secretary, Bhartiya Dhyaniy Bahuuddeshiya Gramin Vikas Sanstha said that his organization is involved in making pellets from agro-residues. He emphasized that his competition is with coal and pointed out various advantages in terms of employment generation and increase in GDP with the promotion of pellet industry. He spoke about various financial schemes by MEDA, SIDBI, NABARD for subsidizing the pellet machinery. He emphasized linking biomass collection in the MGNREGA scheme and using the CSR fund for energy plantations on the barren land not under agricultural area. Mr Pisalkar also stressed on the need for technology innovation in pellet making industry. A range of subsidies is available, but only for high capacity pellet making machines. He mentioned that community based business models must be developed. He remarked that he saw biomass residue collection as first and foremost a rural livelihood enhancement opportunity before considering it just as an energy generation initiative.

From his experience, Mr Pisalkar listed the following benefits:

1 ton/hectare biomass on average

Increase in employment of 3-4 man days/hectare

Each man day emuneration average Rs 300

Average land holding in the district 9.52 lakh hectares => 9.52 lakh tons biomass produced/year

3.50 lakh tons go to animal fodder and fuel wood purpose

6.00 lakh ton remaining => If processed in pellets, Rs 300 crore turnover per year (avg)

On average 40,000 families (mostly that don't own land) are directly benefited

District GDP increased by 10%

He listed the following as challenges:

Lack of technical equipments such as chippers, balers, logistics

Government support

Technical innovation from industries side

Financial inclusions

Mr Bharat Sharma, Chairman, Pellet Energy Systems Private Limited said that they have set up pellet plant from agri-residues such as bagasse, bamboo waste, groundnut shell, wood chips and pine needles etc. He emphasized that they produce pellets that abide by the international norms. The pellets so produced can be used for all heating applications and is currently supplied to corporates such as Pepsico and Coke. He pointed out the challenges faced by them with respect to lack of testing facility for higher kW-capacities and that biomass pellets are not recognized as green fuel by MNRE and CPCB. There are no pelletizing regulations and therefore the use of furnace oil and petcoke is promoted over

pellets. Other challenges pointed out by him include pellets not being recognized as an exportable product and non-uniformity of taxation policy across the states. He said that by making pellets there is a 15 time reduction in the volume of biomass. Coal is the closest competitor of biomass pellet. He stressed that consumers should be incentivized for popularizing the pellets.

Mr Amitabh Tandon, Director, Transtech Green Power Private Limited and Secretary, Indian Biomass Power Association opined that biomass application suffered from policy and regulation issues. They as project developers faced regulatory hurdles in the case of biomass power plants and he mentioned that although the Central Electricity Regulatory Commission had made several amendments the plant operators suffered huge losses. He pointed out challenges related to lack of incentives for fuel processing and handling equipment. He emphasized that idle capacity should be revived using financial assistance from National Clean Energy Fund and on policy for promotion of energy plantations by NABARD. He suggested looking at biomass industry as one providing rural employment and also that fuel price should be set independently and out of regulations.

Mr Atul Mulay, President, Praj Industries said that although the ethanol blending program mandates blending of 20% but they could only reach blending of 4-5%. Business model for ethanol that led to industries come forward and invest was due to attractive price. However due to low production and therefore shortage of molasses, molasses-to-ethanol is not viable now. In case of cellulose to ethanol, techno-economic viability is a challenge. There are different business models that are coming up which include models by Oil and Marketing Companies as they have been asked to take their own biofuel initiatives as well. There is a model called Bolton model, relating to sugar and distillery industries whereby ethanol could be produced in the remaining non-operating days using existing infrastructure. He insisted on policy changes to see investment by private players, use of NCEF funding and incentives such as advanced depreciation. On a query to biomass input price, he mentioned a biomass price of Rs 2000-2500/ton landed at manufacturing unit, meaning Rs 500-1000/ton to farmer.

