

National Biogas Programme Ethiopia - Scaling up of Domestic Biogas in Ethiopia

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Biogas for Better Life



Biogas Program

- Over 88% of all citizens in Ethiopia rely on biomass fuel for cooking and lighting. And with 77% of agricultural families having cattle, many Ethiopians are eligible for biogas installation.
- To capture and use the climate-warming methane gas that is emitted from livestock, landfill, and sewage plant operations. Capturing and using biogas, which is composed mostly of methane, contributes to reducing methane in the atmosphere.

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- To promote the uptake of domestic biogas, since 2008, a National Biogas Programme (NBP) is developed to disseminate domestic biogas and develop a commercially viable market biogas sector in four selected regions in Ethiopia. This program envisioned to promote 14,000 family-sized domestic biogas digesters in four selected regions.

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- The standardized Sinidu Fixed Dome model is the most preferred plant in Ethiopia. As of September 2013, over 7024 plants had been constructed in 102 Woredas. Operating as the National Biogas Programme –Ethiopia, the programme is operational in four regions of Oromiya, Amhara, Tigray and SNNPRS. The programme has also trained over 5600 users on maintenance, 2560 of them female.

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- **Development** of a special biogas stove that can bake Injera, a traditional flatbread national dish in Ethiopia made of teff flour, is ongoing and distributed to four regions for final test.
- Bio-slurry extension has about 90% of all plants with a slurry pit, with 85% having compost pits for organic manure. Use of bio-slurry has seen improved agricultural production and incomes in many regions, including from sale of excess slurry to other farmers. **With 63%** of all plants connected to the latrines, setting an enviable example to other programmes, sanitation and hygiene levels have continued to improve.

What is the implementation infrastructure?

- Intervention Area

In its first phase, the biogas program will be executed in the 4 national regional states. However, after the 1st phase it will be scaled up to other regions. Currently, the biogas program is implemented in 102 woredas/districts of the 4 national regional states namely;

- SNNPR : 11 woredas;
- Oromiya : 42 woredas
- Amhara : 21 woredas ;
- Tigray : 28 woredas

Key implementation Approach/strategies

Multi actor: The promotion and dissemination of NBP is implemented through the active participation of different stakeholders such as government, private sector, civil society, cooperatives, donors and users.

Public private partnership: Government, NGOs, private, sector are involved and make strong partnership for the successful dissemination of the technology in the country.


Market-oriented/Commercial: users buy the technology (construction materials, appliances and labor) with reasonable costs from the competitive market.



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How has been the trend of production over the years?

With a significant growth of biogas production from 2009 to 2013 and the trend shows progressive growth from year to year as indicated in the following table:



years	2008	2009	2010	2011	2012	2013 (end of Sept)	Total
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# of digester built	98	30	731	1643	2509	2013	7024
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Key implementation challenges

- High cement price (500 Birr/Qt)
- High investment cost of the biogas plant
(increase in the price of construction materials)
- Inadequate promotion of the program
- Lack of credit service for biogas program

ETHIOPIAN HOUSEHOLDS NOW ENJOY THE BENEFIT OF DOMESTIC BIOGAS

- Madam Azmera Mesafnt is head of a family of 6 persons; she resigned 11 years ago from her civil servant job to become a dairy farmer. She own 8 heads of hybrid cattle in her yard of 450 m² of land. In August 2008, she invested 6 000 Ethiopian Birr (about 326 €) in a digester (the second constructed in Ethiopia under the national programme). Fed with 80 kgs of dunk, mixed with the same quantity of water, it produces more than enough gas everyday to cover her cooking and lighting needs so that she is sometime obliges to reduce the feeding.

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- Her installation works perfectly and since August 2008, she has only change the main valve. she declares that the benefits of biogas in her life are multiples: free from smoke and have installed kitchen in the main house, time is saved because of fast cooking, save money to the amount of approximately 300 birr (17 €) per month from kerosene, wood fuel and charcoal. Also use biogas to boil drinking water. Finally, she knows legally practice her farming in town.

