NORTH-SOUTH PARTNERSHIP PROGRAMME OF DEN (GERMANY) AND INSEDA (INDIA) FOR ISSUING GREEN CERTIFICATES FOR GREENHOUSE GAS (GHG) ABATEMENT IN RURAL INDIA

PILOT PROJECT TO REDUCE GREENHOUSE GAS EMISSION: - by the abatement of Methane- (CH_4) to atmosphere from the dung produced from Indian bovine (cattle and buffalo) population, by recycling it through building household biogas plants

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I. INTRODUCTION

1.01. Over 75% of Indian population lives in rural areas, in about 600,000 villages, which mainly depend on agriculture and allied activities for their livelihood. India also has about 300 million bovine (cattle plus buffalo) population, majority of which live in rural areas as domestic farm animals, forming the backbone of Indian agriculture. The female bovine provides the milk, and the male cattle are used as draft animals for carrying out farming operations, like ploughing, levelling, thrashing, hauling of farm inputs and crops etc., as well as short and medium distance transport of farm produced and other goods. In addition to this, the manure produced from bovine population in India is of great value to local people, though often not defined in terms of economic value, as at present it does not give direct cash benefits to majority of rural people. The average daily collectable quantity of dung in India would be 1,500 million Kgs or 1.5 million tones (safe value taken as 5 Kgs dung/bovine/day, as the size of Indian animal varies greatly from region to region, and the majority of bovines in rural areas are sent for grazing during the major part of the year during the day).

1.02. About 1/3rd (500 million kg/day) of total bovine dung produced annually is made in to dried dung cakes by rural people- this dried dung cakes are then used by rural women as fuel for cooking purpose. This is not only an inefficient way of using dung as fuel, which gives only 11% energy but also pollutes the local and the surrounding environment, and contributes to the greenhouse gases (GHGs), global warming and the climate change. At the same time cooking in the traditional and inefficient cook stoves in the rural India also contributes to the drudgery of the rural women (for example- time spent in collection and cooking etc.) as well as adversely affects their health (lungs & eye diseases), as it has been estimated that burning of biomass (including dried manure) for cooking in the traditional stoves in the rural areas of India contributes to inhaling of smoke equivalent to smoking up to 20 packets of cigarettes each day. The health of

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infant children (staying with the mothers) and girl child are also affected due to smoky kitchens in the rural India. Out of the balance of approximately 2/3rd (1,000 million kgs/day or 1 million tones/day), the major portion (say 75% or 750 million kgs/day) of the balance of dung is used for making organic manure in an inefficient manner. In fact this dung which is either left in the fields to dry or dumped in heaps, releases methane (CH_4) to the atmosphere in the form of greenhouse gases, that too with out given out any benefit to the people. This major portion of the dung also becomes responsible for the breading of flies and mosquitoes and creates pollution and public health problems. This major quantity of dung used at present for making organic manure in a traditional way in villages also leads to major losses in beneficial nutrients by way of leaching and washing. The balance left over bovine dung (say 250 million kgs/day) is used for other miscellaneous activities, e.g. for building simple rural houses by mixing it with mud, as well as periodic plastering of walls and floors houses in the villages.

II. RECYCLING OF BOVINE MANURE THOUGH BIOGAS PLANTS IN INDIA

2.01. If biogas plants are used for recycling of this bio-degradable waste (dung) then apart from providing a clean & convenient domestic fuel for rural houses in the form of biogas. The biogas could also be used for lighting and if surplus gas is available then could also be used for operating engine for mechanical operation or generating electricity in a decentralized manner in remote and far-flung regions of the country. Where transmission lines from the centralized power plant and grids would never reach, and even if reached, it would be not be cost effective and would require very high maintenance cost. On the other hand, the digested liquid manure coming out of the plant would provide an excellent organic manure in which all the useful nutrients remains preserved (due to decomposition in the enclosed digester of the biogas plant) for promoting environmentally sound eco-farming. Because the nutrient in the biogas digested liquefied manure gets mineralized, it is easily available to the crop. Moreover, the humus in the biogas digested manure, improves water-holding capacity of the soil, and acts like a soil conditioner, improving its fertility and builds-up micro-flora in the soil (which might have lost due to excessive use of chemical fertilizers & pesticides. Due to the residual effect of the biogas-digested manure on the soil, its positive impact could be observed in the next 1-2 crops. As the biogas-digested manure provides all the plant food, minerals and micro-nutrients, it produces healthy crops, due to which the attack of insects and disease is less. As the inherent strength of the plants develop the capability and capacity to fight back the diseases and also can stand under worst stress conditions and water shortage, as compared to the chemical fertilizer based crop. Some experiments have also shown that crop seeds soaked in the biogas digested liquid manure for 24 hours, has comparatively better germination and tender seedlings can withstand stress conditions, with better chance of survival as compared to those germinated using the chemical fertilizer. If the farmers are not able to use the biogas plant digested liquid manure immediately, they could use this liquid for making excellent scientific compost along with other locally available bio-degradable waste. The digested liquid manure would also promote faster making

of compost, and all the nutrient of the manure will remain preserved when composting rather than letting it dry- this compost could then be used during the crop season.

2.02. Thus it is clear that the potential of dual benefits, for the generation of environmental benign fuel and organic manure from bovine dung is lost by either directly burning the same manure as dried dung cakes or using it directly for making organic manure, apart from creating negative environmental impact.

III. IMPLEMENTATION OF HOUSEHOLD BIOGAS PLANTS IN INDIA

3.01. India is one of the pioneer countries in the design and application of household biogas plants as well as large-scale implementation of this technology in rural areas. Systematic development and promotion of household (Hh) biogas technology is over 60 years old. The demonstration and limited extension phase of Hh plants was first initiated in India by KVIC (Khadi and Village Industries Commission), using their floating steel gasholder model in 1960. However, the implementation of Hh plants got impetus in India only after the Ministry of Non-Conventional Energy Sources (MNES), Government of India, launched a centrally sponsored scheme, known as National Project on Biogas Development (NPBD).

3.02. With the Multi-Model and Multi-Agency approach adopted under the NPBD, (MNES), Government of India (GOI), ensuring wide coverage throughout the country in which NGOs, especially **INSEDA** (Integrated Sustainable Energy and Ecological Development Association) members, played constructive role. As a result, India has achieved massive target of over 3 million household (Hh) biogas plants, till the close of fiscal year 2000-2001. Yet it is still a drop in the ocean when considering the revised potential (in year 2001) of 20 million Hh plants[2], and the present rate of implementation of 150,000- 200,000 units per year, it could take 75-100 years to realize this potential.

3.03. By November 1, 2001 there were over 75 NGO members of INSEDA who have together built over 130,000 household plants under the NPBD. The development, promotion and implementation of low cost, Hh biogas plants by an NGO network (now members of **INSEDA**) in India and the lessons learned for empowering rural people in general and women in particular is of great significance.