Dr Laveesh Bhandari, Director, Indicus Centre for Financial Inclusion is an entrepreneur who has developed a range of business models around the topic of biomass burning, focusing mainly on the economics. He spoke on the role of Government towards rural development and curbing of pollution to make a clean environment. He pointed out that the price of energy is going down in the coming years and policy reforms have to be implemented fast rather than taking 10-15 years of time as in the current situation. He suggested to have a biomass policy covering biomass as a whole and not restricted just to biomass energy policy. The revenue aspects should be considered seriously for sustainability of the bioenergy plants. He also suggested having low energy production cost, huge technology investment and coming up with suitable cooperative model. He added that a considerable share of benefit should go to the farmers and that the cost of collection of biomass should be

reduced through appropriate business models. He mentioned that an oligopoly market model is to be created for bioenergy products and services.

Mr Dinesh Pant, Fellow, TERI discussed different gaps related to biomass and bioenergy and they all initiated with 'I', namely information gap on biomass, institutional gaps for implementation of policies, integration gaps to integrate biomass programs in Skill India and Swachh Bharat Mission and implementation gaps for setting standards for biogas technology. He spoke about policies for recycling of plastics from municipal solid waste.

During the following discussions, on the case of addressing of burning of agri-residues that become available together throughout the country over a short period of time during harvest season, Dr Bhandari stated that MNREGA could be engaged as part of the biomass collection activity. It was pointed out that farmers already bring their produce to whole-sale purchase where they get money in return for the sale of their goods. Similarly a mechanism could be put in place whereby the farmer would bring the biomass residue to a large collection/processing facility provided there are such commercial facilities and there is enough money to be paid to the farmer. The state co-operative establishments could also be employed for such collections. Mr Pisalkar mentioned that biomass must be collected by local people first at generation sites, compressed and then MNREGA programs can come in. It was discussed that in China, continuous balers have been deployed in villagers where by the residue is compressed at the generation site itself and then shipped to processing facilities. The extra cost of continuous balers is offset by the volume reduction through compressing and the resultant shipping and storing savings. In Punjab, the Government is supporting the capital cost which reduces the financial burden associated with the activities. Col. Ahuja remarked that there is no need to teach farmers how to collect residue and that they would collect it provided there is some financial gain for them in it. The rice residue is burnt, but the same residue of wheat is not burnt because the farmers get financial value for it by selling them as fodder. He mentioned that that there is already good enough price for the farmers to interest them to collect and supply biomass. The problem happens after that. What do we do with the collected biomass? Who would provide the capital investment to ship and process the residue? The industries care only about the production premises. 'Should there be an integrated supply chain management?', Col. Ahuja remarked. There should be some policy intervention from the government to facilitate this step that requires co-operation between multiple stakeholders and related capital investment. The government could create a support program for say 5 or 10 years so that the activity is initiated after which it would sustain itself.

SESSION 3: POLICY INTERVENTIONS AND REGULATIONS

The session was moderated by Dr Vibha Dhawan, Distinguished Fellow & Senior Director, TERI. The first panelist was Dr Sangita Kasture, Joint Director, Department of Biotechnology, Government of India. She briefed that DBT is working on implementation and R&D under the National Biofuel Mission. Biohydrogen, biobutanol and microalgal biofuels are the Department's focus. She mentioned that some of the main challenges are limited availability of inexpensive biomass, high cost of conversion technologies and the cost of enzyme for pretreatment in lignocellulosic ethanol production from agri-residue. DBT has set up bioenergy and biofuel centers which work on these issues. DBT also fosters international collaborations through bilateral funding programs. She lamented that India's commitment of \$80 million to R&D was much less compared to other countries and that even smaller EU nations contribute at least double that amount. The US on the other hand sets aside about \$6 billion (World total - \$30 billion). India plans to raise it to \$140 million by 2019. She mentioned that DBT has set up a new integrated mission program called missioninnovation.net in association with other ministries to take up and support innovative R&D concepts and demonstration projects. Industries are also welcome for investment and participation in this. DBT is interested in expanding the National Biofuel Mission with MNRE. She also mentioned about the usage of high biomass sorghum and pearl millet (low lignin content) for ethanol production. She informed that market value for ethanol energy is \$20 billion presently and is estimated to be \$200 billion by 2020. She added that there is a need to work in consortium and collaborate on projects, with a focused effort.

