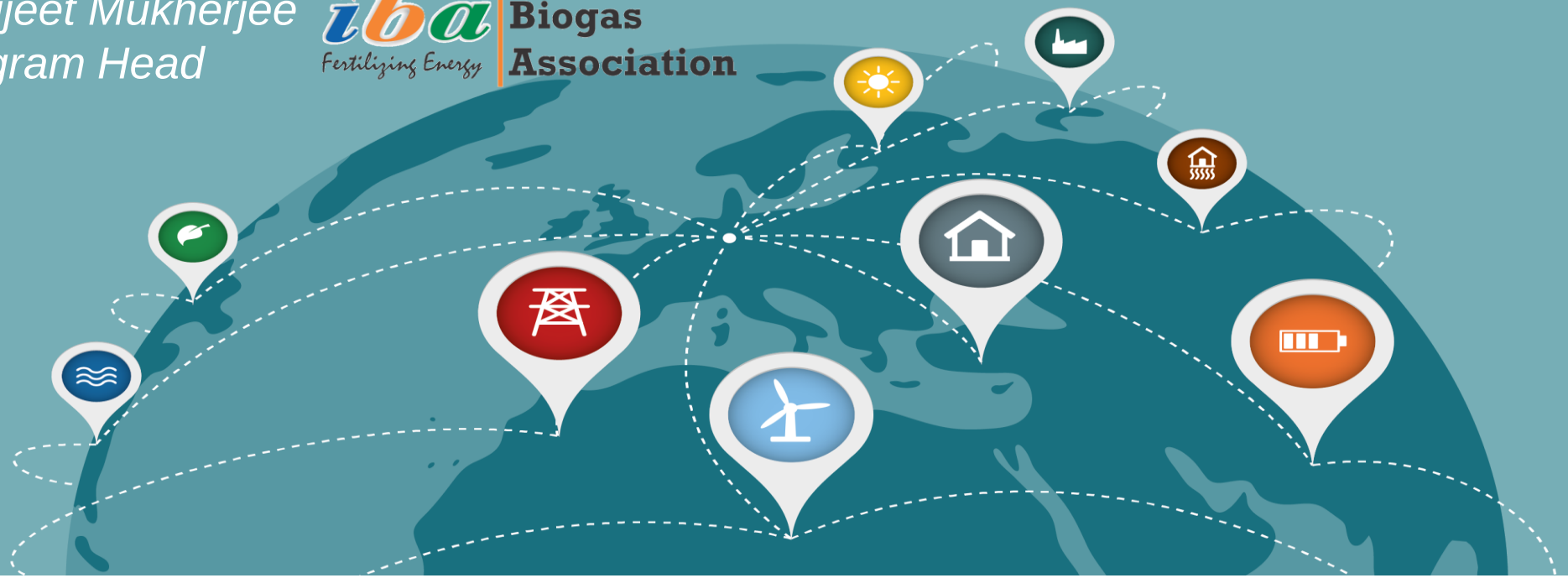
Federal Ministry
for Economic Affairs
and Energy

MITTELSTAND
GLOBAL
ENERGY SOLUTIONS
MADE IN GERMANY

Biogas Market in India

Presented by,
Abhijeet Mukherjee
Program Head

Indian
Biogas
Association



Facilitator

eclareon

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Introduction to Indian Biogas Association (IBA)

- Headquarters: Gurgaon
- First nationwide and professional biogas association, established in 2011
- Supports and represents the stakeholders:
  - Operators,
  - Manufacturers,
  - Planners,
  - Representatives from public bodies,
  - Science and research, and
  - All other environmental enthusiasts.
- In Partnership with German Biogas Association (BIG-P)

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Members of IBA

SOME OF OUR KEY MEMBERS

GAIL

encare

Mahindra Rise.

Committed to the Environment
ATMOS POWER

BHS SONTHOFEN

ikos MAILHEM

praj
Innovate • Integrate • Deliver

VOGELSANG

BAUER KOMPRESSOREN
Quality. Our DNA

PAQUES

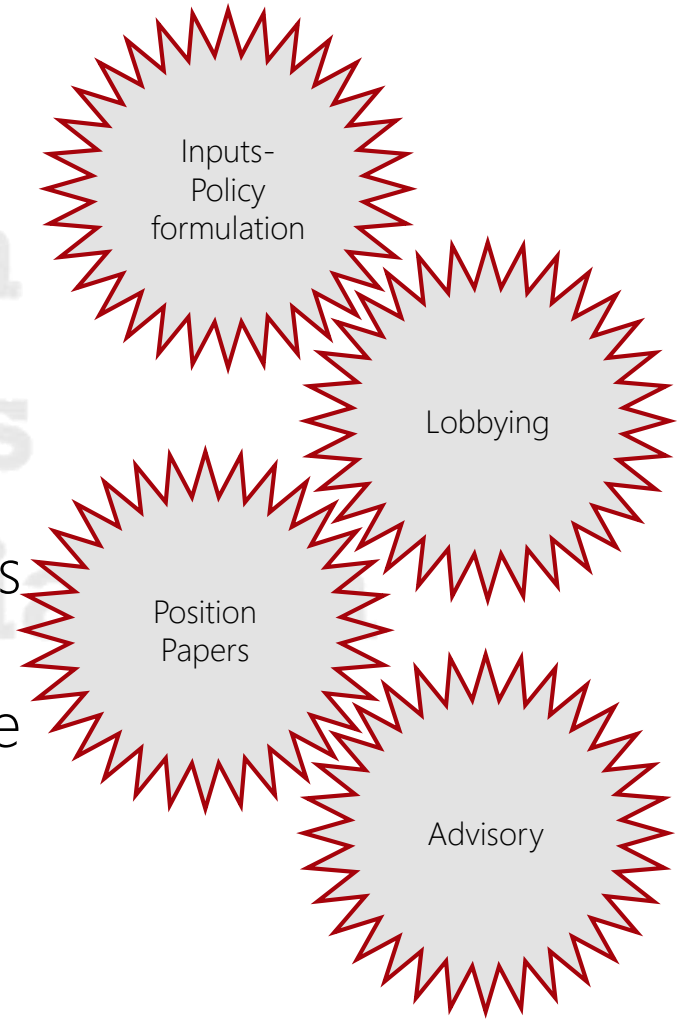
agraferm

Nourish. Nurture. Nature

Arka BRENStech Pvt. Ltd.