IV. ENVIRONMENTAL IMPACT OF BUILDING HOUSEHOLD BIOGAS PLANTS IN RURAL INDIA

4.01. Based on the practical experience gained by the INSEDA members NGOs in the last over two-decade it is clear that a 2 M^3 capacity household biogas plant (BGP) is the most appropriate size for implementation I rural India. The reason for this

[2] As per official figure of the MNES, Govt. of India, the potential for family size BGPs is 12 million units, which was estimated by MNES for building an average size of 3-4 M^3 capacity plant, based on the bovine population in 1980. This official figure (potential) needs up ward revision (as estimated by INSEDA in this proposal), because on the one hand the bovine (cattle + buffalo) population have gone up in the last over 20 years, and on the other hand the majority of Hh biogas plants being built in India are of 2 M^3 capacity.

is that this capacity BGP can easily meet the entire cooking needs of a rural family having an average of 6-8 members, and can also provide lighting needs of one biogas lamp for about four hours in the night. More over, a 2 M^3 capacity BGP requires an average of 50 kgs bovine dung every day for operating such plants, which is available from 3-5 farm animals. It also requires about 50 liters of water to mix the bovine dung to make it to liquid manure with 10% total solids (TS) for daily feeding in such BGP. The experience has shown that this quantity of dung (50 kgs) and 50 liters of water for mixing the manure to form a homogenous liquid manure of 100 liters (50 kgs dung plus 50 liters water) for feeding in 2 M^3 capacity BGP would be comparatively easily available through out the year, to operate these plants at their optimum capacities in rural India. Moreover, enough dung and space would be available with 20 million houses to build 20-million biogas plants of 2 M^3 capacities with out any problems in rural India. In view of this, 2 M^3 capacity Hh plants operating on bovine (cattle and buffalo) dung has been taken as the most ideal size for DEN-INSEDA partnership programme for the purpose of the abatement of greenhouse gases (GHGs).

4.02. The 2 M^3 capacity plant refers to a simple design of semi-continuous household plant which when working under the ambient temperature and a defined HRT (hydraulic retention time) for the Indian conditions, would generate an average of 2 cubic meter (2000 liters) biogas per day (in 24 hours) when fed daily with 50 kgs of bovine dung mixed with 50 liters of water, to make it in to liquid form with approximately 10% total solids (TS). This capacity (2 M^3) is the ideal size under the Indian conditions, as when operating under optimum conditions, it can provide energy for cooking of all the major meals (55-60% efficient biogas stoves) for a family of 6-8 persons as well as can provide 4 hours of lightings from biogas lamps. This capacity plant requires on an average 50 kg of bovine dung (available from 3-5 bovine, the number of animal required to produce this quantity of dung would depend on the size of bovine, according to which they would give dung) per day. The average biogas production per day would go up during the 3 months of summer season by 10-15% and go down in the 2 months of severe winter by 10-15%, but the over all daily average production would remain as 2 M^3 per day from the same quantity dung. Thus there is maximum potential and need for building 2 M^3 capacity household plants in India.

4.03. In view of the above, by assuming that the entire household biogas plants built in India would be of 2 M^3 capacity, and taking in to account that out of the 1,500 million kgs (or 1.5 million tones) of dung collected every day, eventually about 2/3rd (or 1,000 million kgs or 1.0 million tones) would be available for biogas plants. Thus, using this availability of dung for biogas, the total potential for 2 M^3 capacity plants comes to 20 million (1,000 million kgs per day @ 50 kgs of dung per 2 M^3 plant per day) units.

V. ABATING OF GHG GAS EMISSION BY BUILDING HH BIOGAS PLANTS IN RURAL INDIA

5.01. There is a large potential of abating/offsetting greenhouse gases (GHGs) emission to the atmosphere by building household biogas plants in rural India,

covering about 600,000 villages in a decentralized manner, using animal dung (manure) from the domestic farm animals. Since the bovine (cattle and buffalo)-dung is available in plenty in rural India and almost all these 600,000 villages have some bovine population, therefore the majority of household plants are operated on bovine dung, and the rural people are aware of its importance and various uses in their daily life. In fact the bovine population has been the integral part of the life of the rural people in India for centuries- both female and mail of the species playing key roles in the socio-economic well being of the people.

5.02. Inefficient utilization of the large quantity of dung which is not being utilized in an appropriate manner in these villages are creating other types of problems and GHG, contributing to global warming and climate change.

5.03. Out of all the dung available from the domestic farm animals in India, the quantity of dung available from the bovine population and its present utilization in India is fairly well documented. Therefore, the environmental impact of present utilization of bovine dung in India is estimated with a view to analyze and suggest alternate method of recycling it through the large-scale decentralized implementation of simple household biogas plant models, which could be built and serviced by rural artisans and easily operated and maintained by rural families after appropriate training to these groups.

5.04. The calculations for abatement of the amount/quantity of two key greenhouse gases (GHGs) emission (namely carbon dioxide- CO_2 and methane- CH_4) from bovine dung available for building the 2 M^3 household biogas plant in rural India is given in the subsequent paragraphs.

5.05. **Abating/Offsetting of Carbon dioxide (CO_2) emission**

5.05.1 Fresh bovine dung has 80% moisture and 20% dry matter (total solids-TS); therefore, 50 kgs dung (fed daily in a 2 M^3 capacity biogas plant) is equivalent to 10 kgs (50 Kgs x 0.2) of dry dung.

5.05.2 1 kg dry dung (dung cake) when burnt directly would produce an average of 2.5 kgs of carbon dioxide (CO_2) emission[3]- i.e. 2.5 kg CO_2 emission per kg dry dung.

5.05.3 Therefore, 10 kgs dry dung (equivalent of 50 kgs fresh bovine dung) would produce 25 kgs (2.5 kg CO_2/kg of dry dung X 10 kgs) CO_2.

5.05.4 Biogas is mainly the mixture of methane- CH_4 (Average of 60%) and carbon dioxide- CO_2 (average of 40%). By recycling of 10 kgs of dry dung (in the form

[3] No data and information could be found for the emission of carbon dioxide (CO_2) from direct burning of bovine dry dung cake. Therefore, based on the CO_2 emission from coal and charcoal (which is 3.10 kg of CO_2/kg), the author has taken a safer figure of the CO_2 emission from the burning of bovine dung cake as 2.50 kg CO_2/kg dry weight- this is only to highlight the relative benefit (in terms of total quantity of CO_2 abatement) of using biogas plant for generating fuel energy for cooking in the rural houses of India. In any case, this assumed carbon dioxide (CO_2) figure is not going to affect the final emission figure from bovine manure, because the methane (CH_4) being more potent and aggressive greenhouse gas, only the CO_2 equivalent of methane (CH_4) emission (refer paragraph 5.06 for the calculation of methane emission from bovine dung) has been taken in to account in the final calculations for determining the environmental impact of building household BGPs in rural India.

of 50 kgs of fresh dung) through a 2 M^3 capacity plant would prevent release of about 60% of CO_2 per kg of dry dung, which is converted in to CH_4 through microbial activities under anaerobic (in the absence of oxygen) environment in side the biogas plant[4]. This would mean a 2 M^3 household biogas unit would offset 60% of 25 kgs of CO_2, which is presently released from burning of 10 kgs of dry dung and going directly to the atmosphere when the same quantity of dung is used in the form of dung cake as cooking fuel.

5.05.5 Thus, installation of a 2 M^3 biogas unit would prevent 15 kgs (25 kgs x 0.6) CO_2 from 10 kgs of dry (50 kgs fresh) CO_2 emission from dung to go directly in to the atmosphere, there by reducing GHG emission by 60%, as compared to when it is burnt directly as cooking fuel in the form of dung cake.

5.05.6 Therefore, by installing 20 million, 2 M^3 capacity Hh biogas plants in India, the offsetting (abatement) of total CO_2 emission from bovine dung would be 300 million kgs (15 kgs CO_2 x 20 million BGPs) every day. This would be abatement of 99,000 million kgs (300 million kgs x 330 day) or 99 million tones (say 100 million tones) of carbon dioxide (CO_2) every year.

5.06. Abating/Offsetting of Methane (CH_4) Emission

5.06.1 Bovine dung when allowed to decompose in a traditional manner (making organic manure by either dumping in heaps or in open pits in the backyard of the house) in Indian villages would release (emit) methane (CH_4) to the atmosphere.

5.06.2 As per estimate from the Danish Farm[5], liquid manure (which is about 7% total solids-TS[6]) from cattle manure, when left in the open field, releases 3.6 kg of methane (CH_4) per cubic meter (M^3) of liquid manure.