Dr S N Srinivas, Program Officer, UNDP talked in detail about a variety of policy topics. He stressed that one of the biggest advantages of biomass power is the high load factor of a biomass power plant (80%). That is, a 10 kW biomass power plant is equivalent to a 40 kW solar power plant. Then he listed some challenges and action required.

Challenge 1: Tariff is not remunerative for sustaining plant operation

Action required: All SERCs to implement fixed tariff set by CERC immediately, revise variable tariff annually vis-à-vis once in 3 to 5 years now.

Challenge 2: Enormous time taken for approvals for new power plants: There are at least 8 to 9 approvals required to establish a biomass power plant. They are namely, State Nodal Agency, Gram Panchayat, State Pollution Control Board, Land – competent revenue authority, DISCOM/ Transmission Co., Town planning, Factories and Labour laws, Chief Electrical Inspectorate, District Industries Centre. This has often taken over 15-20 months' time in most biomass power plants.

Action required: Single window clearance, simplified process with fixed short timeline, concept of biomass park (similar to solar park), reduce number of approvals

Challenge 3: Supply of biomass unreliable and at increasing prices: make biomass markets organized and reliable. Increase predictability. For example Solar and Wind predictability in Germany is 3 to 7%. There are now some successful examples of operational 'biomass exchanges' (e.g. Minneapolis (USA) Biomass Exchange www.mbioex.com) which help give online information of supply and demand of biomass as commodity along with price transparency.

Challenge 4: Lack of updated data on surplus biomass availability

Action required: Government to establish dynamic / regularly updated biomass atlas

Challenge 5: Burning of biomass on field

Action required: Develop policies and fiscal support to ensure that the crop-residue which is considered a waste is converted as resource

Challenge 6: Uneven regional distribution of biomass power plants

Action required: Develop and implement guidelines on plant sizing and distribution as well as promote scattered smaller plants than large plants

Biomass holds an edge over other renewable energy systems in off-grid power generation. It does not require any energy facilities unlike the solar or wind energy systems. Dr Srinivas mentioned that 20 GW is the target for off-grid power generation.

Challenge 7: Smaller Vs large or Small and Large biomass power plants

Action required: India has scope and opportunity for different capacity of power plants depending on situation, develop guidelines and policies to support all of them.

Challenge 8: No mandate to purchase biomass power or generation of biomass power by obligated entities (particularly given its rural livelihood and environmental benefits)

Action required: Mandating biomass power purchase by creating separate BPO (Biomass Power Purchase obligation)

During the discussions, it was stressed that bioenergy should not be looked at just an energy source, but as an integrated solution in combating air pollution and waste management. This must be taken as a key consideration in formulating policies for bioenergy and biomass power facilitation and related financing mechanisms. It was also mentioned that some of the funds set aside for health care and environment could be contributed towards development of bioenergy technologies since they can address the serious environmental impacts of biomass residue burning.

Dr Arindam Datta, Fellow, TERI stated that in India, the highest biomass burning happens with sugarcane residue and rice residue. But these issues are not highlighted regularly. These issues gather attention only in November and December due to smog in New Delhi NCR due to media popularizing it. He added that soil carbon is degrading every year. It is less than 0.4 currently. Biochar production can be applied for soil carbon restoration. This

will increase carbon content. He further added that storage facilities for biomass are required.

Mr Amit Mehta, Executive Director, Mozo Bamboo Group briefed that his company has partnered with the Andhra Pradesh Government to grow bamboo over 20,000 hectares to find applications for bamboo and also use the residue generated from its main applications such as agarbatti production. He mentioned that his initiatives started when he noticed that the bamboo original planted for paper manufacture were going waste and new applications could be found. He noted that the Governments don't know how to allot land in spite of a policy to promote private public partnerships in developing marginal lands. He also reiterated that monetary benefits to farmers are key and that they won't put up with being short-changed for any biomass they sell.

