

Development & Implementation of RE Projects: Private Sector Experience on Biomass Energy



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President & CEO Full Advantage Phils, International

InterContinental Hotel, 4 December 2015



About Our Company

Experience the *Full Advantage* of...

COMPETENT SERVICE AT ITS BEST



Your business partner and solutions provider in the field of sustainable energy and environment

- ◆ **A**dvisory and Consulting
- ◆ **B**usiness/Project Development
- ◆ **C**limate Change Activities

Sub-sectors:

- ✓ Renewable energy and rural electrification
- ✓ Cogeneration and decentralized energy systems
- ✓ Biogas production and energy recovery from wastewater, landfill and MSW
- ✓ Energy efficiency
- ✓ Biofuels
- ✓ Climate Change and Greenhouse Gas (GHG) mitigation activities

Our Service, Your Advantage.

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Immediate Drivers of Bioenergy Development

1. GHG Emission Reduction
2. Power Supply-Demand

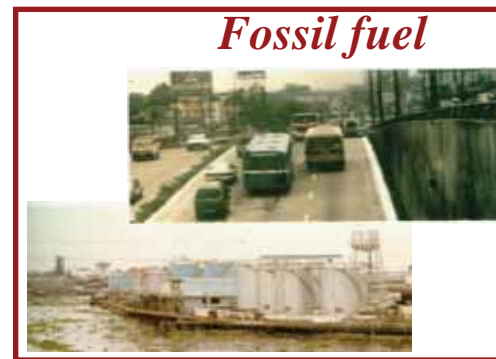
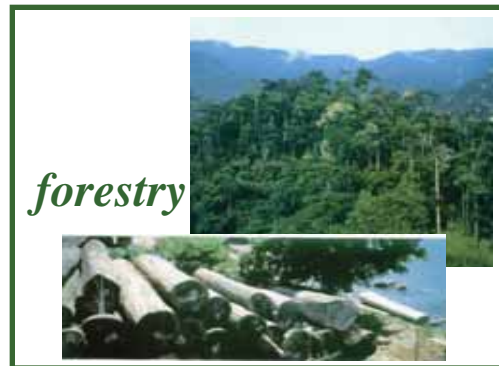
1. Human Sources of GHG Emissions