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- Before, it was forbidden by the municipality because of the sanitation conditions and nuisances for the neighbors (smell). Thanks to biogas, this is no more a concern and her farming has been legalized.



Biogas products and



Bio-slurry application at farm



Synergy



Cont...

Biogas programme is useful for the farmers to:

- improve health and living conditions of men, women and children; to reduce the use of firewood and charcoal for cooking;
- improve soil fertility, agricultural production and reduce greenhouse gas emissions; and
- create new jobs, through the development of a robust biogas-related business sector

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- To Scaling up of Domestic Biogas in Ethiopia we develop a proposal for agricultural initiative to reduce short-lived climate pollutants specially methane from livestock's.

PRIMARY OBJECTIVES:

The main aim of the project is:-

- to improve the livelihood and quality of life of rural households in Ethiopia through the exploitation of market and non-market benefits of domestic biogas. This is realised through replacement of unsustainable utilization of wood and charcoal for cooking and lighting;
- the application of high-value organic fertilizer from the bio-slurry;
- enhancing the adaptive capacity of rural households to climate change and thereby improvement of their overall economic situation.

EXPECTED RESULTS:

- The key result of the project will be 30,000 biogas plants installed,
- This will yield an estimated energy production of 366,786 MWh and a GHG emission reduction of 327,116 t CO₂eq.
- the project will generate substantial income opportunities for local companies, masons and financial institutions, especially in rural and peri-urban areas. (with steady demand a mason can potentially construct 24 biogas plants per year. Based on this assumption, an SME employing five masons could construct 120 biogas plants per year and a total of 50 SMEs can benefit from the project.)

EXPECTED RESULTS:

NBPE II Expected Results

Biogas plant construction

30,000

[plants]

Energy

Energy production

366,786

[MWh]

Power installed

102,489

[kW]

Environment

GHG emission reduction

240,000

[t CO₂eq]

Deforestation reduction

26,280

[ha of forest]

Soil nitrification

216,000

[t(DM) bio-slurry]

Soil nitrification

58,000

Ha

Fuel substitution

Biomass

242,400

[t biomass]

Fossil fuel (quantity)

2,400

[t]

Fossil fuel (financial value)

1,459,200

[EUR]

Socio-economic

Persons reached	180,000	[persons]
Workload reduction (women & children)	6,667	[pers years]
Exposure to indoor air pollution reduced	150,000	[women & children]
Toilet connection (40 % of hh)	12,000	[toilets]
Productive slurry use (80 % of hh)	24,000	[households]

Business and finance

Enterprise Development	50	[SMEs]
Sales turnover per SME per annum	85560	[USD p/a]
Profit potential per SME per annum	25560	[EUR p/a]
Total sales turnover SMEs	21.4	[Mln USD]
Total profit potential SMEs	6.4	[Mln USD]
Employment generation (direct)	1250	[person years]

Training

User training	42,000	[person days]
Professional training	15,713	[person days]

DESCRIPTION:

- Ethiopia's domestic energy situation is characterised by a very low per capita energy consumption combined with a dominant usage of traditional biomass fuel, with cooking taking the major share. The use of modern sources of cooking fuel such as butane gas, electricity and kerosene is uncommon in the rural areas (0.4%) and it is estimated that biomass fuels meet 88% of total energy consumption in the country.

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- As a result, current domestic energy requirements in Ethiopia are mostly met from wood, animal dung, and agricultural residues and this situation presents a number of disadvantages:
- Traditional stoves used in rural Ethiopia are very inefficient, and as a result consume large quantities of biomass which results in extensive deforestation and forest degradation. On average, a single family burns 20 kilograms of wood per week.
- Women often travel long distance to collect firewood – occupying a significant amount of productive time that could be spent on other domestic and economic activities.
- Prolonged exposure to smoke from traditional stoves is a major health hazard for rural Ethiopian women and children. As a result, a significant number of women and children suffer from lower respiratory infection disease.

