Power Generation

Based on

Biomethanation of Cattle Dung

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INTRODUCTION

- **HAEBOWAL DAIRY COMPLEX**
- **WTE PLANT**
- **POSSIBILITY OF TRANSFERRING GENERATED POWER TO GRID**

HAEBOWAL WTE PLANT

- **235 TPD of Cattle Dung**
- **10,000 m^3/day Biogas**
- **Biogas Used to Generate Electricity (1MW)**
- **Approx. 15% of Power Used in Plant, Rest Exported to Grid**

Haebowal Plant Contd.

- **35-40 TPD Biofertilizer**
- **Treated Water Recycled / Used for Irrigation**
- **Plant Fully Automated and SCADA Controlled**
- **‘Best Green Plant in Asia’ Award of Asian Power Awards 2007**

SECTIONS IN WTE PLANT

- **Feed Preparation**
- **Biomethanation**
- **Power Generation and Distribution**
- **Effluent Treatment and Biofertilizer**

FEED PREPARATION SECTION

- **Collection of Cattle Dung**
- **Mixing with Water**
- **Size Reduction of Solids**

BIOMETHANATION SECTION

- **Anaerobic Digesters**
- **Biodesulphurization Unit**

ANAEROBIC DIGESTERS

- **Conversion of Organic Waste into Biogas**
- **Temperature: 37-39 ^{o}C**

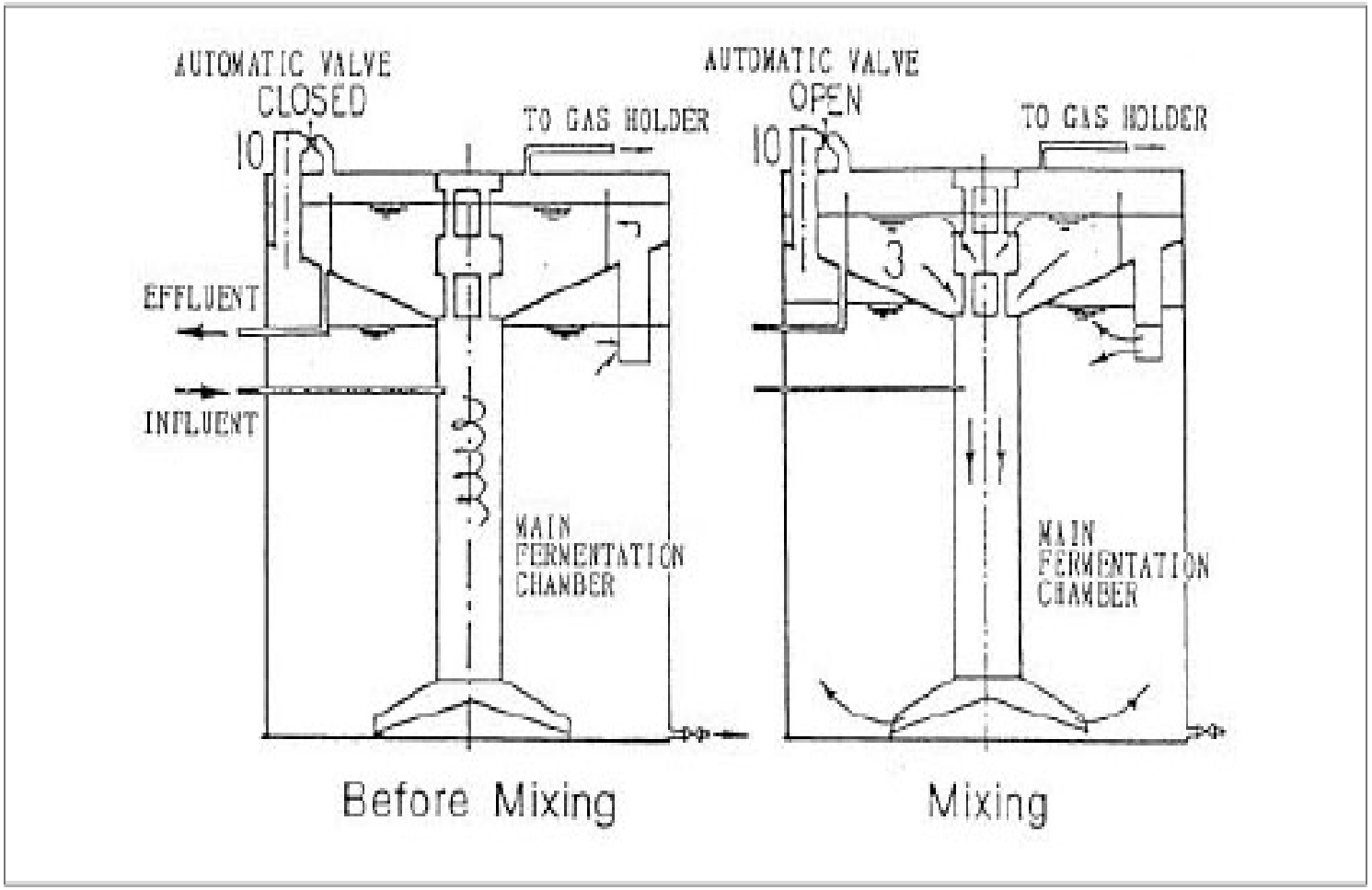
BIODESULPHURIZATION UNIT

- **Removal of H_2S from Biogas**
- **Use of *Thiothrix* or *Thiobacillus* Aerobic Bacteria**
- **Nutrients and Trace Elements Provided by Digested Substrate**

ANAEROBIC DIGESTER

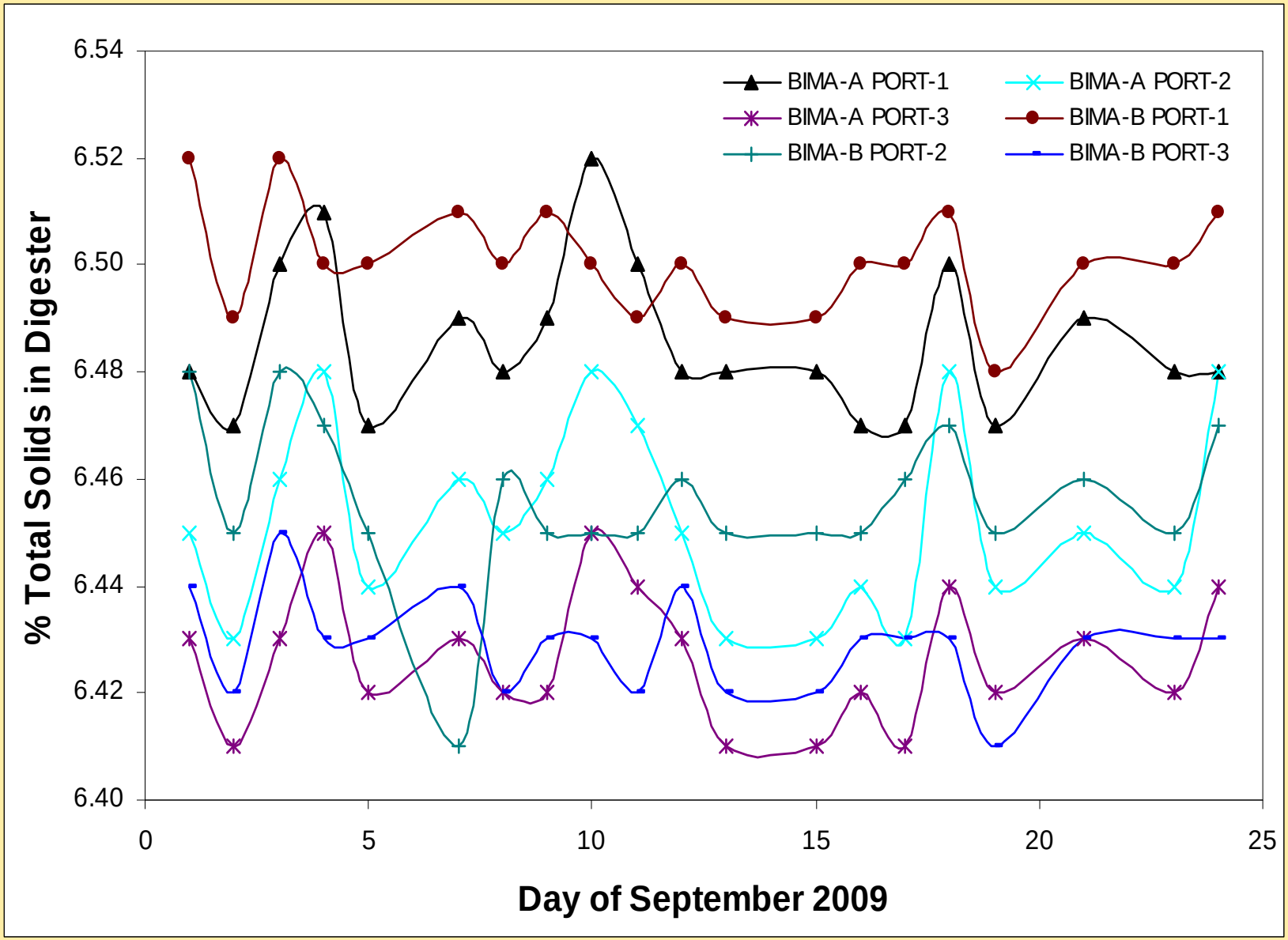
- Patented Design of Entec, Austria
- Mixing of Substrate Through Biogas Induced Mixing
- Conversion Efficiency : 50 – 55 %
- Biodesulphurzation Unit
- Complex Design with Sophisticated Instrumentation and Control System

