

# Biomethanation of Biomass

## A complimentary route to Biofuels

By

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# Major problems of India

- Ever soaring fuel-bill
- Fertilizer subsidy
- Lack of Decentralized Infrastructure

# THE SOLUTION

- THE SOLUTION LIES  
WHERE THE PROBLEM  
EXISTS

# SOLUTION IS BIOMETHANATION OF BIOMASS

- THE SOLUTION IS GREEN
- THE SOLUTION IS SUSTAINABLE
- THE SOLUTION REVERSES THE SUPPLY CHAIN OF ENERGY
- IT IS A FEASIBLE SOLUTION

# BIOMETHANATION OF BIOMASS

- PRODUCTS:
- BIOGAS
- BIOCOMPOST

# BIOGAS IS GREEN

- IT IS PRODUCED FROM AGRICULTURAL CROPS WHICH ARE RENEWABLES

# BIOGAS IS CLEAN

- IT'S USE IN COMBUSTION SYSTEMS  
LEAVE MINIMAL EMISSIONS

# BIOGAS GIVES SUSTAINABLE DEVELOPMENT

- BIOMETHANATION CO-PRODUCES BIOCOMPOST WITH BIOGAS:
- BIOCOMPOST WILL GO BACK TO THE SOIL TO COMPLETE THE BIOCYCLE AND SUSTAIN THE SOIL-HUMUS HIGH TO SUSTAIN YIELDS AND GIVE FREEDOM FROM CHEMICAL FERTILIZERS

# AND ABOVE ALL

- THIS ROUTE REVERSES THE SUPPLY CHAIN OF ENERGY AND FERTILIZER (ORGANIC CARBON + MINERALS)

# PRODUCTS

- POWER, STEAM & REFRIGERATION
- COMPRESSED NATURAL GAS
- PIPELINE GAS
- COOKING GAS
  
- CDM BENEFITS
  
- BIOCOMPOST

# IT IS FEASIBLE

Feedstoks	Yield Ton per acre	Biogas Potential M3/ton	Biogas Potential M3/acre, year	Revenue through Biocompost @ 1500/- per ton	Revenue through CDM Benefits	Revenue through CNG at Rs. 20/- per m3	Total Revenue, Rs. per care per year
Sweet Sorghum	187.5	150	28,125	43,500	22,617	56,250	1,22,367
DOC	3	600	1,800	3,845	7,500	18,000	29,345

# FEASIBLE IDEAS FOR ORGANIZED AGRI-SECTOR

- GREEN CNG FOR CANE TRANSPORT
- FREE ALL THE BAGASSE FOR PULP OF NON-WOOD PAPER AND NEWSPRINT (LIKE TNPL, TAMIL NADU)
- GREEN POWER FOR MORE CANE

# INTANGIBLE BENEFITS

- CLEAN CITIES – EMISSION FREE AND BIOSANITATION
- LOCAL EMPLOYMENT POTENTIAL IN RURAL AREAS, WITHOUT NEED FOR UPGRADATION OF SKILLS
- DECENTRALIZED DEVELOPMENT
- PERMACULTURE
  - PREVENTION OF SOIL-EROSION
  - CO<sub>2</sub>-SEQUESTRATION
  - HUMIDITY CONTROL
  - IMPROVEMENT OF LANDSCAPE

# FEEDSTOCKS

- MSW – LEAST COST DISPOSAL
- SWEET SORGHUM / SUDAN GRASS
- MAIZE SILAGE
- DOCs OF NON-EDIBLE OILSEEDS FROM BIODIESEL PROGRAMME AND OF CASTOR
- CANE TRASH / CANE TOPS
- BANANA STALKS / LEAVES

# INDIAN STRENGTHS

- PLANTS (VEGETATION ) ARE THE BEST ENTRAPPERS OF SOLAR ENERGY AND INDIA ENJOYS THE HIGHEST AVERAGE SOLAR FLUX IN THE WORLD
- CLIMATIC CONDITIONS IN MOST OF INDIA ARE CONDUCIVE TO BIOMETHANATION

# INDIAN STRENGTHS

--- CONTD. ---

- CNG VEHICLES (BUSES WITH 110 HP TATA CUMMINS ENGINES, 3-WHEELERS OF BAJAJ AUTO, INDICA WITH PETROL / CNG VERSION) EXIST
- GOBAR GAS PROGRAMME IS THE MOST SUCCESSFUL IN THE WORLD

# PROBLEM OF POWER IN INDIA

- POWER IS THE MOST CRITICAL INFRASTRUCTURE FOR DEVELOPMENT AND IT CAN NOT BE IMPORTED. WE HAVE TO DEVELOP OUR OWN POWER
- CENTRALIZED POWER-PLANTS HAVE LONG GESTATION PERIOD
- T & D LOSSES ARE HIGHEST IN THE WORLD
- POOR QUALITY OF RURAL ELECTRICITY

# PIPED GAS FOR COOKING

- RURAL HOUSE-WIFE SPENDS LONG HOURS FOR COLLECTING FIREWOOD FOR COOKING
- EYE-SORES AND LONG COOKING TIME ARE RESULTS OF WOOD-STOVES
- BLUE-FLAME OF BIOGAS REDUCES THE COOKING TO MERE 3 HOURS (8 HOURS). HOUSEHOLD INCOME SHOOTS UP, CHILDREN'S EDUCATION GOES UP, FAMILY HEALTH IMPROVES
- TURN-THE-KNOB CONVINIENCE FOR QUICK MODULATION

# COLD-CHAIN DEVELOPMENT

- FOOD PRESERVATION IS THE NEED, PROCESSING IS AN EXCUSE
- INDIA IS A WARM-CLIMATE COUNTRY AND FOOD SOILAGE IS THE MAIN CULPRIT FOR THE FOOD NOT REACHING THE PLATE
- GAS-FIRED REFRIGERATORS AND CHILLERS ARE AVAILABLE NOW
- DRY-ICE CAN BE SEPARATED FROM BIOGAS AND USED AS REFRIGERANT