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- The continued dependence on biomass fuel has greatly contributed to the decline in access to biomass in all areas of the country. As a result, in the last decade many poor households are increasingly forced to use inferior fuels such as dung and agri-residues. This in turn creates an imbalance between agricultural production (e.g. using animal manure for fertilizer) and domestic energy (e.g. using dung for fuel). The use of dung for fuel precludes its contribution to the soil nutrient pool, exacerbating declining crop yields due to loss of soil fertility and erosion.

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- The National Biogas Program of Ethiopia (NBPE) is implemented by the GoE and was launched in 2009 covering the four populous regional states of Amhara, Oromiya, SNNP, and Tigray. Since 2009 the program has played an increasingly significant role in addressing the domestic energy needs of rural communities in the targeted regions.

RELATIONSHIP TO THE INITIATIVE/THEORY OF CHANGE

- The use of firewood increases pressure on the rural environment, while existing alternative sources (biomass) are cumbersome and unhealthy. Increasingly, a largely unutilised agriculture-based source (cow dung) has become a relevant source of safe renewable energy. Biogas is a proven and tested technology with demonstrated impact through reduction of economic and financial costs expended on fuel for cooking and lighting and improved food security through increased agricultural production using the bio-slurry. It is produced on a sustainable basis as the carbon dioxide associated with its combustion is reabsorbed in the process for the growth of fodder and food for the animals and human beings.

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- Proper use of bio-slurry reduces the dependency of farmers on increasingly expensive chemical fertilizer. By returning the slurry to the fields, depletion of nutrients and organic matter in the soil is reduced and through that the pressure to expand the area of land to be cleared for agriculture is also reduced. Organic matter improves soil tilth, increases water-holding capacity, lessens erosion, improves soil aeration and has a beneficial effect on soil microorganisms and plants. Therefore, by displacing traditional fuels, by changing traditional manure management systems, and by reducing the need for chemical fertiliser, biogas reduces greenhouse gas (GHG) emissions. Biogas sector development creates off-farm employment opportunities for artisans.

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- The technology is local in nature and construction does not require heavy infrastructure. Service providers and enterprises form a second important labor market that link the production and supply of additional renewable energy technologies, such as improved cooking stoves, to biogas programs that can bring a huge impact on GHG reduction. Youth in households with access to biogas gain important economic benefits as well. In particular, young rural women can free up time for education and productive activities, as they are released from time-intensive collection of firewood and charcoal, and no longer need to spend their budgets on these energy sources.

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- This second phase of the project is planned to be implemented over 5-year period and is coordinated under the leadership of the Ministry of Water, irrigation and Energy. At regional level, line bureaus (BoWME, MoA, MoH) and other stakeholders such as Biogas Construction Enterprises, private sector organizations, and NGOs will be engaged, through contractual relations, in the implementation of the program. The program will continue to be guided by a Steering Committee consisting of key stakeholders which meets bi-annually.

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- The programme's ambition is to scale up the current level of Phase I domestic biogas by making the biogas installations affordable to prospective users of the technology in rural and peri-urban areas of the established four regional states and the proposed expansion to a further two regional states. This project will succeed by combining genuine participation of stakeholders, demand-driven approaches, matching skills to market needs, opportunities for on-the-job training along with relevant skills building, support for nascent enterprises, and in forging public-private partnerships that share responsibility and leverage results.