Again, during discussions, it came up that biomass pellets have not been listed as fuel by the government and the process for obtaining approval has been reported to be long, arduous and complicated as agreed by many biomass panelists in the workshop. In spite of having set up large pellet production systems and huge capital investment, an efficient biomass energy form such as biomass pellets have got no traction for application.

Dr Shilpi Kapur, Fellow, TERI during her talk mentioned that from the survey studies she had coordinated in the past, she understood that the villagers wanted local collection centers for agricultural residues. She added that equipments for residue collection could be rented and managed through rural cooperative societies and these could be bought and provided by government agencies and then these could be hired for usage. She mentioned that farmers from Rajasthan brought residue to Punjab where paper industry used it as feedstock as they saw value in it for them through the demand for biomass. She also pitched for the inclusion of women in the supply chain as they occupy an integral part in the workings of rural communities and agricultural activities.

Mr Shirish Garud, Director, TERI wrapped up the workshop with summary and a vote of thanks.

WAY FORWARD

The proceedings of the workshop are intended to lead up to an initiative on national policy on bioenergy and facilitate wholesome and efficient utilization of various bioenergy resources. A study could be planned as the next step to create a bioenergy policy-facilitating document. The workshop discussions could be used to serve as pointers for the study to present a convincing case for the national policy.

Also, it is proposed to set up a national forum on bioenergy based on the proceedings of the workshop and the networking of the various stakeholders. It would be a continuously working platform where those who are involved in the field of bioenergy can share their opinions and suggestions, get together, constantly update and improve the various bioenergy initiatives and act as follow-up mechanism on the bioenergy priorities. A nodal agency from the Government along with various stakeholder partner organizations could be part of it. Regular meetings (annual) could be organized to discuss developments, plans and priorities. This would make sure that the discussions are ongoing, the government agencies are constantly in touch with the players of the bioenergy and the policy shall be refined and improved continuously with time. It would also provide a straight and quick access to governing bodies on a mission-mode as opposed to any time-consuming procedures.

SPECIFIC COMMENTS FROM STAKEHOLDERS

Mr Amitabh Tandon, Director, Transtech Green Power Private Limited, Jaipur and Secretary, Indian Biomass Power Association:

1. The Biomass sector has to be looked differently from the point of view of environment, health, rural development benefits it provides and employment creator to rural India. It directly increases the income of farmers and flow of liquidity in the rural system which meets country's overall goal and objective of rural development and biomass sectors needs and requirement 'must be met accordingly without compromise and comparison with other renewable sectors.
2. The Biomass plants are located in rural backward areas and provide lifeline to rural economy. All plants and machinery are indigenous and made in India unlike solar and wind which still has large components of imported material and majority of the tariff which the solar and wind industries get goes outside the country towards meeting payment of the imported component, whereas 100% of the tariff which the biomass industry gets remains in the country and 70% of it goes into the rural sector of the country.
3. The government and each state must have a biomass target to meet on annual basis for five year till which the biomass sector must be supported with its needs and requirements, which would imply a higher tariff than may be solar and wind energy fields currently. The solar and wind sectors do not have any fuel cost, whereas biomass sector uses agriculture, and forestry waste, which have a fuel cost that goes into rural economy and the fuel supply management creates employment opportunities in the rural sector for the rural people. The biomass tariff is in two parts, levelized fixed cost and variable cost, and variable cost is the prevailing fuel cost as decided by the regulator.
4. Biomass power connected to grid are mainly ranging from 5 to 12 MW capacity, which are small and as the generation is localised with evacuation to the grid station, this power is mostly utilised in the local rural area as distributing it elsewhere would result in transmission losses, which are very high. Hence it helps in meeting the power needs of rural area. IBPA has estimated that there is a saving of 0.94 paisa per unit on savings of transmission losses as the power is locally utilised. Hence the net outcome of higher tariff to biomass sector is actually less due to the savings in transmission losses.

5. In order to encourage and promote the biomass sector not only as clean energy but also as one with various other benefits to rural development, the government must have some incentive mechanism. This mechanism shall be smooth and shall not create any controversy to provide the incentive to distribution companies for purchasing biomass power either from National Clean Energy Fund or from rural development schemes, as the operation of the biomass sector automatically meets many rural development objectives. This would remove the resistance of buying biomass power by State distribution companies and promote the biomass sector without the benefit going to individual power plants. There may be lesser benefit accredited for biomass power that is already being purchased and more benefit could be given to the purchase of new biomass power.