5.06.3 Whereas, the fresh bovine (cattle and buffalo) manure collected in India has approx. 20% TS, therefore this would be equivalent to 2.86 M^3 (20/7)- say almost 3 times that of the liquid manure having 7% TS.

5.06.4 From the above, the 1 M^3 fresh liquid cattle manure (7% TS) = 0.35 M^3 (7/20) of fresh bovine manure (20% TS), as collected in rural India.

5.06.5 CH_4 is much more potent and aggressive greenhouse gas (GHG) and remains for far longer period in the atmosphere, as compared to CO_2- the CH_4 is 19 times more potent than CO_2. Therefore, due to this the greenhouse gas characteristic of 1 kg of methane (CH_4) is equivalent to 19 kg of carbon dioxide (CO_2).

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4 The bovine dung converted in to biogas is much more efficient to burn as cooking fuel using a specially designed biogas stove having 60% efficiency, as compared to burning it as fuel for cooking in the form of dung cakes with 11% efficiency in the existing traditional cooking stoves used in villages. Even if a very efficient biomass stove of 20-25% (not common in rural India) is used for burning dung cake as fuel still it would be appropriate to recycle it through a biogas plant to prevent about 60% of CO_2 going directly in to atmosphere.

5 Calculation by the Danish Energy Agency is based upon liquid manure, where the fresh manure (dung), urine, and water from the stable, are processed together; therefore its total solids (TS) content is about 7% for cattle manure.

6 Name of the Report: Biogas Plant Cooperation- From Idea to Reality. Official figure from the Danish Energy Agency Report: 1995)

5.06.6 From the above, the methane content of fresh bovine manure (20% TS) would be 10.2857 kgs/M^3 {(3.60 kgs of methane/M^3 liquid manure)/ (0.35 M^3/M^3 liquid manure)}- or say 10.30 kg CH_4 /M^3 fresh bovine manure.

5.06.7 Therefore, the carbon dioxide (CO_2) equivalent of methane in one cubic meter (M^3) of fresh manure (20% TS) would be 195.7 kgs (10.3 kgs carbon dioxide x 19)- **say 200 kgs CO_2 /M^3 of fresh bovine (cattle and buffalo) manure**.

5.06.8 The calculation of methane (CH_4) emission and its equivalent value in terms of carbon dioxide (CO_2) under **paragraph 5.06.7** is given in terms of 1 cubic meter (M^3) of fresh bovine dung. Therefore, this value of CO_2 has to be calculated in terms of 1 kg of fresh bovine dung for practical purposes and subsequent use.

5.06.9 For calculating the CH_4 emission from 1 kg of fresh bovine dung of CO_2 in kg per kg of bovine manure (equivalent to), for all practical purposes it is assumed that the weight of 1 M^3 (1,000 liter) of fresh bovine dung (20% TS) is equivalent to 1,000 kgs of fresh bovine dung.

5.06.10 Therefore, 10.30 kgs of methane/1,000 kgs = 0.0103 kg CH_4 /kg fresh bovine dung. This in terms of CO_2 would be equivalent to 0.1957 (19 x 0.0103) kg CO_2/kg of fresh dung. **Or say 0.20 kg of CO_2/ kg fresh bovine dung**.

5.06.11 Therefore, to sum up from the above calculations one can say that 1 kg of fresh bovine dung (manure) would emit 0.0103 kg methane (**0.0103 kg CH_4/ kg dung**) per kg fresh dung- which in terms of CO_2 would be equivalent to **0.20 kg of CO_2 /kg fresh bovine dung**.

5.07. Abatement/Offsetting of Greenhouse gas (in terms of Methane) by building 20 million 2 M^3 capacity household biogas plant in rural India

5.07.1 From the calculations under paragraphs **5.05** & **5.06** we get the figures for the abatement of carbon dioxide (CO_2) and methane (CH_4) emission from bovine dung, by recycling it through biogas plant.

5.07.2 *The burning of manure in the form of dried dung cake from bovine manure, which produces* carbon *dioxide (CO_2), as calculated under paragraph 5.05 would normally be considered as carbon neutral, as it is biomass, which is recycled through bovine stomach in a short cycle and therefore renewable. Therefore, in spite of knowing that there is a relative gain (due to efficient burning and conservation of nutrient) by recycling the same quantity of dung through biogas plant, for this proposal, it has not been considered as gain in terms of greenhouse gas (GHG) emission*.

5.07.3 *However, as can be seen from the calculation of methane emission (refer paragraph 5.06) from bovine manure (dung) that by recycling the dung through biogas plants would provide substantial gain in terms of abating methane (CH_4) which is comparatively more potent greenhouse gas (GHG) than CO_2, as compared to the decomposition of manure in a traditional way in Indian villages.*

5.07.4 Therefore, by installing average size of 2 M^3 capacity household biogas plant, from utilizing the 750 million kgs (0.75 million tons) of fresh dung per day, which

is presently being dumped in heaps or in open pits in rural India for making organic manure and is responsible for releasing methane (CH_4) in to the atmosphere, the following quantity of greenhouse gas (GHG) would be abated:

a). A 2 M^3 capacity Indian household plant requires 50 kg of fresh bovine dung to be fed each day to generate on an average of 2 M^3 of biogas every day in 24 hours, on an annual basis operating at ambient temperature, taking in to account the season variation of biogas production, more in summer month and less in winter season.

b). 50 kg of fresh bovine dung would release 0.515 kg methane (0.0103 x 50) per kg fresh dung methane (CH_4), which is approximately equivalent of10 kg (0.2 x 50 kg) of carbon dioxide (CO_2) to the atmosphere.

c). In other words, a 2 M^3 capacity Indian household plant fed every day with 50 kg of fresh bovine dung would abate/offset methane (CH_4) equivalent of 10 kg per day of carbon dioxide (CO_2).

5.07.5 And if 20 million household plants were installed in India, it would abate methane (CH_4) emission equivalent to 200 million kgs (20 million BGPs x 10 kgs/day) of carbon dioxide (CO_2) per day or 0.2 million tones of CO_2 /day.

5.07.6 Assuming that the average working days for these BGPs is 330 days per year, then the quantity of emission abated/offset by these 20 million BGPs would be equivalent to 66 million tones (0.2 million tones x 330 days/ year) of carbon dioxide (CO_2) equivalent of methane (CH_4) emission annually.

5.07.7 The average useful working life of Indian household plant is over 20 years (based on the building and operation of fixed dome household biogas plants by NGO network of INSEDA members for over two decades. But for the purpose of abatement of methane (CH_4) emission to the atmosphere, for the DEN (Germany) and INSEDA (India) partnership **'GREEN CERTIFICATE'** programme, to be on the safer side, the useful working life these plants has been taken to be only 10 years, as a large number of household BGPs are involved, and not all of them would be expected to perform at optimum level for the entire 20 years.

5.07.8 Therefore, by installing all the 20 million household plant of 2 M^3 capacities (as per the present potential), rural India would be able to abate 660 million tones of carbon dioxide (CO_2) equivalent of methane (CH_4) emission in their 'Useful Working Life' of 10 years of these plants. In addition, these Hh biogas plants (BGPs) would also become instrumental in promoting ecological agriculture, using enriched organic manure from BGPs, contributing to overall positive environmental impact, contributing to the empowerment of rural people as well as would play an important role in the promotion of people centered, sustainable human development.

VI. PROPOSAL FOR BUILDING HOUSEHOLD BIOGAS PLANTS BY ISSUEING 'GREEN CERTIFICATES' TO INTERESTED PARTIES BY DEN, GERMANY-INSEDA, INDIA

6.01. The calculations in the preceding paragraphs convincingly shows the positive environmental impact by installing all the 20 million household biogas plants of 2

M^3 capacities (as per the present potential) in rural India. This alone justifies support of international community for building of biogas plants in India for the efficient recycling of bovine manure for providing two other important benefits (clean and convenient cooking fuel and the enriched organic manure) of socio-economic consequences for the rural community in general and the empowerment of rural women in particular, and therefore needs to be strongly supported by global community and more specifically the industrialized countries.