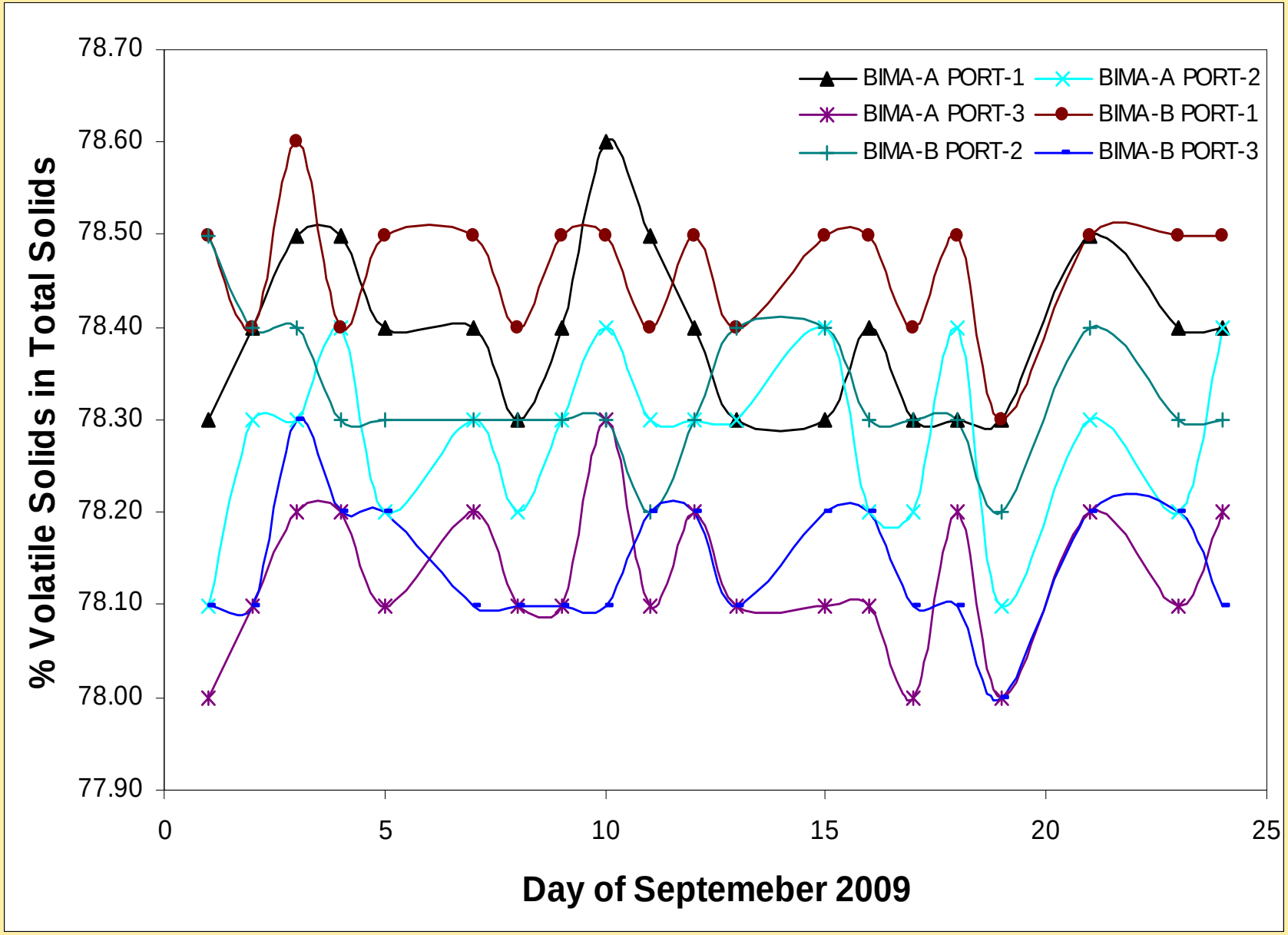
WORKING PRINCIPLE OF ANAEROBIC