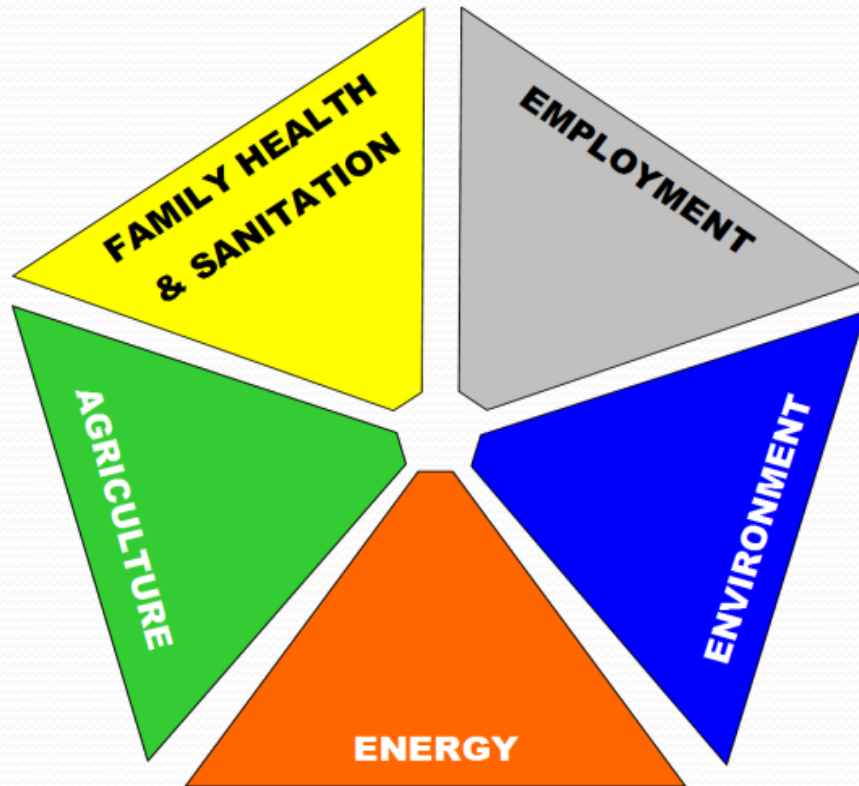
EXPECTED BENEFITS:

- Domestic biogas installations principally reduce greenhouse gas (GHG) emissions in three ways: by changing the manure management modality; by substituting fossil fuels and non-renewable biomass for cooking (and to a smaller extent for lighting) with biogas, and; by substituting chemical fertilizer with bio-slurry. Biogas impact areas and specific benefits include:

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A well-managed and properly utilised biogas plant can generate multiple benefits by:

- reducing greenhouse gas emissions
- providing opportunity for women and girls to spend more time in productive activities;
- reducing the use of traditional biomass cooking fuel such as agricultural residue, dung cake, fuel wood, and charcoal
- reducing sickness and premature death related to indoor air pollution;
- using the digested effluent (bio-slurry) as a fertilizer for increased agricultural production, thereby saving chemical fertiliser and promoting livelihoods;



- Gender aspects, women economic and children's educational Status
- Improved health from nutrition and reduced indoor air pollution
- Environmental protection through reduced deforestation and environmental degradation
- Employment creation, especially in the rural areas
- Improved food security due to agricultural application of Bio-slurry
- Greenhouse Gas reduction
- Control GHG emission from livestock manure
- Recycle nutrients and restore soil fertility
- Promote environmental awareness and link it with economic advantages

IMPLEMENTATION

Roles of partners and stakeholders

- The NBPCU is responsible for the day-to-day management and coordination of all program activities
- Among the major roles of the NBPCU are:
- strengthening the Regional Biogas Programme Coordination Units;
- standardization, quality control and quality management;
- internal monitoring of the program.
- will further develop and implement quality management activities and provide policy support on carbon revenue in liaison

Role of Bureaus of Finance and Economic Development (MoFED, BoFED):

- MoFED is responsible for channelling funds to regional BoFED, and similarly regional BoFED will channel funds to RBPCU /MEAs. In addition BoFED will be responsible for integrating the National Biogas Program within their regular planning; impact monitoring; timely disbursement of project funds.