6. The funding of biomass sector remains a challenge, which needs special attention, focus and push from the government in providing smooth and low cost fund to the biomass sector in operation. Interest subvention should be supported from NCEF for the biomass sector. FIs should be given target to fund the biomass sector, which would automatically promote the sector.

7. Due to past difficulties out of total capacity of 1250 MW of grid connected plants, more than 70% have either shut down or operating at low PLF due to the issue and challenge of no working capital available with them to purchase fuel and O&M of the plant. This needs to be addressed quickly so that the idle capacity of installed biomass power can start generating power. The Ministry had approved an interest subvention scheme of supporting 30% of the outstanding loan from NCEF at 2% for the biomass sector, which did not receive much response due to various conditions and requirements put in it. IBPA has requested to allow Rs 50 lacs per MW as working capital loan for a period of 5 to 7 years at 2% interest from this fund that is already available and approved for the biomass sector. This would enable a major installed idle capacity to start generating biomass power.

8. Accelerated depreciation benefit may be provided to the biomass sector as a policy benefit not only as renewable power but also in view of the contribution it makes to rural development, employment generation and in enhancing farmers income.

9. Income tax exemption and holiday shall be extended for the biomass sector considering the struggle and difficult time, they are in. The current exemption is for a period of 10 years from commencement of plant, which needs to be extended for another 10 years.

10. Biomass sector, plant equipment, fuel shall be exempted from GST. Solar has been moved by the Ministry as renewable power for exemption from GST, similarly the biomass sector may also be exempted from GST.

11. Fuel handling and processing equipment are currently not treated as part of the biomass plant and equipment. These are the most important components of biomass power plants. It should be treated as part of plant machinery so that all benefits of excise duty, import

duty exemption can be extended to biomass fuel handling and processing equipment. The government should consider financial support for creating fuel collection centres and all equipment as required for making fuel available to the biomass power plants.

12. Ideally each power plant should go for 15 to 20% of its total fuel requirement to be met from captive energy plantation. Currently there is no policy, mechanism for developing energy plantation. NABARD does not have energy plants listed as one of agriculture activity. This implies even loans are not available for development of energy plantation for biomass use. Not only a clear policy needs to be made for energy plantation, but some pilot projects should be initiated with the government support or risk-guarantee schemes involving expert organisation such as TERI and CAZRI with buy back of produce agreement with the biomass power plants.

13. Solar sector had started with a tariff of Rs 20 plus and it was only due to government support and proactive policy that the solar power tariff has reduced down today. However the biomass sector has not yet got such support from the policy makers and is in a bad shape. Biomass will also be able to reduce tariff if support on energy plantation, fuel handling mechanism and collection centres are provided, hence time must be given to the sector backed with good supporting policy from government.

14. Discoms are reluctant to buy biomass power today as the same is a bit more expensive than the conventional power and solar power. Hence targets may be set in each state for purchasing biomass power and the relevant support shall be provided. Another policy initiative could be bundling power similar to the support provided to the solar energy sector in the past or as mentioned incentivising Discoms to purchase biomass power.

15 The new CERC regulations for biomass set up after task force have not yet been adopted by the state governments of Karnataka, Madhya Pradesh, Gujarat and Tamil Nadu which needs to be looked at as policy as the biomass sector can get level playing conditions for operations.

MNRE already has a bio-energy mission document prepared, in which the biomass sector and IBPA had given a lot of inputs in the past. The document is of 200 pages already and is an exhaustive one that could be used for drafting the bio-energy mission, a need of the hour.

Mr Bharat Sharma, Chairman, Pellet Energy Systems Private Limited, New Delhi:

Challenges faced:

- Biomass Pellet was not accepted by the industry as it was neither recognized as a green fuel by MNRE nor it was listed as a non-polluting fuel in Central & State pollution control board's list of fuels.