DIGESTER

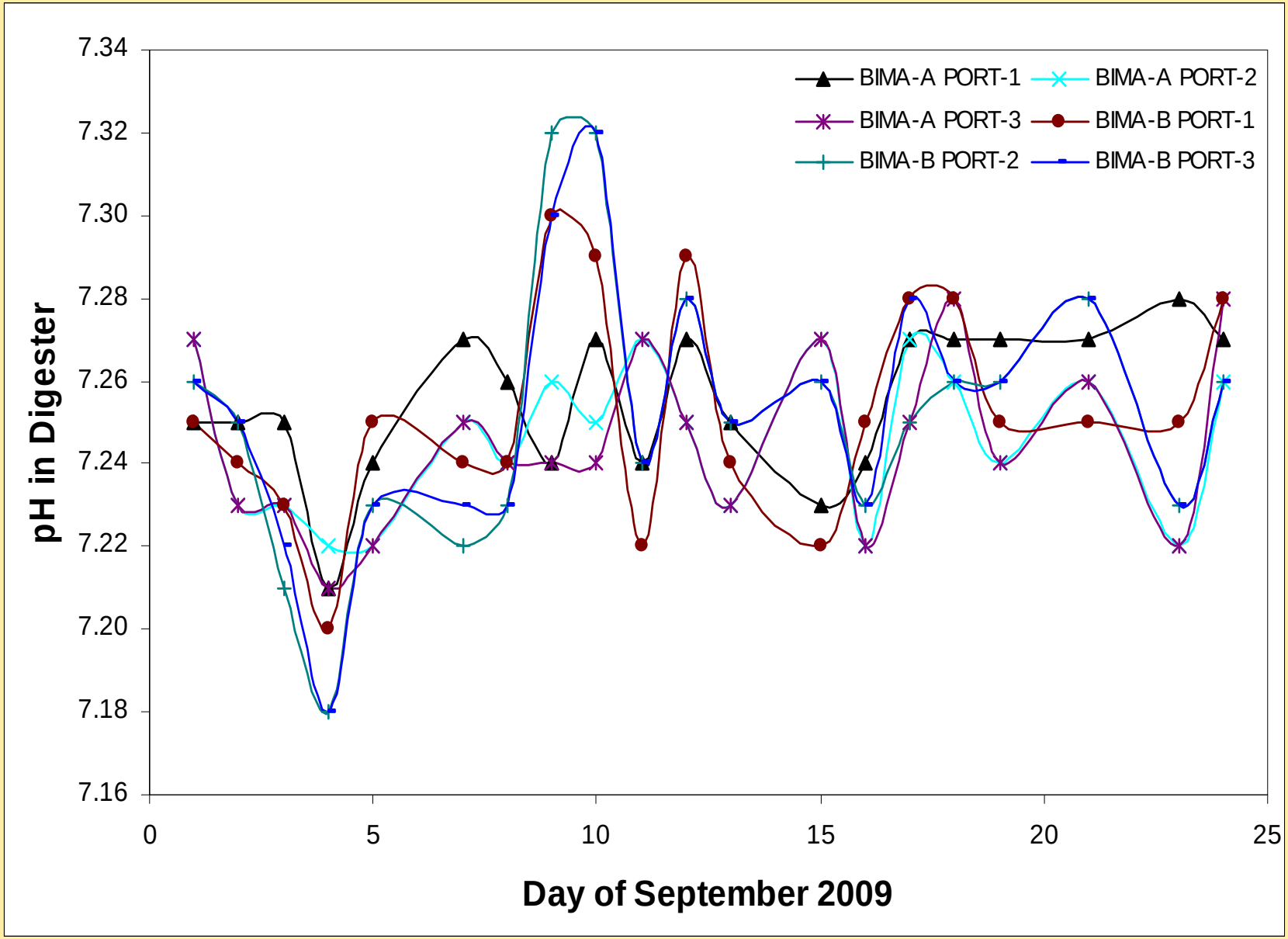