6.02. ***Table-1*** gives the quantity of methane abated (per day, annually and during the useful working life of the household plants) in terms of CO_2 equivalent of methane emission for 5 difference capacities (1, 2, 3, 4 and 6 M^3) household biogas plants in India, as well as the present average cost of abatement in carbon market.

6.03. ***Table-2*** gives the total abatement of CH_4 emission in terms of CO_2 equivalent for building different number (1,000 to 200,000) of household biogas plants of 2 M^3 capacities per year in rural India, as well as their present total cash value in the carbon market.

VII. SOCIO-ECONOMIC IMPACT OF THE PROGRAMME IN RURAL INDIA

7.01. Any technological oriented programme implemented in the rural areas of the developing countries should be analyzed for its socio-economic implications to ensure that it would fulfill the development goals, by promoting process oriented, people centered, sustainable human development of the target communities, particularly the poor, marginalized, landless rural labourers and other weaker sections of the society, more specifically focused on the empowering of women. This would more than justify the programme for the introduction of any alien technology developed outside the rural environment of the developing countries.

7.02. It is therefore important that the proposed north-south cooperation/partnership programme for implementation of household biogas plants in rural India, supported though mobilization of financial resources through issue of 'Green Certificates' should not be treated only as a means of empowering the local people from the developing countries, rather than it becoming an end by itself. This would mean that the creation of positive environmental impact by the abatement of greenhouse gas (GHG) largely going to the north, should also create the positive social and economic impact in the operational areas of the south, and then only, it would be a truly north-south partnership programme, ensuring sustainability.

7.03. The main focus of the proposed DEN-INSEDA partnership programme for the mass implementation of the household biogas plants is viewed as an important vehicle and tool for the improvement of the socio-economic status and the quality of life of the people from the south, as against taking it only as a means for balancing the 'greenhouse gas' emission for the countries from the north.

7.03.1 *Social impact*

a). Implementation of household biogas plants would create more positive social impact on rural women, contributing to their empowerment.

b). The following positive social impact would be created by the programme:

- Removing drudgery of women in the collection of firewood,
- Provision of clean and convenient cooking fuel to rural women at their door-step,
- Saving in time of cooking,
- Saving in time in cleaning cooking vessels as no soot is formed,
- Saving in time spent by rural women to fetch lesser quantity of water for cleaning,
- Smoke-free kitchen and Soot-free walls of the kitchen and the areas surrounding the cooking area,
- Adolescent girls who normally required to stay at home and help their mothers to assist in the domestic chores including cooking, could have time to be sent to schools,
- Availability of more time for the rural women for carrying out other more productive (socially and economically) activities, and
- More time available to the rural women to take rest during the day as the time spent in collecting the firewood and in cooking would be substantially reduced.

7.03.2 *Economic impact*

a). There are several models of household biogas plants being built in India, and the most popular amongst them, at present are the fixed dome models, which are comparatively cheaper as compared to the floating gasholder models. Therefore, the majority of plants being built in rural India are the fixed dome models and the INSEDA members are only building fixed dome models for the last over two decades. However, the proposed programme would follow an approach to implementation multi-model, to ensure flexibility, as in some cases and in some regions it would be desirable and appropriate to construct even the floating gasholder models.

b). The criteria for including the different biogas models would be that the technology is well tested and mature to ensure that they are technically foolproof and generate employment and self-employment in the programme areas and regions, during the construction as well as for providing service, maintenance and repairs, after these plants are built.

c). The following economic impact would be created by the implementation of household biogas programme:

- The construction of the fixed models, about 30% of their cost would go towards providing wages to the local labour, in the form of skilled (local artisans), semi-skilled and unskilled labourers, who generally work as a daily wage earners. This programme would also generate employment and self-employment to trained local people in providing post-plant implementation services to the plant owners.

- The digested liquid manure coming out of the biogas plant after recycling would be used either directly or after drying it or by converting it in to compost along with other biodegradable waste biomass and used as manure in the farmers' field. This would enable to save money, which is being spent at present for the purchase of costly inorganic fertilizer. The improvement in crop yield with reduced cash outflow would increase their net economic benefits, which improving micro-flora of the soil and building the soil structure and texture, conservation of natural resources, gradually leading to their economic sustainability, using the available local resources.

VIII. IMPACT OF PROGRAMME ON MIGERATION TO THE URBAN CENTERS FROM RURAL AREAS

8.01. Proposed programme would be instrumental in checking migration from the villages to the urban centers in search of employment, as given below:

8.01.1 This programme is expected to generate employment & self-employment in the form of post-plant implementation services to the plant owners by the appropriately trained local artisans, un-employed rural youth & rural entrepreneurs, through regular follow-up service, maintenance and repairs of plants, after a large number of plants are built in a particular area and region.

8.01.2 With awareness, motivation, training and demonstration undertaken on the efficient use of organic manure and scientific composting using biogas digested slurry by the partner NGOs of INSEDA, the change over to ecological farming will take place, which would save their cash going out of the villages for the purchase of seeds, fertilizers, pesticides and other external inputs, and will also promote more seasonal employment from the agricultural activities. The eco-farming is being promoted by some of the NGO members of INSEDA, which will be geared-up in a bigger scale with a large number of biogas plants implemented in cluster of villages. Slowly but gradually the urban consumers of food products are getting aware about the benefits of the organic food, which would also create good market for such eco-product, thus promoting economic self-sufficiency with in the villages.

8.01.3 Due to more economic activities generated with in the villages, the number of local people, specially the daily wage earners would stay back in their villages, thus checking the migration to urban centers in search of jobs.

IX. IMPACT OF THE PROGRAMME ON THE HEALTH IN RURAL INDIA

9.01. Proposed programme would create positive impact on public health, as under:

9.01.1 *Impact on public health*

- Presently, bovine dung, which is not made in to dung cakes for using as cooking fuel, is normally left outside the houses of the families for getting decomposed in an un-scientific manner. This becomes the breading ground for flies and mosquitoes, causing diseases. Biogas plants would effectively recycle this dung which would create positive impact on the health of the rural people, and

- The dung, which is normally left unattended in heaps, cause foul smells and creates nuisance and during the rainy seasons they are spread in the village streets and could cause pollution and public health problems. This problem would be effectively tackled by recycling the dung through biogas plants.

9.01.2 *Impact on the Health of the women and her family-* following is the negative impact on rural women and her family, which needs to be addressed:

- The health of the women of the rural household are affected the most due to the traditional ways of cooking. It is estimated that while cooking on the tradition biomass cook stoves, a rural woman daily inhales as much smoke as smoking of 10 packets of cigarettes every day. This causes both, eye as well as lung disease, which could be prevented by using biogas for cooking,
- Adolescent girls and the infants who normally remain with their mothers at the time of cooking also get affected with the smoke & soot formed during cooking,
- Because the kitchen is built very close to the living place therefore, the smoke could also spreads to other rooms of the houses, especially those belonging to the rural poor, therefore to certain extent the health of the entire family also gets affected, and
- With this physically exhausting routine it is understandable that the women are not interested in activities such as literacy and education, which is then viewed as a further burden on their overworked days. Neither do they have the motivation for taking any initiative.

9.02. In view of the above, the installation and use of biogas plants for cooking, under the proposed programme would create positive impact on the heath of the rural woman, her entire family, as given above.