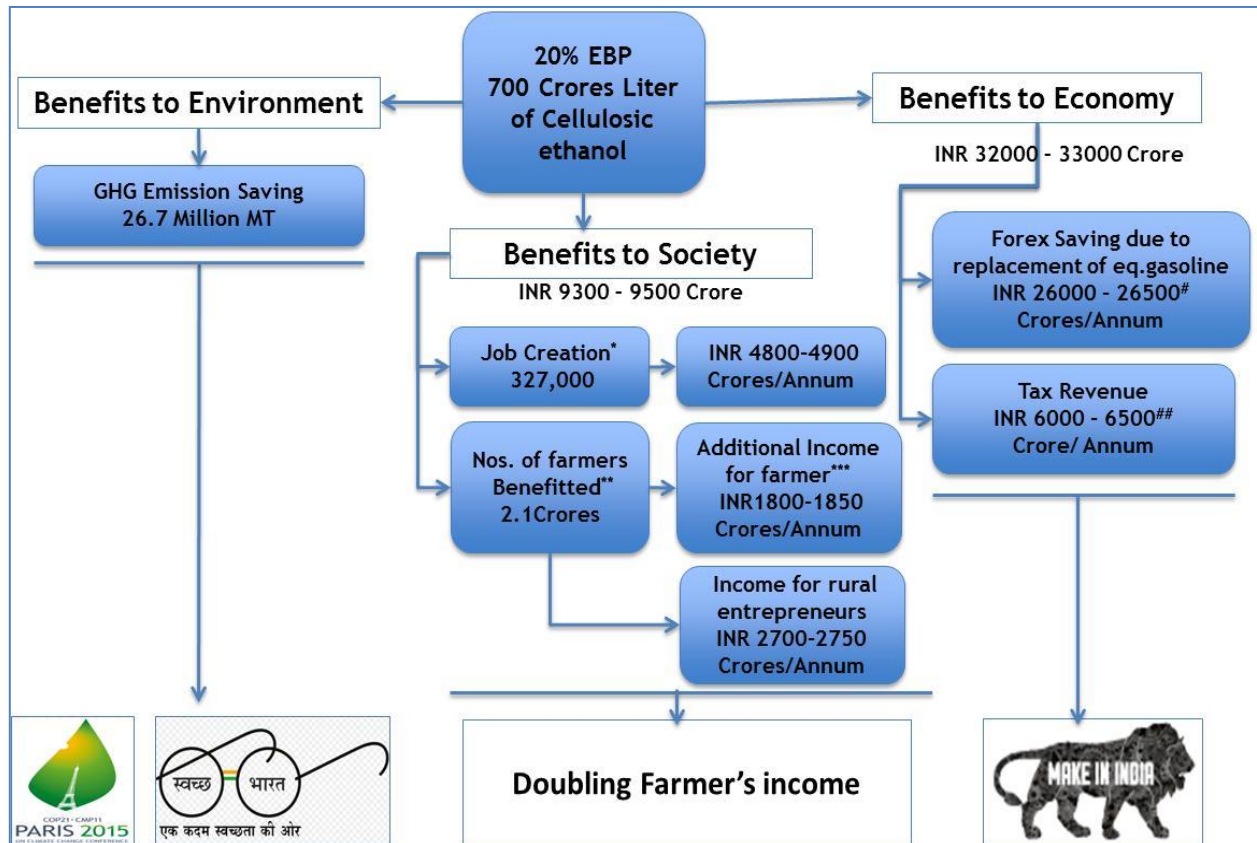
- Over the last 4 years, one of the most polluting fuels namely PETCOKE and FURNACE OIL replaced biomass as a fuel because of cost advantage & automation.
- Could not get raw material guarantee from agri and wood processing industries as they followed an auction process every year, hence signing long term contracts was not possible.
- Clean cook stove initiative at MNRE was discontinued mid-way and did not get any momentum due to significant correction in crude oil prices making pellet stoves uncompetitive.
- No thrust or incentive for promotion or development of pellet based appliances and automation systems like given in case of gasifiers.
- Co-generation for Power was not a thrust areas and hence did not get the required attention.
- No uniform taxation and rebate provided across states.
- Export to countries where biomass pellets usage is already established but have scarce biomass generation could not be fed from India because of lack of clarity on export.