Carbon Dioxide (CO₂) – Most prevalent GHG

Methane (CH₄) – 2nd most common, 21x the potency of CO₂

Nitrous Oxide (N₂O) – 310x the potency of CO₂

Other Gases – HFCs, PFCs, and SF₆ = range 600 – 23900x potency of CO₂

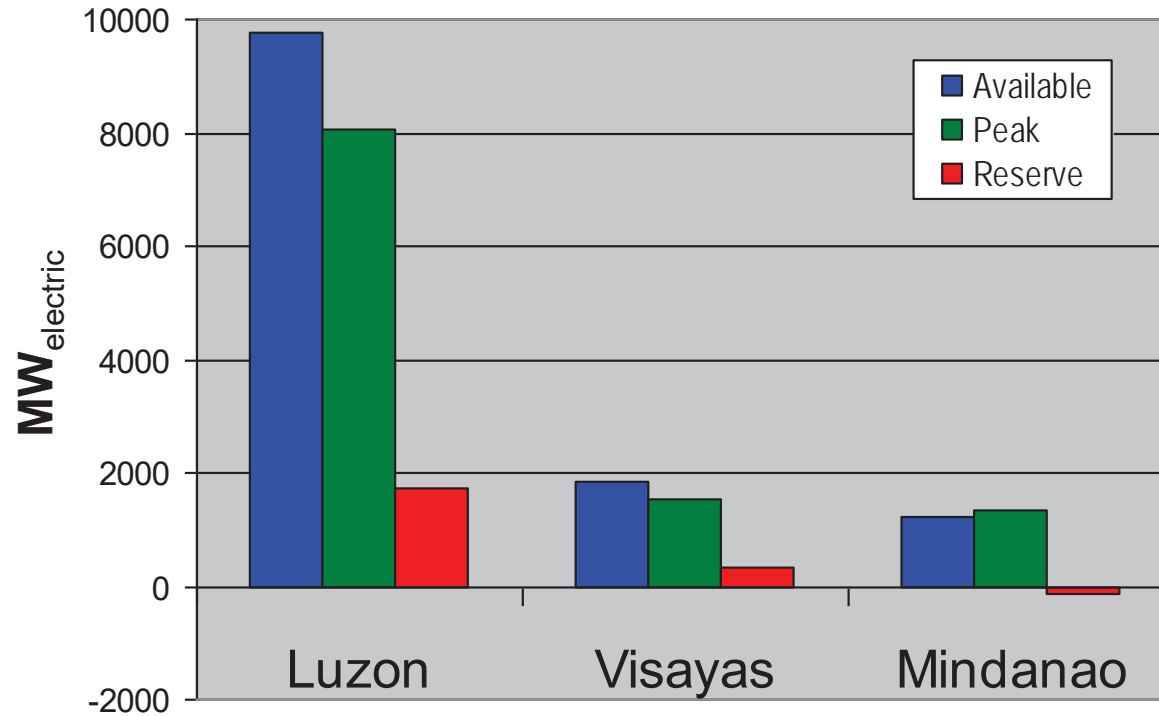


Environmental Advantage:

- Less GHG Emissions by 2,000~4,000 tCO₂e/MWe
- Less pollution to land, air and water
- Compliance to existing laws
(Solid Waste, Clean Air, Clean Water, etc.)
- Conformance to local & global standards



2. Power Supply-Demand



Note: Demand is based on 12 noon Day Ahead Projection of WESM

MWe	Luz	Vis	Min
Available Capacity	9,774	1,851	1,229
Peak Load	8,044	1,518	1,356
Gross Reserve	1,730	333	-127

Source: NGCP website as of 24 Nov 2015

Feed-In Tariff Rates

RE	ERC	Digression
Wind	PhP 8.53, ?	0.5% after 2 y
Biomass	PhP 6.63	0.5 after 2 y
Solar	PhP 9.68, 8.69, ?	6% after 1 y
Hydro	PhP 5.90	0.5 after 2 y

FIT payment guidelines

ERC Res #24, s 2013

FIT rate

ERC Res # 10, s 2012

FIT rules

ERC Res #16, s 2010

BIOMASS

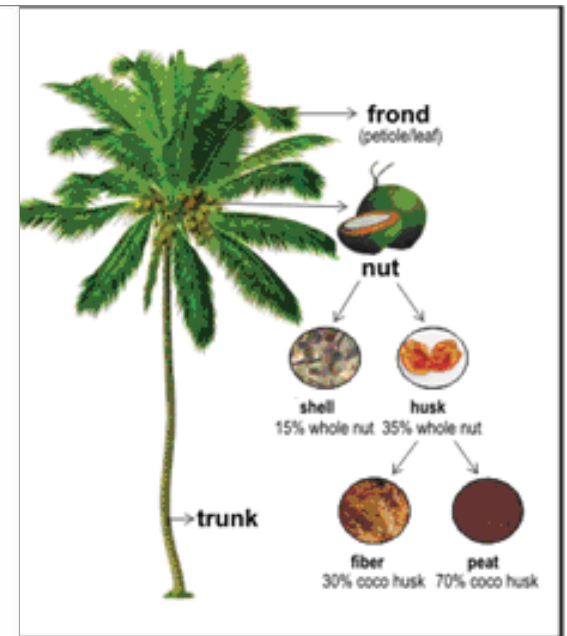
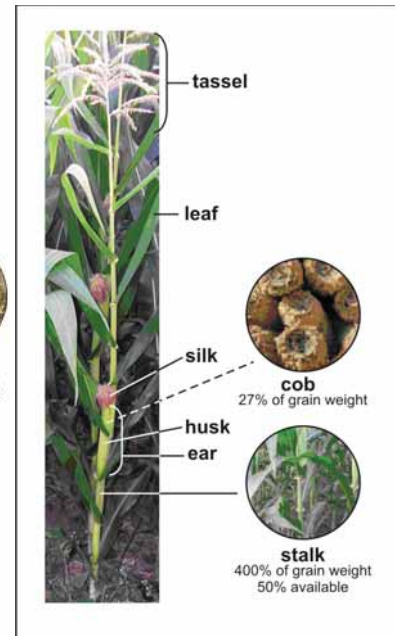
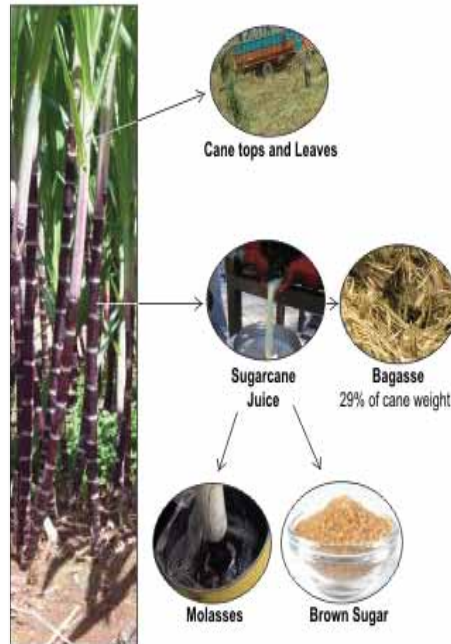
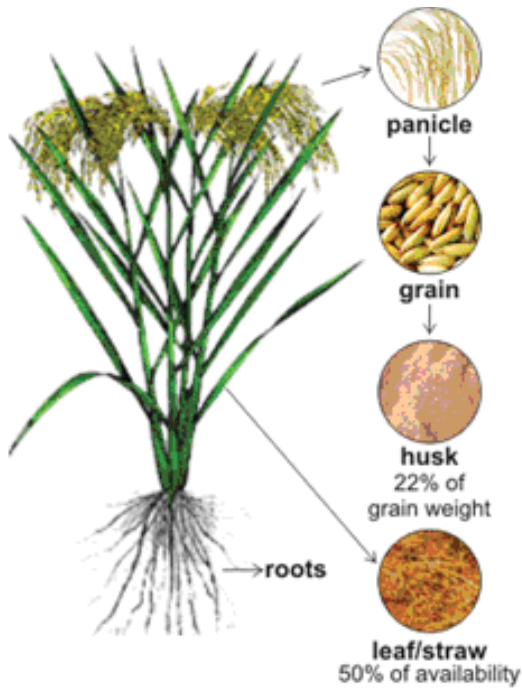