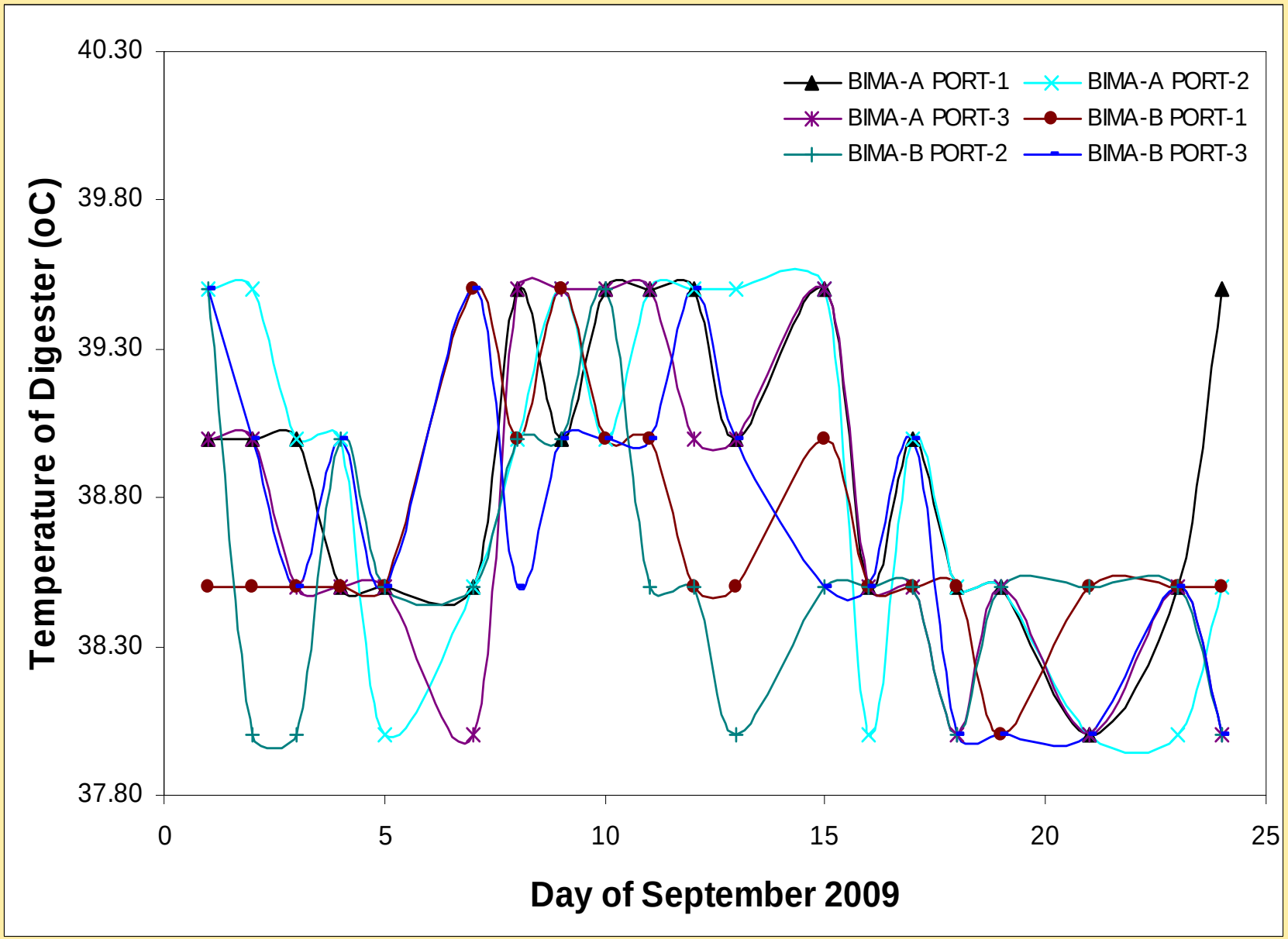
PERFORMANCE ANALYSIS OF ANAEROBIC DIGESTERS