X. IMPACT ON THE MICRO-ENVIRONMENT OF THE RURAL AREAS OF INDIA

10.01. By saturating each village by installing biogas plants as per the potential in the selected villages and in the surrounding villages in an area operated by INSEDA members, the biomass, either in the form of trees, shrubs and the harvested crop residues, would be saved from burning as fuel for cooking, would prevent release of greenhouse gases (GHGs).

10.02 he rural people could be motivated and trained to convert the major part of the biomass available form the harvested agricultural crops as well as in the form of the dung from bovine and other domestic farm animals could be converted in to enriched compost (scientifically produced organic manure), which would be returned to the farmers field for crop production. This would create positive environmental impact at the micro level.

XI. PROPOSED STRATEGY FOR IMPLEMENTING OF GREEN CERTIFICATE PROGRAMME

11.01. Subsequent paragraphs give some of the suggestions and strategy for implementing **'Green Certificate'** Programme through the North-South NGO cooperation/partnership programme in India.

11.02. The **'Green Certificate'** in the joint name of DEN, Germany and INSEDA, India with their logo would be given to individual, groups, religious congregation, communities, companies, manufacturers and industries etc., who would like to support the programme for building household biogas plants in India. Based on the practical experience of implementing biogas programme by INSEDA members in rural India, the average size of household biogas plants built would be of 2 M^3 capacity, which would abate an average of 33 million tones of methane (CH_4) equivalent of carbon dioxide (CO_2). The present average cost of carbon dioxide (CO_2) abated is US dollar 10.00 per tone of CO_2, which is USD 330.00 per 2 M^3 capacity biogas plant (BGP). This amount would include the cost of building one 2 M^3 capacity BGP, insurance, guarantee against defective construction, administrative, service, technical support, capacity building of PIOs (programme implementing organizations), rural artisans & entrepreneurs and end users etc., publicity, training, construction and operation manuals, follow-up, back-stopping, monitoring, analysis of information and data, reporting, supplying creating appropriate data base on the plant owners covered under the DEN-INSEDA 'green certificate' programme, and other related details. This average cost per tone of CO_2 would remain the same for one year, which would be revised upwards every year, to take care of average annual cost escalation due to normal inflation and average annual for building the 2 M^3 capacity plant, but would be much below the allowable cost per tone of CO_2 abated in the international carbon market.

11.03. The following way one can obtain the green certificates:

11.03.1 If an individual would like to support building of 1 biogas plants, accordingly the Green Certificate (GC) would mention that so and so has contributed to reduction of 33 tones of CO_2, by contributing to the construction of one 2 M^3 capacity BGP household biogas plant in rural India.

11.03.2 If a group of 5-10 people would like to support building of 5 biogas plants, accordingly the Green Certificate would mention that such and such group (name of the leader could be mentioned on the GC), as contributed to reduction of 165 tones of CO_2, by contributing to the construction of 5 household biogas plant in rural India.

11.03.3 If a school would like to support building of 10 biogas plants, accordingly the Green Certificate would mention that such and such group (name of the leader could be mentioned on the GC), as contributed to reduction of 330 tones of CO_2, by contributing to the construction of 5 household biogas plant in rural India.

11.03.4 If a church community would like to support building of 20 biogas plants every year, accordingly they will be issued GC every year- and the each Green Certificate would mention that so church community so has contributed to reduction of 660 tones of CO_2, by contributing to the construction of 20 household biogas plant in rural India.

11.03.5 If a school would like to support building of 50 biogas plants, accordingly the Green Certificate would mention that such and such group (name of the leader

could be mentioned on the GC), as contributed to reduction of 1,650 tones of CO_2, by contributing to the construction of 50 Hh biogas plant in rural India.

11.03.6 Similarly, if a village or town would like to support building of 100 biogas plants every year, accordingly they will be issued GC every year- and the each Green Certificate would mention that so and so village or town has contributed to reduction of 3,300 tones of CO_2, by contributing to the construction of 100 household biogas plant in rural India.

11.03.7 Similarly, if an industry or a polluting company like to support building of 1,000 biogas plants every year, accordingly they will be issued GC every year- and the each Green Certificate would mention that so and so industry or company has contributed to reduction of 33,000 tones of CO_2, by contributing to the construction of 1,000 household biogas plant in rural India.

11.03.8 Similarly, if an industry or a polluting company could provide one time support for building of a large number of plant of say 5,000 biogas plants, accordingly they will be issued one Green Certificate (GC) that would mention that so and so industry or company has contributed to reduction of 165,000 tones of CO_2, by contributing to the construction of 5,000 household biogas plant in rural India.

11.03.9 Any individual/group/community or company/industry supporting the construction of a very large number of household biogas plants could be given discount as well as, a specially designed Green Certificate.

11.03.10 The individual/group/community or company/industry could also make their contribution either in advance (with certain amount of discount) or in installment with certain additional charges added to it, to take care of additional overhead and administrative cost of DEN, Germany and INSEDA, India.

XII. MONITORING

12.01. The programme would be closely monitor by DEN, India and INSEDA, India to realize its aims, objectives and overall goal in the following manner.

12.01.1 Before the start of the programme, the meeting and workshop of participating grassroots NGOs will be organized in which the roles and responsibilities of each stakeholder will be defined and clarified and agreed upon, for technical, implementation, correct filling with forms with the details of the plant owners, which will be computerized and placing identifications (DEN, INSEDA and NGO name with date of construction and plant owners name etc.) operational, post-plant-implementation and financial aspects. These would form the basis of participatory monitoring of the programme, at the time of implementation, as well as periodic monitoring as given below:

12.01.2 *Technical*: Even though, the member and partner NGOs of INSEDA involved in the promotion and implementation of household biogas plants from a minimum of 10 to a maximum of 20 years, in their area of operation, and have trained personal yet, they would be subject to technical monitoring by Den-India and INSEDA staff to ascertain, if they are following the technical details (the correct plants design, specifications, appropriate building

materials and the construction methodology as agreed and approved by Den-India and INSEDA) or not- if not then the technical team will ask them to make appropriate corrections right in the beginning. Later on the DEN-India and INSEDA technical team will make periodic field visits to check certain percentage of the plants to make sure that the technical aspects of the programme are followed by these NGOs. During the course of implementation, the partner NGOs may decide to switch over to any other appropriate biogas for construction, then this could discussed at the spot and analyzed by DEN-INSEDA specialist/expert and agreed based on the field visit to do technical monitoring of the programme.

12.01.3 *Implementation*: The correct selection of plant owners including the availability of enough animals and the minimum quantity of dung and water for mixing, selection of correct plant sites with respect of place of dung collected, from the house and from the agricultural fields etc.

12.01.4 *Plant owners data:* The correct filling of information about each plant owners with their photographs (about three photos- one of the entire family in front of the completed plant, one of the plant during construction and one after it is built and commission with family using it) for feeding details in the computer and the identification plate with the name of the head of the family, DEN, INSEDA and NGO, size of plant and the date of completion of plant.

12.01.5 *Operational*: Building of fool-proof doesn't necessary means that all of them are being operating as per the standard procedure to get optimum yield of biogas and manure, either due to indifference of plant owner of the local NGOs or due to lack of appropriate knowledge and training. Monitoring of this aspect by DEN-INSEDA would bring the problems if any, according to which warning or guidance and training would be provided to the plant owners.

12.01.6 *Post-plant-implementation*: As an integral part of the proposed biogas implementation programme, each participating grassroots NGOs would sign an agreement with DEN-INSEDA to provided guarantee against defective/faulty plant construction as well as post plant installation services to the plant owners. This DEN-INSEDA team while visiting the field would select and check a certain percentage of plants in each field visit to ascertain if this aspect is being done properly or not. If weakness in this area were found then the NGOs would be asked to appropriately rectify their *Post-plant-implementation* services.