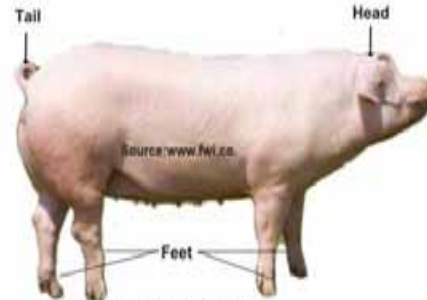
Legal Definition: RA 9513 (Sec. 4b)

- Non-fossilized biodegradable organic materials
- Originating from naturally occurring or cultured plants, animals & microorganisms include agri/by-products, residues (RA 9513, Sec. 4b)
- rice hull/straw, corn cob/stalk,
- sugarcane bagasse, trash,
- coconut husk/shell, frond
- animal manure: poultry, piggery, etc.
- biodegradable industrial/municipal wastes
- energy crops: napier grass, sweet sorghum, bamboo

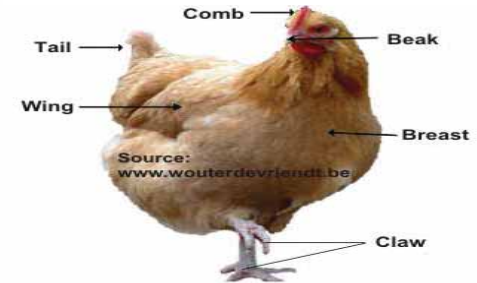


Fuel Source: Dry Biomass



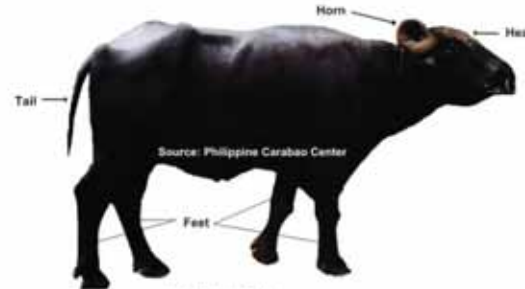


Average Live Weight = 100 kg
Daily manure = 2% of live weight
Slaughter Wastewater = 113 Liters/head
Slaughter Solidwaste = 3% of total live weight



Average Live Weight = 1.5 kg
Daily manure = 4.5% of live weight
Slaughter Wastewater = 10 Liters/head
Slaughter Solidwaste = 6% of total live weight