- **Digesters : 2**
- **Working Volume : 5000 m^3 (each)**
- **Diameter : 20 m**
- **Height : 20 m**

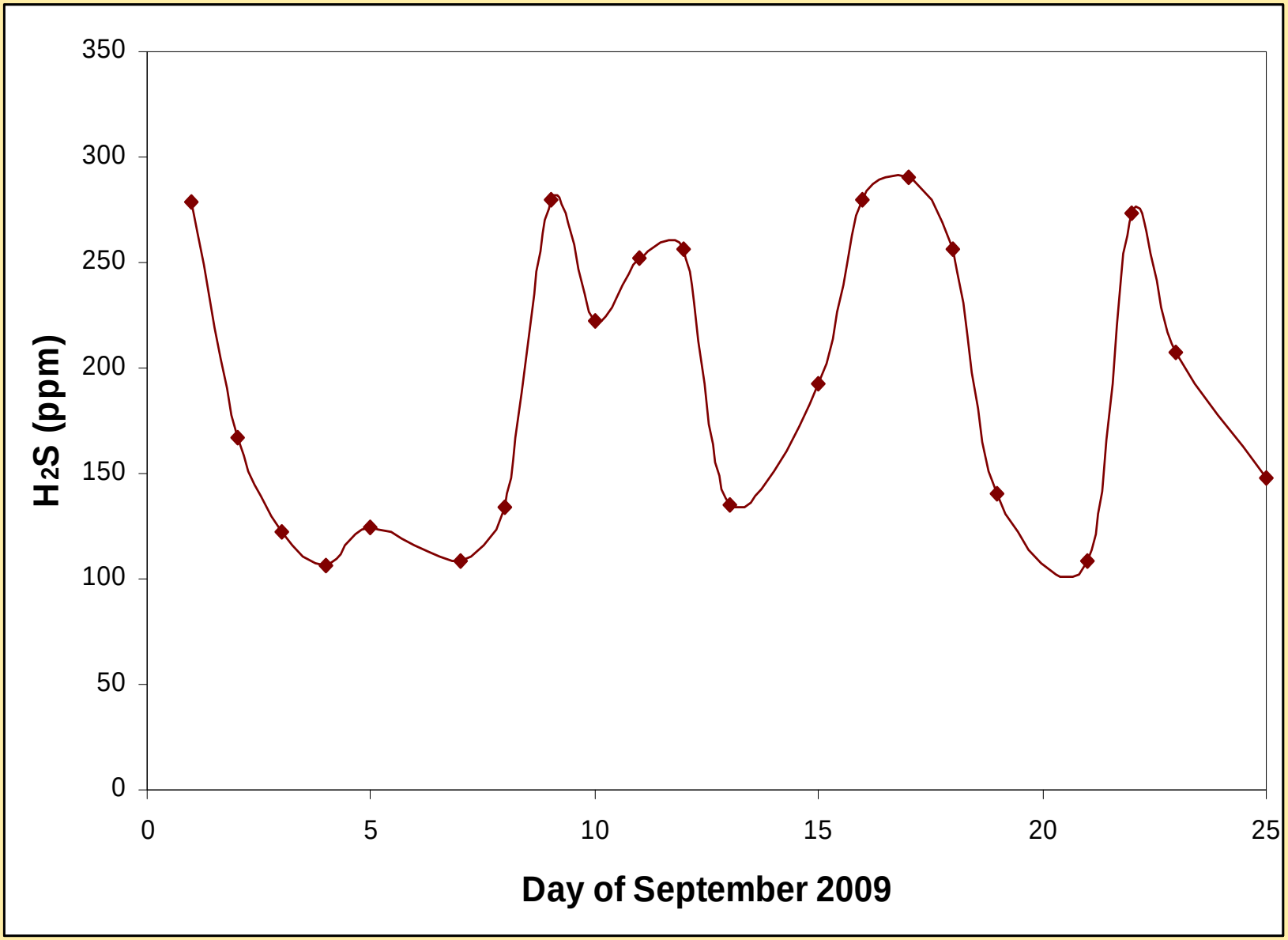

BIMA-A PORT-1
BIMA-A PORT-2
BIMA-A PORT-3
BIMA-B PORT-1
BIMA-B PORT-2
BIMA-B PORT-3
% Total Solids in Digester
6.54
6.52
6.50
6.48
6.46
6.44
6.42
6.40
0
5
10
15
20
25
Day of September 2009


78.70
78.60
78.50
78.40
78.30
78.20
78.10
78.00
77.90
% Volatile Solids in Total Solids
0
5
10
15
20
25
Day of Septemeber 2009
BIMA-A PORT-1
BIMA-A PORT-2
BIMA-A PORT-3
BIMA-B PORT-1
BIMA-B PORT-2
BIMA-B PORT-3


7.34
7.32
7.30
7.28
7.26
7.24
7.22
7.20
7.18
7.16
pH in Digester
0
5
10
15
20
25
Day of September 2009
BIMA-A PORT-1
BIMA-A PORT-2
BIMA-A PORT-3
BIMA-B PORT-1
BIMA-B PORT-2
BIMA-B PORT-3


BIMA-A PORT-1
BIMA-A PORT-2
BIMA-A PORT-3
BIMA-B PORT-1
BIMA-B PORT-2
BIMA-B PORT-3
Temperature of Digester (oC)
40.30
39.80
39.30
38.80
38.30
37.80
0
5
10
15
20
25
Day of September 2009

ANAEROBIC DIGESTERS AND GAS HOLDER


350
300
250
200
150
100
50
0
H2S (ppm)
0
5
10
15
20
25
Day of September 2009

CONCLUDING REMARKS FOR ANAEROBIC DIGESTER

- **Thorough Mixing Achieved**
- **Removal of Scum and Sediments Possible**
- **Conversion : Approx. 50 %**
- **H_2S Removal : < 300 ppm**

POWER GENERATION AND DISTRIBUTION SECTION

Biogas Storage

- A Gas Holder of 1000 m^3 Capacity Provided
- Synthetic Membrane (Polyester) Gas Holder Suspended in a Concrete Silo
- Gas Holder Buffers the Differences Between Gas Production and Gas Consumption

BIOGAS ENGINE

- **Converts Biogas into Electricity**
- **Efficiency of the Gas Engine : 37%**

ELECTRICITY SUB-STATION

- A Portion (Approx.15%) of Electrical Energy Used for In-house Power Requirement
- Balance Successfully Transferred to the Grid
- A Low Tension Supply also Arranged for Plant Power Requirement During Startup or in Case of Break Down of Gas Engine