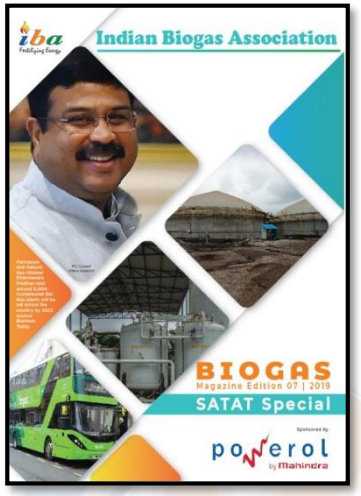
Association supporting Government

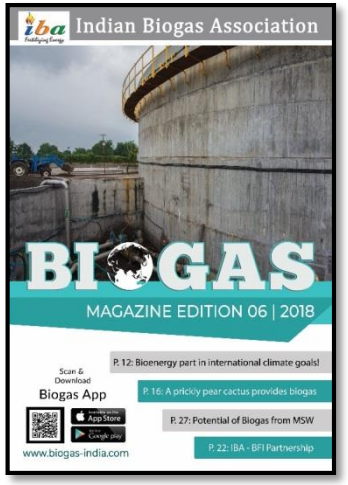
- Position paper on scope of digestate in FCO
- Inputs for optimal price of CBG under SATAT scheme
- Critical inputs Standards' draft prepared by TERI
- Position paper on GBI
- Provision towards setting-up demo CBG plant by OMCs
- Working on inputs for Gas-grid insertion of biomethane
- Inclusion of bio-slurry in FCO
- Basic Biogas Training for govt. executives

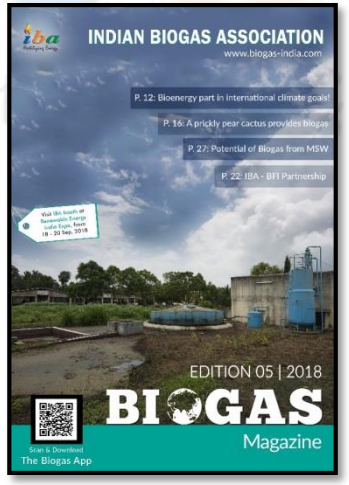


New launches of IBA (2017-2018)

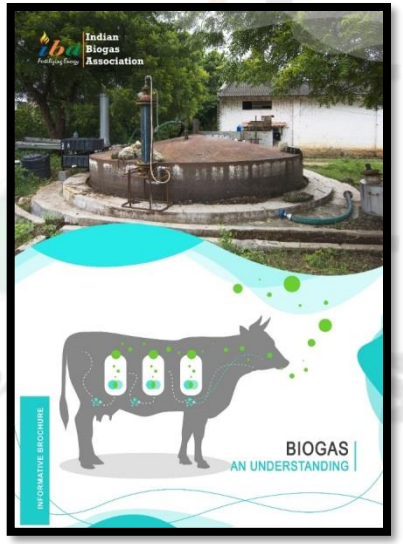
Magazines







Biogas Brochure

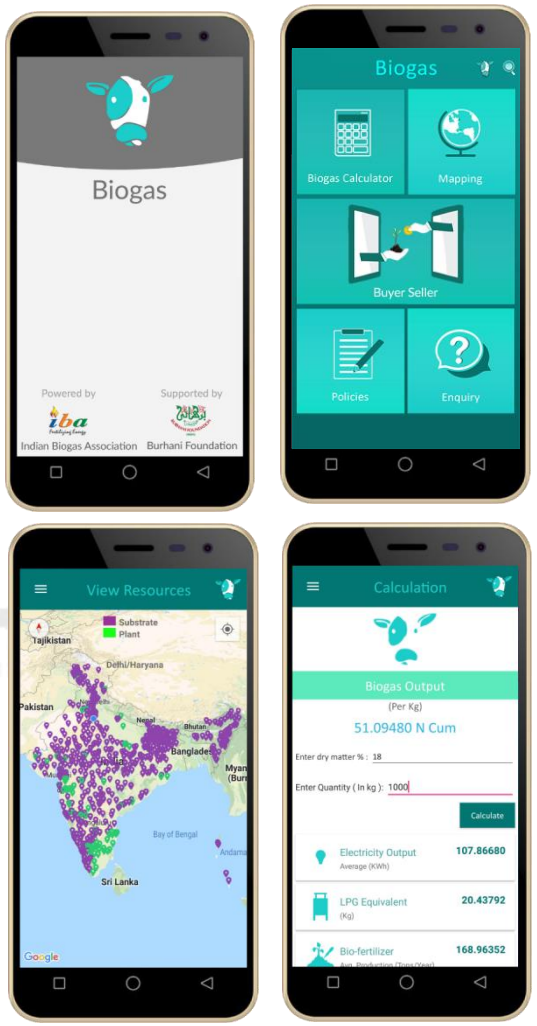


Published by IBA

Digestate Brochure

Published by GBA

Mobile App



Biogas Lab

Key Features:

- Located at IIT-BHU, Varanasi
- Comprehensive testing facility
- State of the Art laboratory
- Cross Disciplinary
- Regional Labs to be set-up

Working Domains:

- Laboratory Analytics
- Yield Optimization
- Study of Substrates
- Feedstock Analysis