Support required:

- Recognition to Biomass Pellets as a green/solid fuel.
- To make way for multiple standards for Pellets manufacture & usage.
- Benefit/Incentive & recognition to end user for the usage.
- Pellet Industry should be categorized in Agriculture Industries to avail soft loans & Incentives
- Implementation of ban imposed by the Honorable Supreme Court on polluting fuels like Pet coke/Furnace Oil.
- Incentivizing the farmers for removal of agri stubs at rates which would meet the expectation of end usage of customer.
- Incentivize Agri processing industries to sign long terms contracts with pellet sector for the industry to in turn provide long term commitment to customers, through various Industrial forums
- Should come under 0% tax in GST regime.
- As per promise of clean cooking solution by the government, biomass pellets to be added as a preferred fuel because of reduced emission's & of ease of logistics & storage.
- Government should promote and incentivize the use of biomass pellets for cogeneration in thermal power plants.
- Actively promote the usage of biomass pellet based appliances for mid day meal, thermal applications, gasifiers by giving incentives as MNRE is already doing for Gasifiers.
- Promotion of pellets and pellet based cooking/thermal solution through PDS (public distribution systems).
- To actively promote the export of Biomass Pellets for better realization for farmers.

Mr Atul Mulay, President and Mr. Venugopal Nair, Assistant Vice President, Praj Industries, Pune:

Second generation ethanol projects will help the Government achieve its various initiatives such as 'Make in India', 'Swachha Bharat Mission' and 'Doubling farmer's income'. The socio-enviro – economic advantages of 2G ethanol are shown here in figure below:



Proposed fiscal incentives and policy suggestions to make the 2nd generation bio-ethanol projects viable, attract investments and achieve blending mandates:

Proposed fiscal incentives availed by renewable energy projects which may also be applied to 2nd generation bioethanol production projects

1. Financial support by way of Viability Gap Funding (VGF) in the form of Capital Grants and Interest Subvention support (soft loans) from MNRE for developers / Technology partners for setting up projects
2. Financial Support by way of Viability Gap Funding (VGF) in the form of Capital Grants and Working capital support from MNRE for Biomass Supply Chain set up by the project developers / biomass suppliers
3. Differential pricing (higher than 1st Generation ethanol) for Cellulosic (2nd Generation) ethanol due to the techno-socio-economic benefits for the country
4. Exemption from customs duty, excise duty, GST for machinery and components during the setting up of the project

5. Exemption from customs duty, excise duty, GST for 2nd Generation ethanol, BioCNG, yeast & enzymes for a period of 10 years
6. A 10-year Income tax holiday
7. Accelerated depreciation: a claim of 40% depreciation in the first year
8. A payment security mechanism to cover the risk of default by OMCs / off takers

Taxation

- Removal of State Levies on the inter-state movement of the bio-fuel
- Administrative reforms at the state level, including digitising the excise permit processes easing transportation and logistical requirements

Proposed policy suggestions:

1. Assurance of Off take of products and Cco-products from 2G Biorefinery
 - a) Long term 2nd Generation Ethanol Purchase Guarantee Agreement (EPA) by OMC's for a period of 15~20 Years period.
 - b) Indexation of BioEthanol & BioCNG Prices – Escalation in line with the Biomass Prices / Brent Crude Prices for the period of EPA.
 - c) Inclusion of power produced from 2nd Generation bio-refinery complex in waste-to-energy category. Tariff of Power should be same as waste-to-energy tariffs.
 - d) Recognition of BioCNG as transport fuel and release of its Specifications.
2. Environmental Clearance for 2nd Gen Bioethanol Projects
 - a) Classification of 2nd Gen Bioethanol projects under the “Orange Category”
 - b) Single window clearances for 2nd Gen Bio ethanol projects
 - c) Waiver of EIA / EMP studies and Public hearing
3. Biomass Collection
 - a) Allocation of Catchment area of 60 – 80 km radius for 100 KLPD , 2nd Gen Bio ethanol projects by the State Governments to ensure that the Project gets sustainable supply of feed stock on long term basis
 - b) Allocation of Land for Biomass storage depots on long term lease basis