# BIOGAS AS FUEL

- IT IS CLEAN - NO PARTICULATE EMISSIONS, NO NO<sub>x</sub>'s, NO SO<sub>x</sub>'s, NO SULPHUR
- IT IS GREEN – OUR GROWERS CAN “GROW” ENERGY
- HIGH EFFICIENCIES OF POWER-PRODUCTION THROUGH TOPPING (COMBINED) CYCLE
- CAN REPLACE PETROL / DIESEL BY 100%
- HIGH ENERGY DENSITY WHEN CONVERTED TO METHANE – CAN BE PUT INTO NATIONAL GAS GRID

# SUSTAINABLE DEVELOPMENT

BIOCOMPOST IS CO-ENERATED: IT  
GOES BACK TO THE SOILS TO  
SUSTAIN HUMUS AND  
THEREFORE THE AGRICULTURAL-  
YIELDS

REDUCES DEPENDENCE ON  
CHEMICAL FERTILIZERS

# BIOMETHANATION VS. GASIFICATION

- BIOMETHANATION KEEPS THE **BIOCYCLE** INTACT BY RECYCLING CARBON IN BIOASSIMILABLE FORM. GASIFICATION AND COMBUSTION RETURN NOTHING
- BIOGAS HAS HIGH ENERGY DENSITY (5,000 – 8,600 KCAL/M<sup>3</sup>) PRODUCER GAS IS VERY LOW AT 1,100 KCAL/M<sup>3</sup>

# BIOMETHANATION vs. GASIFICATION

---- CONTD. ----

- BIOMETHANATION HAS BENIGN PROCESS CONDITIONS WHEREAS GASIFICATION / COMBUSTION INVOLVE HIGH PRESSURE AND TEMPERATURES (600 – 850 DEG C)
- GASIFICATION / COMBUSTION RELY ON NCV WHICH TAKES YEARS TO BUILD UP. THEREFORE THE RETURNS PER YEAR PER ACRE ARE FEASIBLE FOR BIOMETHANATION

## BIOMETHANATION IS COMPLIMENTARY TO OUR BIODIESEL PROGRAMME

- DEOILED CAKE IS USED, LEAVING THE OIL FOR CONVERSION TO BIODIESEL
- BIOCOMPOST GOES BACK TO THE SOIL COMPLETING THE **BIOCYCLE**

# BIOREFINERY CONCEPT IS FAST CATCHING UP

- TORREFACTION
- PYROLYSIS (ABLATIVE PYROLYSIS)  
CONVERTECH PROCESS
- GASIFICATION
- COMBUSTION
- IFGT (INDIRECTLY-FIRED AIR  
TURBINE)

# WHY “DRY” ANAEROBIC DIGESTION

- “DRY” ANAEROBIC DIGESTION (20% - 60% DS):
  - SMALLER DIGESTER – LOWER INVESTMENTS
  - NO ASSOCIATED COSTS FOR AVAILABILITY OF WATER, TREATMENT OF WASTEWATERS
- DIGESTED MATERIAL IS TAKEN STRAIGHT AWAY FOR SOIL-APPLICATION. VALUE CAN BE IMPROVED FURTHER BY YARD-COMPOSTING

# WHY BEKON ENERGY TECHNOLOGY

- **LOWEST INVESTMENT & OPERATING COST IN THE MARKET**
- **USER FRIENDLY TECHNOLOGY: MODULAR, EASY TO OPERATE & MAINTAIN**
- **CAN ACCEPT THE WHOLE PLANT (VEGETATION) WITHOUT CHOPPING OR MACERATION**
- **BEKON ARE IN THE CHP BUSINESS FOR MORE THAN A DECADE**
- **MUNICH INSTALLATION HAS BEEN OPERATIONAL FOR THE PAST TWO YEARS ON SOURCE-SEPARATED ORGANICS OF MSW**

# TECHNOLOGY @ INDIAN PRICES

- MOJJ ENGINEERING SYSTEMS FOR DETAILED ENGINEERING, PROJECT ENGINEERING, START-UP ASSISTANCE
- **LOCAL PRESENCE:** TAILOR-MADE SOLUTIONS

## BIOGAS POTENTIAL OF A FEW AGRI-RESIDUES / DEDICATED ENERGY CROPS

- DE OILED CAKES 600 m<sup>3</sup>/t
- BANANA STALKS / LEAVES 150 m<sup>3</sup>/t
- ORGANIC FRACTION OF MSW / VFG 100 m<sup>3</sup>/t
- MAIZE SILAGE 180 m<sup>3</sup>/t
- SWEET SORGHUM 150 m<sup>3</sup>/t
- CANE TRASH / TOPS < 400 m<sup>3</sup>/t

# FARM GROWN CLEAN ENERGY

- FARMERS CAN NOW “GROW”, SUSTAINABLY, ALL OUR FUEL AND FERTILIZER JUST AS THEY GROW ALL OUR FOOD, FEED, FIBERS & FIREWOOD.
- URBAN MONEY GOES FOR RURAL DEVELOPMENT

# 1200 kWe POWER + 7.5 ton/hour STEAM FROM CASTOR DOC – A CASE STUDY

	Boiler + Steam Turbine	Boiler + Biogas Engine	Biogas Engine
Output:			
Power, kWe	1200	1200	1200
Steam, ton/hr	7.5	7.5	0
Biocompost, ton/hr	0	0.46	0.46
Input:			
Castor DOC, ton/hr	1.69	0.88	1.38
Water	2.25	2.25	0

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**THANK YOU !**