Tests:

- Dry Matter (DM)
- Organic Dry Matter(oDM)
- Biomethane Potential
- Total Alkanity (TAC)
- Total Volatile Fatty Acids
- FOS/TAC
- $NH4\text{-}N_{tot}$
- $H2S_{tot}$
- BOD
- COD
- Acid Spectrum (C2-C6)
- Phosphorus (P2O5)
- Potassium(K2O)
- Total Organic Carbon (TOC)

Feasibility Assessment

- ✓ Site Assessment:
  - Analysis of different available feedstock in project vicinity
  - Land identification and its suitability
  - Utility mapping of frozen site
  - Overall demand mapping and assessing off-take feasibility
  - Socio-economical analysis
  - Identification and earmarking the relevant stakeholders
- ✓ Financial Feasibility
  - Capex , Opex Estimates
  - Free Cash Flow Analysis
  - Financial Appraisal- Profitability, Liquidity, Leverage, Project Returns
  - Sensitivity Analysis

- ✓ Technical Recommendations
  - Comparison with contemporary technologies
  - Specific Technology recommendation across the process steps
  - Mapping with probable equipment suppliers
- ✓ Risk Analysis and Overall Recommendations:
  - Setting up the overall project schedule (micro/macro level planning)
  - Listing project specific permissions and clearance requirement
  - Recommendation for optimal business model
  - Scenario Analysis, overall risk assessment and mitigation plan– feedstock, offtake, social, technical, regulatory

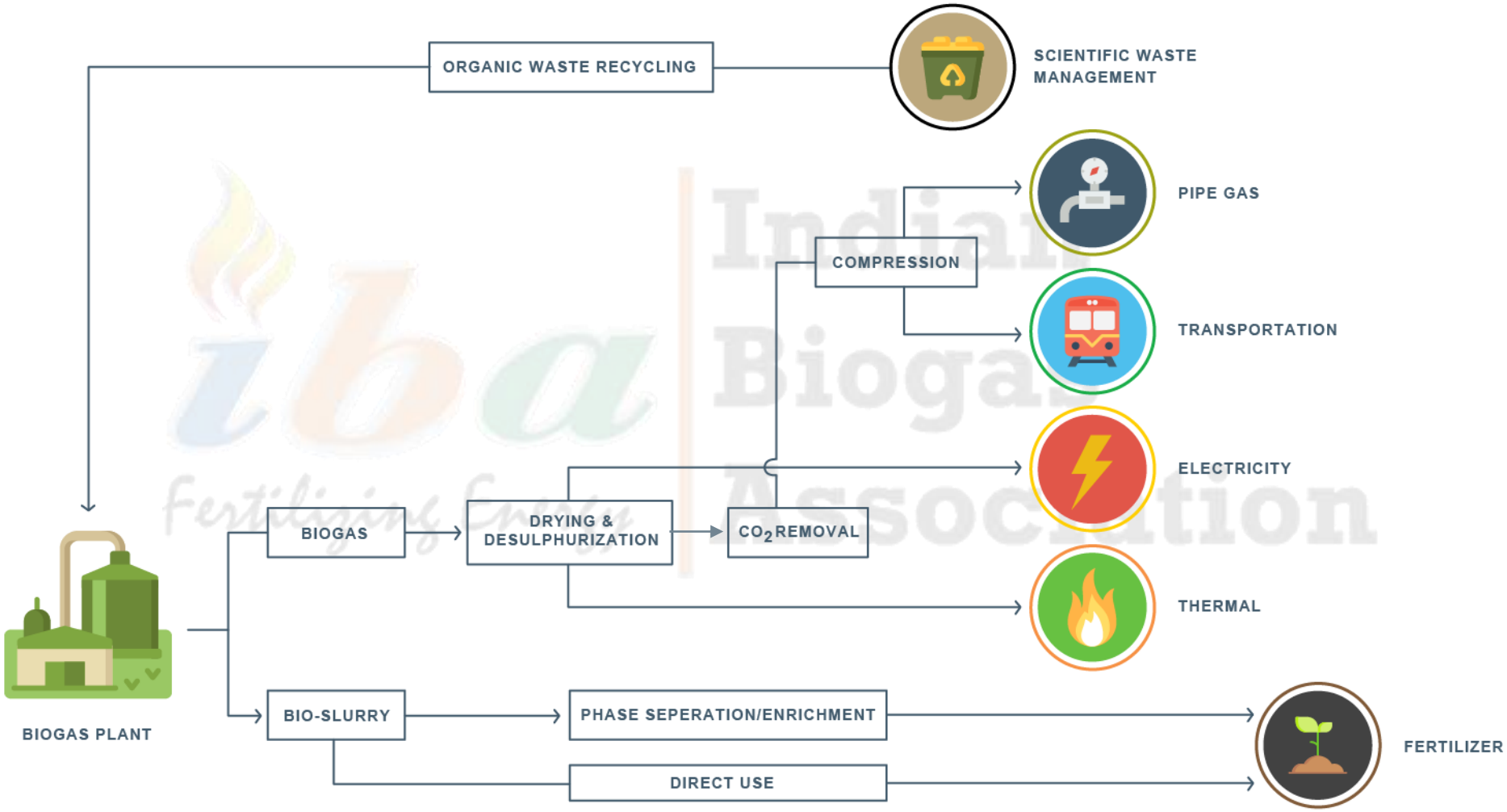
Targets influencing Indian RE sector

Initiative		Targets
Make in India		Manufacturing to become 25% of GDP by 2025. Reduced Corporate Tax rates 100% FDI under automatic route in RE
Swachh Bharat Mission		Open Defecation free districts Scientific Waste Management-SWM rules 2016,
Smart Cities		100 Smart Cities by 2020
Power for ALL		24X7 Power for all by 2022
Voluntary Targets at Int. forum- Nationally Determined Contributions		Renewable Energy to 175 GW by 2022 Emissions reduction by 33%-35% by 2030 (2005 base), Non fossil fuel mix in power to 40 % 2030
Oil Import		By 2022, reduction of oil imports by 10% from 2014-15 levels