Prof V K Vijay, Center for Rural Development and Technology, IIT Delhi, New Delhi:

The optimum utilization of biogas as source of energy depends on plant design and its operation. Biogas systems regulates environmental cycles effectively since nutrients such as nitrogen, phosphorus and potassium are conserved in the process in the slurry and can be returned to the soil. Digested slurry is also a good source for several micronutrients like zinc, iron, manganese and copper. It has been observed that use of slurry as fertilizer has many advantages as compared to farm yard manure. Weed seeds in cow dung are destroyed

completely during the digestion process and is richer in nutrients compared to farm yard manure.

A plan for a national biogas mission in India is proposed which targets installation of one crore Biogas plants across India in all sizes and types for cooking, enrichment and bottling and power generation. This plan will not only help to make country more secure in its energy requirements but will also contribute in proper waste management which can be linked to Swachh Bharat Abhiyan an initiative taken by the Hon'ble Prime Minister of India. India is an agriculture based country with more than 1.2 billion people and largest cattle population nearly 300 million and there is enormous availability of various resource which can be used for biogas production. This can prove a boon for both the rural and urban population.

This program shall serve its purpose to promote biogas energy in India which may replace large amount of petroleum imports and save foreign currency along with utilization of locally available biomass resources in the country in a sustainable development approach. The biogas sector can provide large employment in rural areas and at the same time providing gas, power and organic fuel for tractors and vehicles and biofertilizer for organic farming.

Dr Dheeban Chakravarthi Kannan, Fellow, TERI, New Delhi:

Biofuels for use as transport fuel assume significance in terms of the economic burden it places on the nation through crude oil imports and the higher value it can fetch as a product. Second generation biofuels from agricultural residue have the potential to supply about 40-60 mtoe/year of transport fuels. Third generation biofuels such as algal biofuels have an even higher scope, 80-120 mtoe/year even if they are at an earlier stage of R&D compared to other fuels. Sea water could be used a free and viable water source and marginal lands that won't interfere with food production could be used. There is a need to have a clear road map to develop sustainable renewable fuels for the future. Feedstocks that are promising under Indian conditions must be identified and the development of technologies appropriate for such feedstocks must be encouraged. Funding needs to be increased much more for this R&D initiative even though the Government has already been supporting it and this must be seen as a necessary long term investment given the huge expenditure we incur on the import of crude oil. Gaps in the development of such advanced biofuels must be clearly spelled out and the best minds in the country must be attracted to develop technologies for this crucial field of application. Countries such the US, Australia, the EU and Japan have adopted a clear plan for the development of such advanced transport fuels. India must also adopt such a visible and clear plan for future advanced transport fuels that are tailored to Indian conditions.

KEY PARTICIPANTS OF WORKSHOP

1. Mr Anil Kumar Jain, Additional Secretary, NITI Aayog – Moderator
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3. Dr Ajay Mathur, Director-General, TERI
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6. Mr Sunil Dhingra, Senior Fellow, TERI, New Delhi
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19. Dr Vibha Dhawan, Distinguished Fellow & Senior Director, TERI - Moderator
20. Dr Sangita Kasture, Joint Director, Department of Biotechnology, Government of India, New Delhi
21. Dr S N Srinivas, Program Officer, United Nations Development Programme (UNDP), New Delhi
22. Dr Arindam Datta, Fellow, TERI, New Delhi
23. Dr Shyamala Mani, Professor, National Institute of Urban Affairs (NIUA), New Delhi
24. Mr Amit Mehta, Executive Director, Mozo Bamboo Group, Hyderabad
25. Dr Shilpi Kapur, Fellow, TERI, New Delhi

26. Mr Ramanand Mittal, Fire Cubes, Delhi
27. Mr Sanjay Jain, Star Group, Mumbai

Other Participants of Workshop:

28. Mr Shirish Garud, Director, TERI
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31. Mr N K Ram, TERI
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