FUEL SOURCE: Wet Biomass



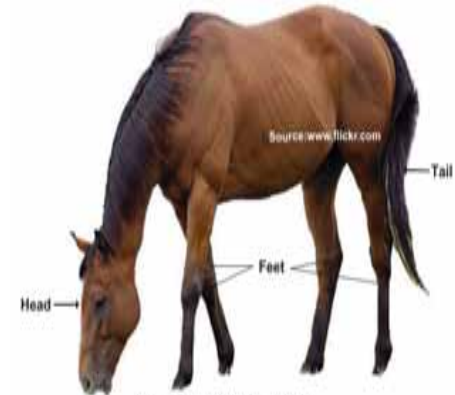
Average Live Weight = 500kg
Slaughter Wastewater = 227 Liters/head
Slaughter Solidwaste = 16% of total live weight



Average Live Weight = 193 kg

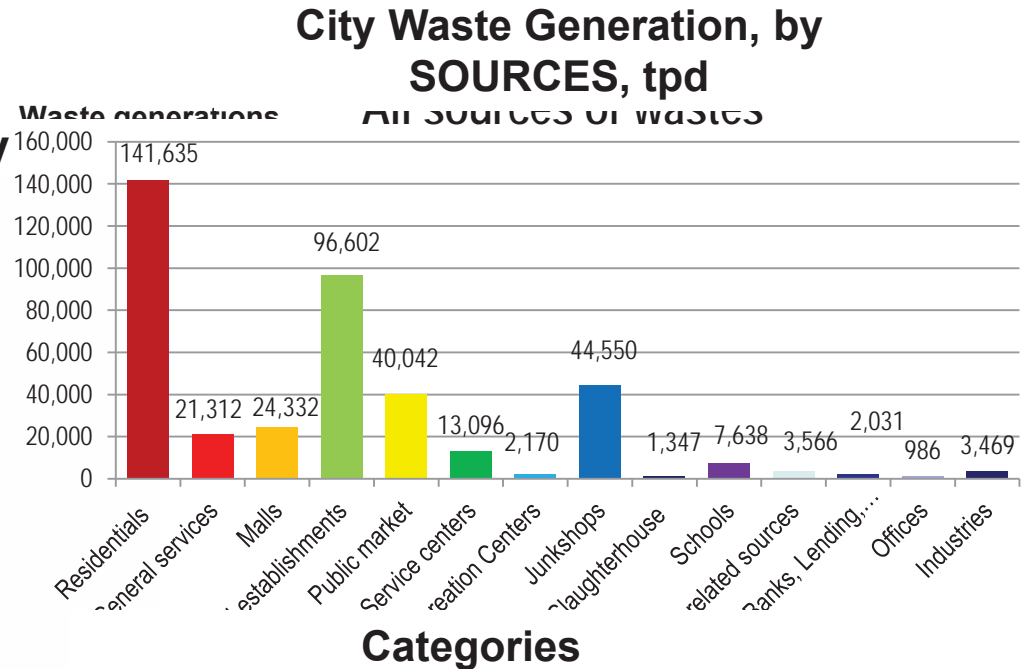
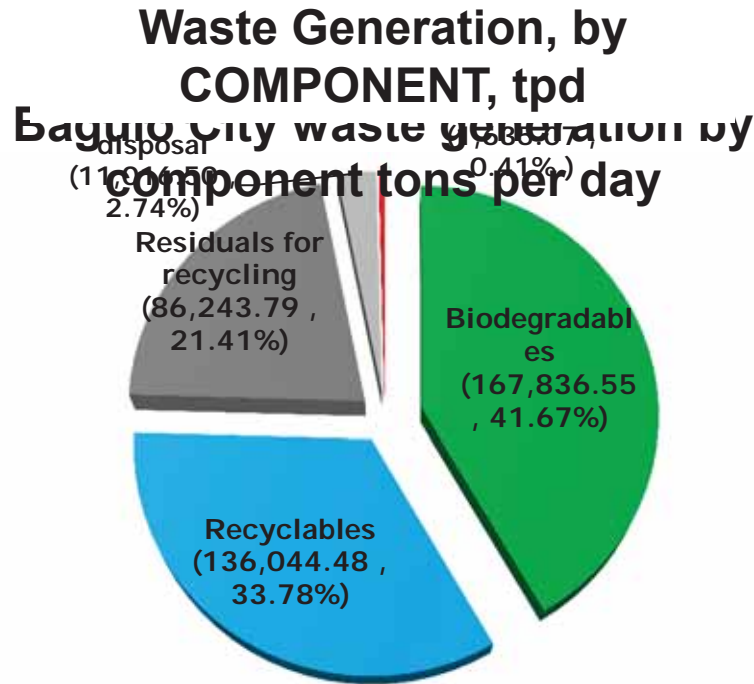