Bio-waste to Biogas In India

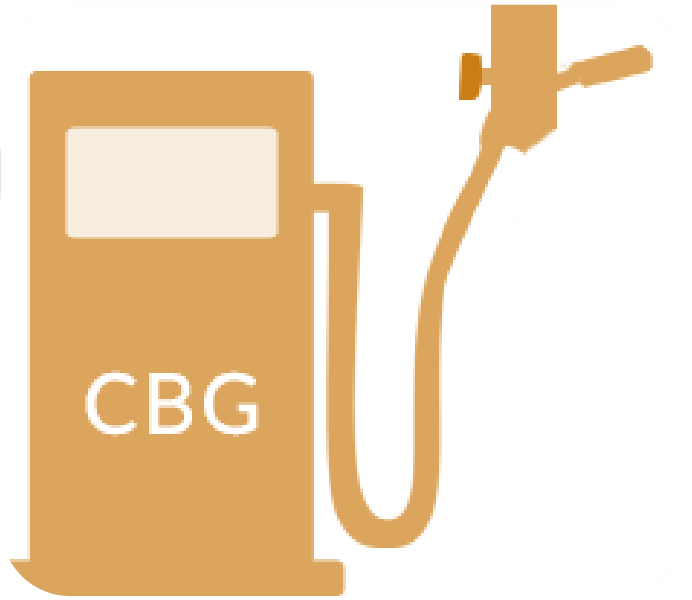
- Cow Dung, poultry litter, horse dung, etc.
- Agricultural residues as rice straw, wheat straw banana stem, maize stalks
- Industrial byproduct-Sugar mill press mud, Distilleries spent wash, Sago plant effluent
- Municipal Solid Waste, slaughter house waste, vegetable market waste, kitchen waste

Biogas Utilization



Specs. of Biomethane(as per BIS)

Components	Range	Method of test
CH_4, percent, *Min*	>90	IS 15130 (Part 3)
Moisture, mg/m^3, *Max*	<16	IS 15641 (Part 2)
H2S, mg/m^3, *Max*	< 30.3	ISO 6326-3
CO_2+N_2+O_2, percent, 10 IS 15130 (Part 3) *Max* (v/v)	<10	IS 15130 (Part 3)
CO_2, percent, *Max* (v/v) 4 IS 15130 (Part 3) (when intended for filling in cylinders)	< 4	IS 15130 (Part 3)
O2, percent, *Max* (v/v)	< 0.5	IS 15130 (Part 3)



Biogas Plants Type in India

House-hold based (1-25 m^3/day)

Commonly used technology :

- Fixed Dome- Janta Model, Deenabandhu Model
- Floating Dome-KVIC, FRP based,

Community based Biogas Plant (20-1000 m^3/day)

Commonly used technology :

- KVIC, Nisarguna (BARC), decentralized containerized solution

Large Scale Biogas Plant (>2500m^3/day)

Commonly used technology :

- UASB, CSTR, Plug- Flow Type, Lagoon type

Digestion Technologies

Domestic biogas digesters

(small scale)