12.01.7 *Financial aspects*: Since the proposed programme envisages, giving certain percentage of subsidy grant and certain interest-free loan (with small institutional service charges) by DEN-INSEDA to the plant owners through the participating NGOs and timely recovery of the loan installments. More over. The average cost of biogas would vary from region to region, due to coat of building materials, labour and transport etc. If the average cost given initial by the partner NGOs changed at the time of implementation or during the programme period, the financial contribution of DEN-INSEDA would have to be revised downwards or upwards. These aspects would be monitored, based on the study of report received as well as during the field visits to insure that the financial part is properly adhered to and if any revision is to be made in the

contribution of DEN-INSEDA it could be properly evaluated and corrective measures taken at the appropriate time.

12.01.8 *Monitoring of any other aspects:* Apart from the above-mentioned aspects if any other relevant things to be monitored, which are felt important to improve the success of this programme, either during the initial meeting/workshop or during the course of implementation, then those could also be included by DEN-INSEDA as a part of monitoring of the programme.

12.01.9 *Peer group monitoring*: Apart from monitoring of different aspects by DEN-INSEDA, the proposed programme would also include peer group monitoring, by the participating NGOs, especially in their area/region of operation. For this purpose appropriate guidelines would be developed by DEN-INSEDA along with the NGOs. One of the ways of doing peer group monitoring would be to ask a small group of NGOs from the region to visit other NGOs and monitor their programme. This would be also a learning and sharing experience for both the parties, leading to improvement of the over all implementation and operation of the programme. In the end of the monitoring visit they could organize 1-2 days review meetings/workshop (which could also be participated by DEN-INSEDA specialists) to share their findings and suggest joint solutions for improvement. The report of the monitoring visit and workshop with appropriate suggestions etc., would be sent to DEN-INSEDA for necessary action.

XIII. REPORTING AND FEEDBACK

13.01. Simple workable reporting format would be developed by DEN-INSEDA in consultation with a few NGO members of INSEDA, for the implementation of the pilot phase of this programme, which would initially involve a very small group of grassroots of NGOs. This reporting format would get gradually evolved and finalized based on practical experience gained and feedback received. Later on, before, launching a bigger programme involving more NGOs in phase manner, it will be discussed in a special meeting/workshop of larger group of NGOs and if need be other expert and resources person and further refined to get maximum useful information and relevant data to also cover the area/regional specific details, with out too much tasking the grassroots NGOs. These information and data would be fed in DEN-INSEDA computer. The benchmark information and data would be very useful in evaluating the local, regional and over all impact of the proposed biogas programme.

13.02. The feedback received from the field and the analysis of data would help DEN-INSEDA to take the appropriate/necessary steps and corrective measures. If required to get maximum benefit from this programme.

XIV. INTERNET- WEB PAGE- PASTING RELEVENT INFORMATION WITH STAKEHOLDERS LIST

14.01. Since, this is a North-South partnership programme in which the people from the north purchasing the 'Green Certificate' to support the biogas implementation programme (in this case rural India) are one of the important stakeholders and

therefore would be interested in knowing how the programme is progressing. There are several ways to give them information and feedback, but the Internet is the most convenient and easy way to supply this information to them.

14.02. In view of the above, the DEN-INSEDA would have a 'Web Page' especially for this programme. This Web Page would have information about DEN, Germany-INSEDA, India, the participating NGOs and the biogas plant owners, as well as the list with address of stakeholders from the north, e.g., the individual/ groups/ communities/ schools/ colleges/ universities/ churches/ companies/ industries etc. This web page would be upgraded periodically.

14.03. The 'Web Page' is also expected to generate awareness about this programme and create wider interest in the north to purchase the 'green certificates' to support building of more household programme in the south.

14.04. The use of Internet would also encourage the existing stakeholders and the prospective stakeholders from the north to interact and give suggestions for the improvement of this programme for the benefit of all the stakeholders as well as get their query answered from DEN-INSEDA.

XV. WOMEN'S AS PLANT OWNERS UNDER THIS PROJECT (AT LEAST 25%)

15.01. In rural India the land and other assets are normally in the name of men-folks and they are the one who take the important and major financial decision for investing on a new enterprise or the purchase of new machines, equipments or gadgets, and it is also the case with the financing of biogas plant. Therefore, even though the women are the major beneficiaries of the biogas plant, it is the men who decide whether to have it or not.

15.02 In the rural India a woman's day begins at 4 am in the summers, and 5 am in the winters, at least 2 hours before the rest of the family gets out of their beds, and the women are the last to go to bed in the night, after finishing all the work. During the crop growing, the woman's workload increases further as she performs the agriculture activities such as sowing, irrigation or harvesting. Yet it is ironical that if one were to ask the man– "what does your wife/mother do?" their immediate normal answer would be "in our family our women do not work", as they are not critically aware about the amount of unrecognized work the woman is doing.

15.03 Among all the work that the woman puts in, it is also the 1-3 hours daily of either collecting firewood/agriculture waste or making cow dung cakes for use as cooking energy. Then there is the actual cooking, taking up a total of about 3 hours daily in a smoky and unhealthy environment, leading to indoor air pollution which is linked to chronic lung diseases, eye problems, low birth rates and other problems. The chopping of fodder for the animals, which can take anything from half an hour to one hour and the grinding wheat for making the daily bread, is

most often done by the women by hand, on the traditional grinding stone, takes away much of her time.

15.04 Therefore, it is proposed that a maximum of 25% of the target plant built annually under the proposed programme (after the pilot phase) would be meant for the women plant owners. It is also proposed to introduce some innovation to study and ascertain the extent of success of this approach to improve the decision making capacity of the rural women leading to their empowerment through this programme- this is given below:

15.04.1 Participating grassroots NGOs will be encouraged by DEN-INSEDA to form small (min. of 5 women to a max. of 20 women per group) self-help groups (SHGs) and to encourage these SHGs to establish micro-credit programme.

15.04.2 If women members of such SHG would like to build household biogas plant in their names (by convincing their family members) then they would be given 10% additional subsidies/grant for building plants, as compared to men owners.

15.04.3 On the balance of funds given as interest-free loan, the DEN-India and INSEDA would only charge 50% of the institutional fees (for processing and handling the application and paper work etc.) as compared to amount charged from the plant built by men owners under this programme.

15.04.4 While the men plant owners would be given only six month moratorium, after their biogas plant are built, to start repaying their loan installments, the women plant owners would be given one year moratorium before they start repaying their loan installments under the proposed programme.

15.04.5 Out of the loan installation (quarterly as decided jointly by DEN-INSEDA in consultation with grassroots NGOs) recovered from the women plant owners through their respective self-help groups (SHGs), the DEN-INSEDA would give back certain percentage as grant to these SHGs to be utilized by their members for promoting and taking up income generating activities. This percentage would, however, be decided later on after trying this concept initially on a pilot scale basis, to understand the greater implications, especially the overall financial implications to DEN-INSEDA, as it would come out of its own savings.

15.04.6 If the women plant owners are regular in returning their loan installment on time with out being defaulter, then repayment of at least their last two quarterly installments of loan could be waved offs, subject to positive recommendations from the local partner NGOs and fund situation with DEN-INSEDA.

15.04.7 All the benefits and concession mentioned above would only be applicable for the women biogas plant owners and not for the men plant owners.

XVI. GUARANTEE/WARRANTY BY GRASSROOTS NGOS TO BIOGAS PLANT OWNERS

16.01. Under the proposed programme, the grassroots NGO partners would provide the following guarantee/warranty and free service to the biogas plant owners for the 10 year, which has been taken as the average useful working life of the biogas

plant, for issuing the 'green certificates' to stakeholders in the north for supporting the construction of household plants in rural India, as follows:

16.01.1 Minimum 5 years guarantee to the biogas plant (BGP) owners against any constructional and defects and fault and free post-plant installation services. If any of the BGPs failed during this period, the defect would have to be rectified free of cost by the NGOs.