Role of the Regional Bureau Mines and Energy

Agencies (RBMEAs):

- At regional level the Mines and Energy Agencies or Energy Departments are mandated for the promotion and development of renewable energy technologies. The role of the regional Bureau MEAs is comparable to that of MoWE at federal level. The main responsibilities of the RBMEAs are:
 - coordination amongst regional bureaus, regionally based (I)NGOs, MFIs and savings and credit cooperatives, the private sector, and construction cooperatives;
 - analysis of existing policies at regional level and policy formulation related to the dissemination of renewable energy technologies and in particular domestic biogas;
 - promotion and marketing of renewable energy and in particular biogas;

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- accreditation of biogas construction cooperatives and private companies;
- strengthening the technical capacity of the experts at the regional Mines and Energy Agencies;
- supporting and strengthening the partner organisations;
- Coordination of the slurry extension program, training, capacity building, gender mainstreaming, and surveys and studies.
- Progress reporting to the regional government.
- Within the RBMEA, the Regional Biogas Programme Coordination Unit (RBPCU) coordinates, facilitates and monitors daily project activities at regional level. RBPCUs are easily accessible entry points for construction cooperatives and private companies, and they are in a position to address geographic and cultural issues.

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- They act as bridging organisations between the government and the private sector, liaising with program stakeholders and, compared to the NBPCO, are closer to the potential biogas users. A clear focus on dissemination of domestic biogas is guaranteed whereby responsibility for the coordination of the National Biogas Program at regional level is delegated to the RBPCOs. It is proposed that the RBPCUs continue with the current staffing but depending on the expansion pace of the program they may recruit additional staff over time.

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- The RBPCU identifies suitable partners for the different activities and drafts working contracts for these partners. The RBPCUs are responsible for annual activity plans regarding promotion, training and construction, subject to approval for implementation from the RBMEAs. The RBPCUs are responsible to produce regular progress reports which form the basis for the results based financing mechanism.

Risks and Mitigation:

- The main risks and mitigation measures in the proposed program are:
- Reluctance of rural population to accept new technology: the growing demand for biogas in Phase 1 indicates that when such resistance comes it can be overcome. There are various examples that can be shown to demonstrate the success of the technology. Through intensive promotion using different approaches the program will ensure households understand the benefits of the technology. The number of clients will increase proportionally to the loans disbursed for the new product;
- Building and installation are overpriced: The NBPE has a regulatory mechanism maintaining ceiling prices for biogas installation;

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- Service providers do not deliver the outputs in the quality agreed: NBPE has a strict quality control monitoring system in place that ensures quality and after sales services
- Lack of sustainability of plant operation: Plants have a very simple technology. Maintenance costs are estimated at US\$2 per year, which is affordable even to the poorer-end of the target group. Although through credit, the target group has to finance a substantial amount of investment costs, ownership is then ensured. Once a plant is installed, biogas will be free, whereas alternative energies have substantial (opportunity) costs.

BUDGET (USD):*Source of funds***2014****2015****2016****2017****2018****Total**Household
contributions

3,172,000

3,965,000

4,758,000

5,551,000

6,344,000

23,790,000

CiDev carbon revenue

323,213

253,839

349,147

457,690

578,806

1,962,695

CCAC funds

868,275**1,209,687****1,495,725****1,743,341****1,946,882****7,263,909**Total application of
funds**4,363,488****5,428,526****6,602,872****7,752,031****8,869,687****33,016,604**

Using climate finance to upscale the Ethiopian National Biogas Programme – a biogas NAMA

- This project will develop a Nationally Appropriate Mitigation Action (NAMA) for the Biogas sector that explores options to upscale the NBP through access to international climate finance. The NAMA will meet the requirements for submission to the United Nations Framework Convention on Climate Change (UNFCCC) registry. It will provide a financing instrument that facilitates farmers' access to capital to help cover high up-front investment costs of installing biogas digesters and related infrastructure. The NAMA will also incentivize the use of bio-slurry to improve degraded soils and increase agricultural productivity.

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The NAMA will be developed through a participatory process that involves all relevant stakeholders. This innovation process has four phases:

- Conducting a situational analysis on biogas experiences, key stakeholders and review of policy and institutions, as preparation for the NAMA concept note.

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- Multi-stakeholder review and strategy negotiation bringing together policy makers, community members and content experts to develop an effective strategy for scaling up the NBP
- Development of NAMA concept note based on the input. UNFCCC guidance will be considered to meet requirements for submission to the NAMA registry and potential donors
- Consultation on the draft concept note using participatory action research approaches and finalization of concept note for submission to the UNFCCC registry



Thank you