(Covered) Lagoon digesters

Garage or Batch

CSTR and Plug-flow

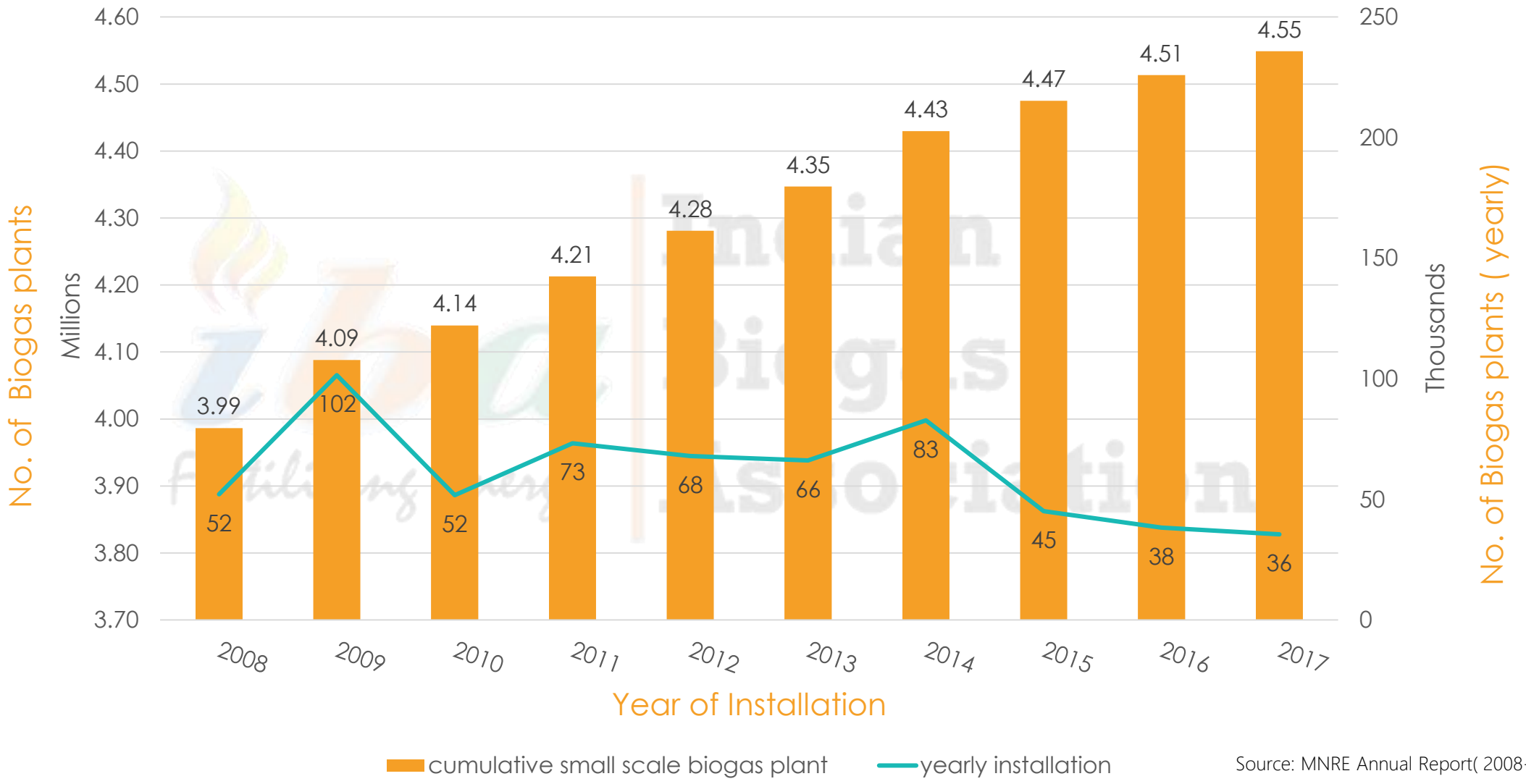
Biomethane

(Bio-CNG/ Biogas upgradation)