16.01.2 In case the defect in the biogas plant was due to the fault of design or construction or use of sub-standard building materials and the BGP is beyond repair then the NGOs would build a new plant free of cost for the owner, again giving similar guarantee.

16.01.3 The guarantee for the fast wearing items like the appliances, pipelines, gate valves and accessories, which are not manufactured by the NGOs, and have to be purchased from the market, would be only for one year against any defects. Cost of any normal wear and tear in the parts of appliances and the replacement of parts like valves and biogas lamp mental etc. will have to be purchased by the plant owners, however service would be provided free of cost by NGOs during the guarantee/warranty period.

16.01.4 If there were major defects in appliances, so that they can't be repaired, then the NGO would replace it free of cost. To this effect, NGOs could also ask the manufacturers to give then similar guarantee on appliances bought by them.

16.01.5 After the first 5 year major guarantee/warranty period is over, during the next 5 years, the NGO would provide limited guarantee/warranty and free of cost service for follow-up and maintenance etc. to plant owners. The cost of building materials for minor repairs or emptying, cleaning and refilling & re-commissioning the biogas in the plant would have to be met by the plant owners beyond the 5 years major guarantee period. However, if there is a major repair in the plant, or the parts in appliances have to be changed, then the cost of spare parts etc., have to be met by the plant owners. This way the NGOs would actually be providing the guarantee/warranty for the entire 10 years useful working life of the biogas plant as fixed for the purpose of the proposed programme, for ensuring that the biogas operate optimally to abate the carbon dioxide-CO_2 to cover the entire cost of the green certificate. This follow-up period beyond the first 5 years would also help the NGOs in the timely recovery of the loan installment from the plant owners.

16.01.6 For appliances and accessories etc., the limited guarantee/warranty and free of cost service for follow-up and maintenance and change of parts in the appliances etc. to plant owners beyond the 1 year period. The cost of appliances and accessories and spare parts would have to be met by the plant owners beyond the 1 years major guarantee period.

XVII. INSURANCE OF BIOGAS PLANTS FOR RISK COVERAGE

17.01. As mentioned above, it is the responsibility of the NGOs to repair or rebuild a new plant free of cost in the event of any of the biogas plant built under the

proposed programme fails due to any minor or major structural problems during the guarantee/warranty period, which is not normally going to happen. But to be on the safe side, it is proposed to insure all the biogas plants built under the proposed programme, as given below:

17.01.1 The cost of plant would also include the cost of annual insurance premium for the 10-year period, given to the partner NGOs in lump sum. In region where there is provision with the insurance company to insure the plant, the NGOs, in their own interest, would be encouraged to insure each and every plant.

17.01.2 In region where there is no provision with the insurance company to insure the plant, the NGOs would be asked by DEN-INSEDA to keep this amount aside and create a separate fund for repair and construction of a new plant for the plant owner. If for any reason, during the 5 years major guarantee/warranty period, if a biogas plant fails due to either minor or major structural defects, the cost of this service or construction of a new plant for the existing plant owner would be done by the NGO absolutely free of charge, after informing DEN-INSEDA.

XVIII. SELECTION OF NGOS FOR INVOLVEMENT IN BIOGAS PLANTS IMPLEMENTATION OF

18.01. Selection of initial group of NGOs for participating in this programme would be done out of the INSEDA members, as they already have practical experience of building household BGPs for a period ranging between 10 to 20 years. More over these NGOs are already aware of certain approach of implementation, and would easily understand this system of implementation. Due to periodic communication between them and INSEDA, any new approach incorporated in the proposed programme would be easily understood by these NGOs.

18.02. In spite of this, the inclusion of these NGOs in this programme by DEN-INSEDA would be in phases, over 5 years period, by using some of the following criteria for their selection:

18.02.1 First and foremost criteria would be that the NGOs selected have experience of implementing household biogas plants in rural areas,

18.02.2 The NGOs who have good track record in the implementation of biogas and other RE programmes,

18.02.3 First preference to women's organization who are implementing biogas and RE programmes in rural areas,

18.02.4 Organization with stronger community organization work and those who have already formed or have experience in forming the self-help groups or any other MLPI (micro level people's institutions),

18.02.5 Organizations who have experience of working with thrift and credit groups and lending and recovery of small loans to target groups in their project areas,

18.02.6 Those NGOs who are working with women target groups with other development or educational programmes,

18.02.7 NGOs who have either experience of integrated rural and agricultural development programme or are interested in such programmes, and

18.02.8 NGOs who have concentrated activities in a few villages or a cluster of villages, which they would like to saturate with biogas plants to ensure better impact.

XIX. METHODOLOGY & STRATEGY FOR LAUNCHING & IMPLEMENTATING THE PROGRAMME

19.01. The success of such a large programme with multi-faced activities, which is to be implemented in a rural India, especially in some of the remote and far-flung regions of the country in a most decentralized manner by grassroots NGO, would depend a lot on the method adopted for the implementation. The partner NGOs have to be on the common wavelength about the building of plant and placing the identification mark to distinguish between the other plants built by them & others in their area of operation and the ones to be built by them under the 'green certificate' programme of DEN-INSEDA. They also have to be very clear about the guarantee/warranty to plant owners and the insurance aspects, the post-plant installation & follow-up service, disbursement of subsidy grants & loans for biogas plant construction (for general and the special categories and especially the women plant owners), timely recovery of loan installment, monitoring, evaluation and the record keeping and reporting, and the roles and responsibilities of all the stakeholders are clear to all the PIOs (programme implementing organizations), right from the inception of the programme.

19.02. Following strategy would be followed for the launching and implementation of the proposed 'Green Certificate' programme for building household BGPs.

19.02.1 National or regional workshop/consultation/meeting of the identified would be organized to discuss the proposed programme threadbare:

a). NGOs would be presented the entire approach including the saturation of villages and implementing this programme in the cluster of contiguous villages to ensure positive environmental impact and close monitoring on cost effective basis, so that they are brought to the common wavelength about the proposed programme and the long-term implications on their getting associated, if selected by DEN-INSEDA.

b). NGOs would also be presented with the broad criteria for selection of NGOs as DEN-INSEDA partners in the proposed programme.

c). The NGOs would also be informed about the roles and responsibilities of DEN-INSEDA as well as that of the grassroots NGOs, selected to be partners and if they agree to join the implementation of biogas plants under the proposed 'Green Certificate' programme.

d). The NGOs would also be informed about the capacity building aspects to be taken by both, DEN-INSEDA for them and by the partner NGOs for the plant owners, MLPIs, local artisans & entrepreneurs etc., and for developing & strengthening other new group of local NGOs in their area

of operation to increase the biogas plant implementation target for wider coverage under this programme.

e). The presentation will be followed by answering the queries & doubts etc., from the invited NGOs, by DEN-INSEDA.

19.02.2 Annual and six-monthly, national level and/or regional level workshop/meetings of all DEN-INSEDA partner NGOs would be organized for discussing the progress report, review, mid-course correction and participatory evaluation and learning from the implementation of the programme. This would be followed-up with presentation and discussions on the next phase of target of each partner NGO as well as inclusion of new partners who are ready to implement this programme.

19.03. Since, all the invited NGOs would not be fully prepared or immediately qualify to be included in the programme, the DEN-INSEDA would work out the phasing of the programme so that the capacity of other NGOs are upgraded, over the next 1-3 years period, so that majority of invited NGOs in the first workshop (programme inception workshop) in a phase manner, over the next 3 years.