BIOFERTILIZER AND EFFLUENT TREATMENT SECTION

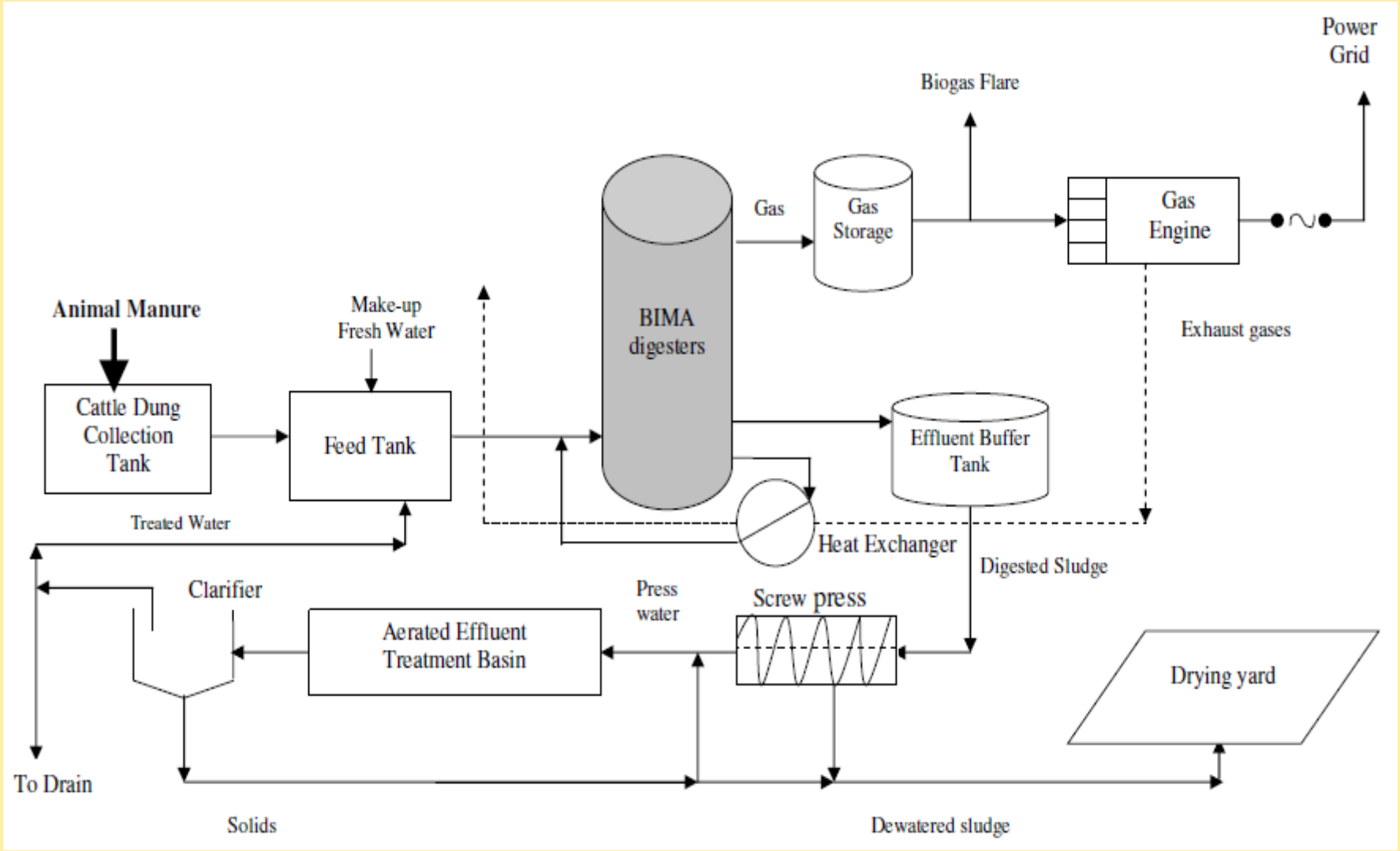
BIOFERTILIZER

- The Digested Substrate Dewatered in Screw Presses
- Sufficient Area Provided to Dry the Dewatered Solid Residue
- Solid Residue Almost Free of Odour and Contains Nutrients

EFFLUENT TREATMENT PLANT

- **BOD/COD Concentration of Press Water Quite High and can not be Discharged Directly**
- **Treated in an ETP by Using Activated Sludge Process**

Process Flow Sheet
Haebowal WTE Plant



SUGGESTED MODIFICATIONS

Addition of One More Feed Mixing Tank

- Required to Check the Flow of Silt / Sand, Syringes etc.

Biogas Engine

- Two Biogas Engines, Each of 0.5 MW Capacity instead of One Engine of 1 MW

CONCLUDING REMARKS

- **Power Generation Based on Biomethanation of Cattle Waste is Possible at Large Scale**
- **Successful Transfer of Generated Power to the Grid**
- **Technology and Design of Such Projects are Indigenously Available**

THANKS