Low-Tech solutions ⟷ **High-tech solutions**

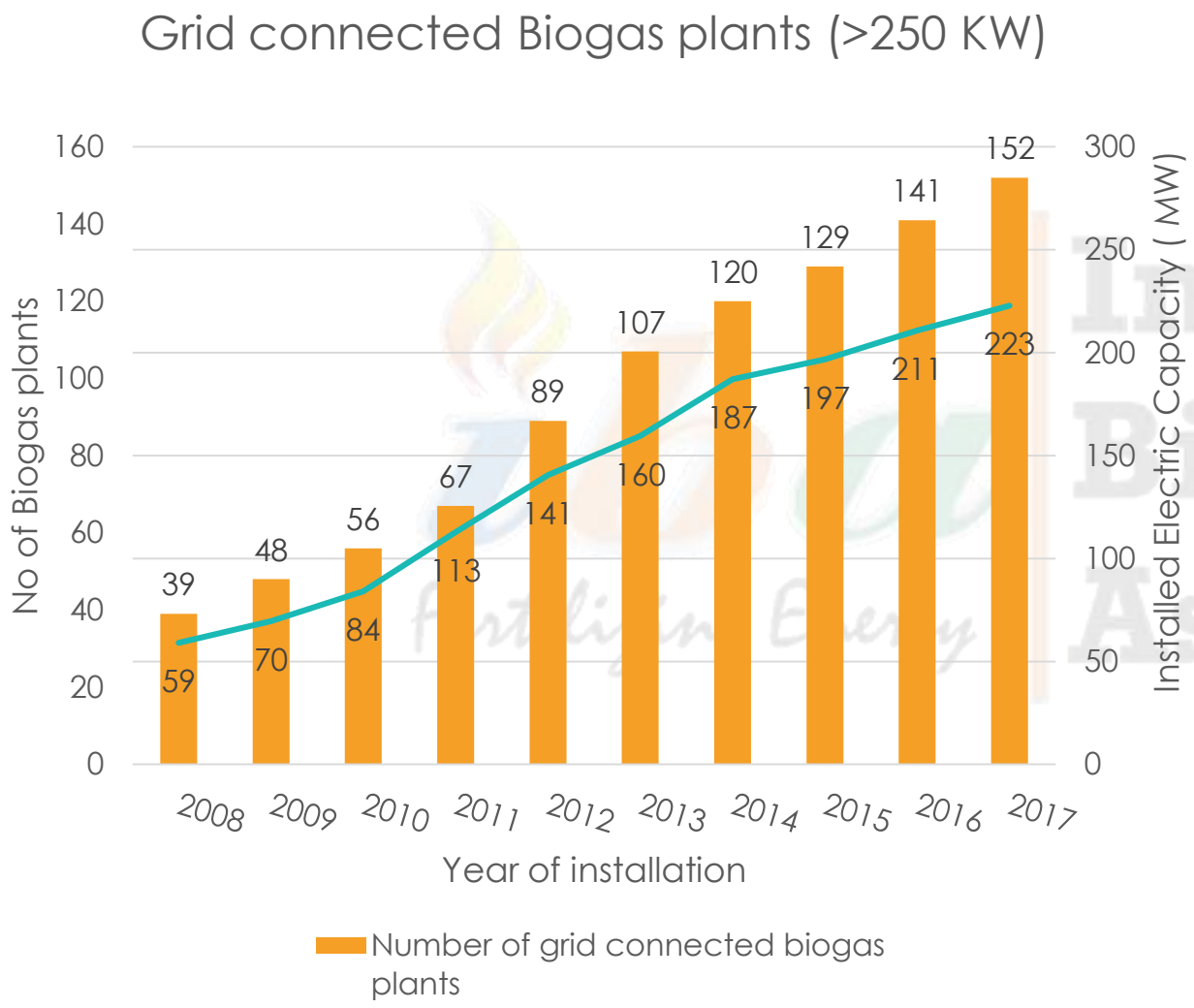
✓ ✓ ✓ ✓ ✓	✓ ✓ ✓	X	✓ ✓	✓

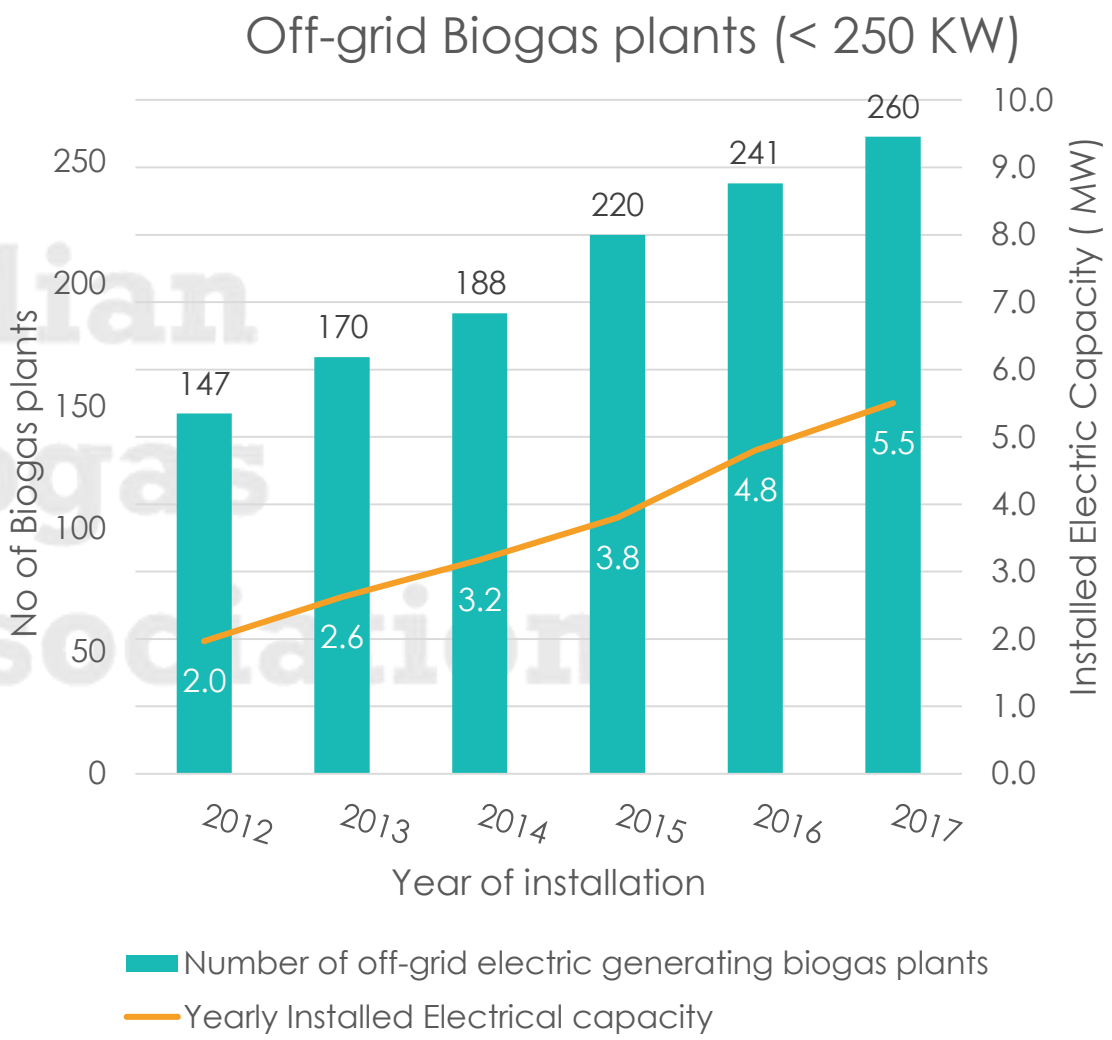
Status of Small Scale Plants (<2m³/day) in India



Source: MNRE Annual Report(2008-2017)

Status of Off-Grid / Grid Connected Biogas Plants in India





Source: MNRE Annual Report (2008-2017)

*Beginning period taken as 2012 due to inconsistent data in earlier years

Biogas Plants across segments

Scale of the plant	Definition	Installation Base (September 2019)	Estimated Potential
Small Biogas plant	biogas plants between 1 to 25 cubic meter/day	Cumulative total of 5.028 million family type biogas plants	Estimated potential of 12 million family plants
Medium Biogas plant	Power generation capacity between 3 KW to 250 KW	About 300 plants (cumulative capacity~6 $MW_{el.}$)	insignificant available data to be sized
Large Biogas plant	Eq. Power generation capacity above 250 $KW_{el.}$ or, 3000 m3/day of raw biogas	~190 large scale installations with cumulative Capacity~ 280 $MW_{el.}$	Overall Potential: ~ 35,000 $MW_{el.}$ • Just from Municipal wastes ~5000 $MW_{el.}$ • Potential from industrial solid sludge and liquid effluent ~ 2,000 MW
Biomethane plants (Compressed Biogas)	Plants based on different upgradation/ purification technologies	Presently around 90 plants	All upcoming projects shall have upgradation facility

Potential Business Cases (I)

Industries	Prominent Wastes Generated	Treatment Option	Potential (in $MW_{el.}$)
Sugar Mills	Sugar bagasse	Combustion and Gasification/ Cogeneration	410
	Pressmud	Biomethanation	
	Sugar molasses	Fermentation	
	Fermentative Yeast biomass	Biomethanation	
Slaughter houses	Organs, Tissues, Blood, Hides, Animal excreta and Carcass etc	Biomethanation	98
Paper mills	Pulp	Biomethanation/Cogeneration	62
	Paper shavings	Combustion	
	Wood wastes and Paper boards	Combustion and gasification	

Potential Business Cases (II)

Industries	Prominent Wastes Generated	Treatment Option	Estimated Potential (in $MW_{el.}$)
Dairy Plants	Whey and Milk cream	Biomethanation	72
Starch/Sago factories	Starch materials and peels	Biomethanation	145
Tanneries	Hides and skins	Acid treatments and biomethanation	8
Argo-residue	Wheat and Paddy Harvest	Biomethantion	10,100
Animal Husbandry	Manure	Biomethantion	7,450
Segregated MSW	Segregated organics-Household, Vegetable Yard, Restaurants, Commercial Estates	Biomethanation	4,950
Distilleries	Spent Wash	Biomethanation	550