XX. CAPACITY BUILDING OF DIFFERENT STAKEHOLDERS INVOLVED IN THE IMPLEMENTATION, MONITORING AND UTILIZATION OF BIOGAS PLANTS

20.01. The capacity building is the key to success of any programme, more so the proposed programme due to its highly decentralized nature implementation, especially in some of the remote and far-flung regions of the country in a most decentralized manner by grassroots NGO in the very diverse socio-cultural settings prevailing in rural India.

20.02. Based on the lessons learnt from over 2 decades of implementation of household biogas programme by INSEDA members, the following types of capacity building activities would be taken up by DEN-INSEDA to strengthen to create the desired impact, as envisage under the 'green certificate' biogas programme.

20.02.1 Capacity building of NGOs functionaries and local artisans

a). Workshop for chief functionaries (CF)/project directors (PD)

b). Training of biogas extension managers (BEM)/biogas extension coordinators (BEC)

c). Training of technical officers (TO)/junior engineers (JE)

d). Training of technical supervisors (TS)/senior technicians (ST)

e). Training of master masons/artisans (MM/MA)

f). Training of technical supervisors (TS)/senior technicians (ST) and master masons (MM) on for repairs of household biogas plants

g). Refreshers training for different energy service provider groups

h). Training of biogas technicians/master masons as master biogas construction trainers (MBCT)

i). Training of trainers (TOTs) for a selected functionaries with aptitude for developing as TOTs and who would like to train other local NGOs for including in the DEN-INSEDA programme

j). Special training programmes for NGO functionaries

20.02.2 Capacity building of biogas producer-cum-end users (producer-cum-consumers)

a). Awareness-cum-motivational camps

b). Operational-cum-care and maintenance camps for end users

c). Special training programme for women end users of biogas

d). Trainings and demonstration camps on utilization of biogas digested slurry

XXI. ROLES & RESPONSIBILITIES OF GC PROGRAMME IMPLEMENTION STAKEHOLDERS

21.01. Roles and responsibilities of the three key stakeholder who would be associated with the implementation of household biogas plant in rural Indian under the proposed 'green certificate' programme are given as under.

21.01.1 DEN and INSEDA (roles and responsibilities):

a). Act as the umbrella-cum-apex body for grassroots NGO members/NGO partners in the implementation as well as overall programme management.

b). Develop and strengthen grassroots NGOs, through capacity building of NGO members for implementation of this programme.

c). Liaise with donors for fund raising, reporting, coordinating and providing support to its members as well as network with other local, state level, national, international groups for wider promotion of this concept within north and India.

d). Provide backup support- technical, advise, guidance and socio-technical and socio-economic and management services to grassroots NGOs.

e). Provide training in technical skills and management skill aspects to grass-roots NGOs for promoting enterprise development of local people as against purely income generating activities being followed now where there is an element of dependency of poor and marginal sections of rural communities on the developmental agencies.

f). Monitor the implementation and operation of the programme.

g). Facilitate and undertake Action R&D in biogas technologies and allied activities.

h). Undertake documentation of the programme, field level studies and preparation of promotional materials, teaching aids, simple booklets for rural people in partnership of grass-roots NGOs.

i). Do planning, development and conducting of need-based training programmes for the different level of functionaries of grassroots NGOs.

j). Organize seminar, workshops, meetings & consultations to discuss the relevant themes & issues.

k). Analysis the data & information, compilation and preparation of reports for the funding agencies; as well as using them for wider dissemination & feeding into wider network for advocacy and policy change in favour of such programmes.

21.01.2. Grassroots partner NGOs (roles and responsibilities):

a). Selected grass-roots partners of DEN-INSEDA and other partner NGOs would be involved in the direct implementation of the project by organizing manpower, planning and get systematically involved in imparting adult & functional education and technical & managerial literacy programme to villagers; as well as selecting prospective plant owners.

b). Would ensure post plant installation (construction) services (i.e. initial charging of plants and ensuring proper gas production, follow-up visits and if require providing repair and maintenance services), either by rural youth clubs (RYCs) or individual rural entrepreneurs.

b). Would organize and conduct capacity building, programmes for developing and strengthening mahila mandals (local women's groups), rural youths, landless peasants and village artisans, for promotion & implementation of appropriate household biogas plant models by them.

c). Would get involved in the development of skills, rural entrepreneurs and micro-level enterprises (both for individual and groups) of rural poor (women, unemployed youth, landless peasants, artisans, for sustainable income generation from the implementation of household biogas plants.

d). Would organize & conduct training programmes for different groups of rural people for the effective implementation appropriate household biogas model.

e). Would organize and disburse of subsidy grant and loans under the programme.

f). Would get involved in the collection and repayment of loan installment from plant owners through their self-help groups.

g). Would compile and send their respective reports (both quantitative & qualitative) to INSEDA-DEN, for synthesizing & preparing one common report for sending to appropriate groups/agencies supporting this programme.

h). Would take-up relevant studies at the grassroots level jointly with INSEDA-DEN.

i). Would organize local meetings and liaise with the local government authorities and financial institutions for sharing the information with them so that learning from this new strategy & approach is discussed, debated, improved and accepted by them to replicate similar programme with other grass-roots NGOs.

j). Would participate in the Action R&D for improving the existing biogas technology & methodology, as well as participating in the field evaluation and demonstration for new biogas plant models for wider application.

k). Would give regular feedback to INSEDA-DEN Secretariat on the implementation strategy & approach for further improvements and if required, do appropriate mid course corrections, to realize desired results and impact of this programme.

l). Would participate/collaborate in any other activities to fulfill the aims, objectives and overall goals of the proposed 'green certificate' programme.

XXII. CHANNELING OF FUNDS FOR BUILDING BIOGAS PLANTS

22.01. Funds mobilized by selling 'green certificate' in the north by DEN, Germany for building household biogas plants in rural India would be channeled to grassroots partner NGOs through DEN-India & INSEDA secretariat, New Delhi, India.

XXIII. ADDITIONAL FUNDS (BY RECOVERY OF CERTAIN AMOUNT IN THE FORM OF LOAN ON)

23.01. Additional funds generated by DEN-India and INSEDA would be used by INSEDA through its NGO members and other partner NGOs for pursuing the overall goals of the programme, capacity building of different stakeholders, technical support and monitoring etc., by DEN-India & INSEDA, other related activities with focus on rural women; as well as undertaking a few people centered, community oriented, sustainable energy based eco-village development activities with in the green certificate supported biogas programme villages.

XXIV. DESIGNING AND ISSUING OF GREEN CERTIFICATE

24.01. Green certificate would be designed which would have the joint name and logo of DEN, Germany and INSEDA, India with the name and address and the details of advance purchase of the amount of carbon dioxide (CO_2) abated by the number of 2 M^3 capacity plants.

24.02. From the practical point of view, each 'Green Certificate' would be issued for supporting a minimum of 33 million tones of CO_2 abated (which is equivalent to the average useful working life, taken as 10 years, of one 2 M^3 capacity household plants in India) or its multiples.

24.03. The green certificate could either be bought by any individual in his/her name or as a gift in the name of any other individual(s) or by groups or religious congregation or society or communities or industries/company etc., for themselves or as a gift to others, as explained earlier.

XXV. SUMMARY AND CONCLUSION

25.01. The concept of household biogas plant in India as an efficient clean energy device for the abatement of **methane emission** as a potent greenhouse gas (GHG), with a view to mobilize potential support from the international community and other stakeholders from the north for the promotion and implementation of household biogas plants (BGPs) in India as one of the most appropriate, rural oriented, green technology under the aegis of **carbon market**. This would also fulfil the aims, objectives and vision of **KYOTO PROTOCOL** to support the projects/programmes by the industrialised countries in the developing countries to reduce the greenhouse gas emission using the "clean development mechanism (CDM)", though the north-south NGO partnership.

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