Stakeholders of Biogas

- **Policy**
  - Centre
  - State
  - Municipal Bodies
- **Economy**
  - Farmers
  - Company
  - Associations
  - Standard Bodies
- **Academia**
  - Research Organizations
  - Training Institutes
  - Universities
- **Finance**
  - Banks
  - Subsidy, MSP
  - Funds
  - Other Innovative Instruments
- **Society**
  - NGO
  - Public
  - Social Entities

Stakeholders based On Value Chain

Resource

- Agricultural residue
- Industrial residue
- Municipal Solid Waste
- Professionals
- Planners

Processing

- Small Scale
- Community based
- Large Scale
- Manufacturers
- Operators

Distribution

- Electricity
- Thermal
- Biomethane
- Fertilizer
- OMC
- DISCOMS

Policy Support for Biogas sector (I)

FINANCIAL

- Concessional rates of 5 % GST for:
  - Biogas production
  - Equipment procurement for biogas projects
- BCD of 5% for imported equipment for biogas projects
- 40 % Accelerated depreciation on WDV method
- **Feed in Tariff** (~10 cents/ Kwhr) **by CERC** for biogas based WTE projects
- **Tax holiday** on Net Income up to 10 years (for end use as power > 1 MM_{el})
- **Central Financial Assistance** (CFA) for projects of different categories:
  - National Biogas and Manure Management Program (NBMMP): 1-25 m^3
  - Biogas Power(off-grid) programme (BPP): 3- 250 kW
  - Waste to Energy projects: 250 kW+

Policy Support for Biogas sector (II)

INTER-MINISTRIAL

- **SATAT (Sustainable Alternative Towards Affordable Transportation)**
  - Secured offtake of Compressed Biomethane for 10 years.
  - Upward price revision every three years
- **Electricity Policy**- Distribution Licensee/ Discoms to compulsorily procure 100% power (RPO) produced from all the Waste-to-Energy plants
- **Motor vehicles rule**: Provisions made by **Ministry of Road Transport and Highways** for usage of biogas (Bio-CNG) in motor vehicles
- **Biogas standards by BIS**- Composition of biogas for applications in engines, automotive ,and piped network

INSTITUTIONAL

- **Implementation bodies** State Nodal Departments/ State Nodal Agencies, KVIC
- Introduction of Eight BDTCs as knowledge hubs for Biogas programmes

Inter Ministerial Policies

Technical Specs and controlling means of organic fertilizer

Composition of biogas for automotive and piped network

Opportunity for bio-toilets, Modern and Scientific Management of MSW paves way for bio-methanation

Generalized tariff for electricity for Biogas based WTE projects, RPO for distribution licensee, issuance of REC

Increased usage & promotion of bio-fuel. Assured offtake of Bio-CNG by OMCs

Bio-CNG permitted for motor vehicles as an alternative to CNG

Guiding Policies

- Fertilizer Control Order
- BIS Standards
- SBM, MSW Handling rules
- CERC guidelines, Electricity Policy
- Bio-Fuel Policy/ SATAT
- Motor Vehicles Act
- Solid Waste Management rules

At source organic waste processing through composting, bio-methanation. Defines role of other ministry

MNRE-Central Coordinating Ministry

Involved Ministry	Usage of Biogas and by products			
	Thermal	Electric	Transport	Organic Manure
MoAFW/ MoCF				✓
MoCA			✓	?
MoUD	✓	✓	✓	✓
MoP		✓	✓	
MoPNG	✓		✓	✓
MoRTH	✓	✓		
MoEF	✓	✓	✓	✓

MoRD, MoCI (PESO), MSME(KVIC), MoF (IREDA,NCEF, NABARD)

Other Supporting Ministries and bodies

Policy Support for Biogas sector

Scale of Biogas plant

1-25 m^3

Region	1 m^3 (Subsidy in INR)	2-6 m^3 (Subsidy in INR)
NE States	17000	22000
General	7500	12000
Toilet linked Biogas Plants	1600 (Additional subsidy)	
Turn-Key Fee (5 year warranty)	2500 per plant (1-10 m^3) 4500 per plant (15-25 m^3)	

National Biogas and Manure Management Program (NBMMP)

3-250 kW

Capacity	Subsidy (in INR)
3-20 kW_{el}	40,000/kW**
20-100 kW_{el}	35,000/kW**
100-250 kW_{el}	30,000/kW**

Biogas Power(Off- grid) Programme (BPP)

For BPP, Thermal Subsidy is 50 % of above rates

***>250 kW

Waste/ Process/ Technology	Subsidy (in INR)
*Bio-CNG from MSW	4 crore/ MWeq (max 10 crore per project
Power generation based on biogas produced from Urban/ Agro Waste or, production of bio-CNG	3 crore/MWeq (max 10 crore/ project)
Only Biogas generation from Urban, Industrial and Agricultural waste/ residue	1 crore/ MWeq (max. 10 crore/ project)
bio-CNG generation from biogas produced from Urban waste/ Agro waste/ Ind. Waste or mix of these	4 crore/MWeq (max. 10 crore/ project)

Programme on Energy from Urban, Industrial and Agricultural Wastes/Residues

**Presently the subsidy amount is 4 cr/ MW_{el}. Prospectively its on cards to increase it to 5 cr/ MW_{el}*
***Rates defined are for SC/SCT and NER states; for general states specific cost is 5000/ kW lesser across all scale*
**** For only cattle dung based projects, limit of > 250 KW holds good*

Agreement /Permissions / licenses need in India

Topics which should be considered regarding permissions for biogas plants:

- Pollution control
- NOC from Municipal corporation or Gram Panchayat
- PESO
- Electricity connection
- Water connection
- Factory license from inspector of factories
- Change of Land of use
- NOC from SEB

Get informed on the permission procedures for your country/area

Involve authorities right from the start

(Consent to Establish & Consent to Operate)

What has to be fulfilled in order to get an approval?

What kind of information is needed?

Challenges in Indian Biogas Industry

	Challenges	Mitigation Strategies
MARKET	• Social Stigma (NIMBY syndrome) • Market for organic manure missing • Nascent Market with limited players	• Promoting Awareness, Reaching last mile with NGOs • Work on amendment to FCO, Dept. of Fertilizer • Awareness building, collaboration with Academic Institutes
OPERATIONS	• Feedstock security/Repeated break in Supply Chain • Non-Segregated waste supply • Availability of Skilled Manpower	• Resource Mapping, emphasis on pre-feasibility • Pan-India adaptation of SWM rules • Capacity Building, Tailor made courses
FINANCE	• Insecurity over business viability • Lack of credibility of customers • Access to loans from FI • Higher capital cost/ payback period	• Securing off-take, roping in OMCs • Due diligence, Certification of players • Priority Sector lending, Innovative Financial Models • Market development, Fostering Industry-Institute Partnership
REGULATIONS	• Inclination towards power based projects • Lack of concrete Standardization • Non Synchronous Centre and State Policies • Lengthier subsidy sanction method of MNRE	• Balance of centralized and decentralized tech. • Expedite development of Indian Standards • Building regional working groups to work on local policies • Performance based Incentives shall induce faster clearances

Indian Biogas Association

Case Study (I)

Project details:
1 MW high-rate bio-methanation plant based on cattle manure

- Location: Haebowal Dairy Complex, Ludhiana, Punjab, India
- Project: **Site Type** : Dairy Complex
- Waste Collection: Collected manually from local Gaushalas
- Digester Type: Intermittently stirred tank reactors based on biogas-induced mixing arrangement
- Gas Storage: 1000 CUM (bell and shell type made of neoprene coated nylon fabric
- Owner: PEDA, Punjab
- Digester Volume: 2X5000 CUM
- Feedstock: Cattle Manure 200 MT/day
- Year of commissioning: Sept, 2004
- System Designer: ENTEC- Austria
- End Use: Power generation

Case Study (II)

Project details:
14000 m^3 Biogas plant from dung, vegetable waste, and press mud

- Location: Umreth, Vadodara, Gujarat
- Site Type: Rural Locality
- Waste Collection: Dung collection from dairy, dicarded potato pulp and press mud from local industries.
- Technology: CSTR based biogas plant, up-gradation facility(MPSA) and CNG filling station

- Owner: Bharat Biogas Energy Limited
- Digester Volume: 2X 6000 m3
- Feedstock: Dung, press mud, and potato pulp
- Year of commissioning: Nov, 2015
- End Use- Bio-CNG for industrial use. Fertilizer processed, conditioned and sold to the market with defined nutrients

Case Study (III)

Project details: 3000 Kg/ Day bio-CNG based on sewerage waste water

- Location: Delawas, Jaipur, India
- Site Type: STP
- Waste Collection: Sewerage waste water from 25Km surrounding
- Technology: Activated Sludge Process with anaerobic Digester and centrifuge unit
- Digester Volume: 2X 3500 m^3
- Owner: Jaipur Municipal Corporation
- Feedstock: 125 MLD sewerage water
- Year of commissioning: July 2010
- System Designer: VA-Tech Wabag
- End Use: 3,000 kg/day from 8,400 m^3/day of Bio-CNG. Captive Power generation from remaining.

Case Study (IV)

Project details:
8000 kg/ day Bio-CNG producing bio-methanation plant based on press mud

- Location: Kolhapur Maharashtra, India
- Site Type: Nearby Sugar processing plants
- Waste Collection: Collected from nearby sugar processing plants and fed through conveyer system
- Technology: Three CSTR type reactors of 3000 m^3 each operating at mesophilic temperature
- Owner: Spectrum Renewable Energy Limited
- Feedstock: 100 TPD press mud and spent wash
- Year of commissioning: 2012
- Gas Storage Capacity: double membrane type of 950 CUM
- End Use: Bio-CNG and Bio Manure

Case Study (V)

Project details:
25 KW decentralized Biogas to Power Project from MSW

- Location: Model Colony, Pune, Maharashtra, India
- Site Type: Urban Locality
- Waste Collection: Wet waste
- Collected by Pune Municipal Corporation from nearby establishments (vegetable markets, hotels, colonies)
- Technology: Two stage digestion with aeration, biogas & leachate recirculation facility
- Owner: Pune Municipal Corporation
- Digester Volume: 200 m^3
- Feedstock: Segregated Organic from MSW (~5 Tons/day)
- Gas Storage: 2 Nos of 75 CUM each in neoprene rubber with enclosure
- Year of commissioning: Nov, 2009
- End Use- Illumination of street lights and organic manure used for horticulture

Conclusion and Take away

- Biogas Plants provide 3 in 1 solution:
  - Biomass waste Treatment Plant, bio-fuel generation Plant and Organic fertilizer production Plant.
- Long history of Biogas in India
- Share of biogas/WtE in Energy mix is extremely low
- Govt. support available across scale of biogas plant
- Solution for India-
  - Mix of centralized and decentralized approach
- Immense opportunities lies in
  - utilizing diverse range of available substrates
  - organic fertilizer production
- Wider spectrum of shareholders
- Ample Success stories for replication across India

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India Expo Mart, Greater Noida

- Biogas
- Waste management
- Bio-mass
- Bio-fuel
- Bio-Ethanol
- Bio-remediation
- Bio-fertilizer
- NGO/NPOs
- Start-ups

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