Average Live Weight = 70 kg
Slaughter Wastewater = 56 Liters/head
Slaughter Solidwaste = 3% of total live weight



Average Live Weight = 600 kg
Slaughter Wastewater = 189 Liters/head
Slaughter Solidwaste = 15% of total live weight

MSW: Most Sustainable Feedstock



Source: Baguio City SWM Plan, 2015

DENR Administrative Order No. 2010-06



Republic of the Philippines
Department of Environment and Natural Resources
Visayas Avenue, Diliman, Quezon City
Tel. Nos. (632) 929-66-26 to 29 • (632) 929-62-52
Website: <http://www.denr.gov.ph> / E-mail: web@denrgov.ph



DENR ADMINISTRATIVE ORDER No. 2010-06

SUBJECT: GUIDELINES ON THE USE OF ALTERNATIVE FUELS AND RAW MATERIALS IN CEMENT KILNS

Pursuant to the provisions of Executive Order No. 192, series of 1987, Republic Act 6969 otherwise known as the "Toxic Substances and Hazardous and Nuclear Waste Control Act of 1990" and its Implementing Rules and Regulations, Republic Act 8749 otherwise known as the "Philippine Clean Air Act of 1999" and its Implementing Rules and Regulations, and Republic Act 9003 otherwise known as the "Ecological Solid Waste Management Act of 2000" and its Implementing Rules and Regulations, the following guidelines on the use of alternative fuels and raw materials in cement kilns are hereby promulgated for the guidance of all concerned:

Section 1. Basic Policy. These guidelines adhere to the policy of the government to regulate, use and dispose of hazardous substances and wastes as stipulated in RA 6969, promote compliance to emissions standards as contained in RA 8749 and advocate resource recovery as specified in RA 9003.

Section 2. Scope and Coverage. These guideline set the registration and permitting requirements, standards and procedures on co-processing of alternative fuels and raw materials (AFR) for clinker for cement production, which include among others, the following:

- a) Waste delivery control;
- b) Waste acceptance criteria;
- c) Occupational health and safety requirements;
- d) Co-processing operations;
- e) Emission limits and monitoring;
- f) Documentation and reporting; and
- g) Enforcement of standards and requirements

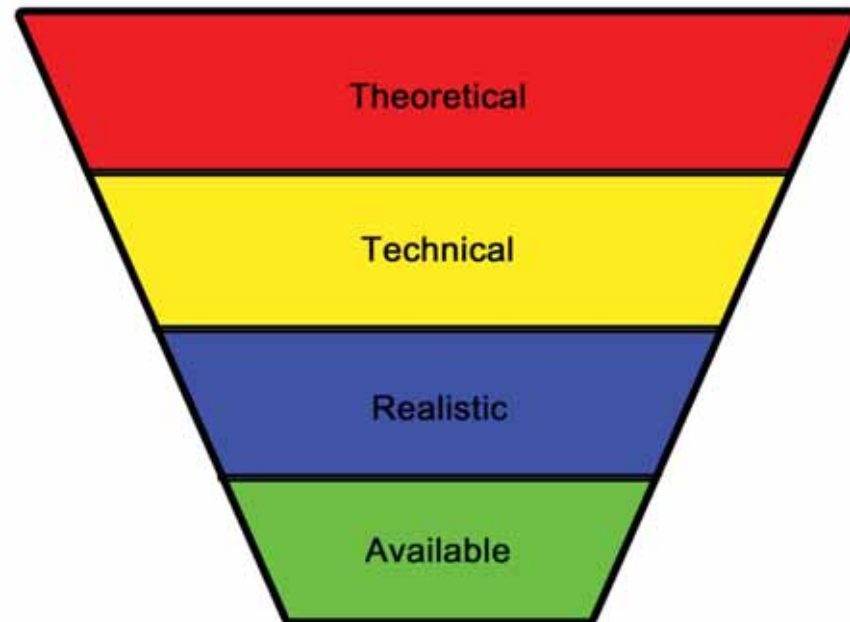
Section 3. Definition of Terms. For the purpose of these guidelines, the following terms are hereby defined:

- a) **Alternative fuels** refer to non-traditional fuels, such as waste materials, that provide thermal energy in the production of cement.



One Challenge: Biomass Collection/Consolidation?

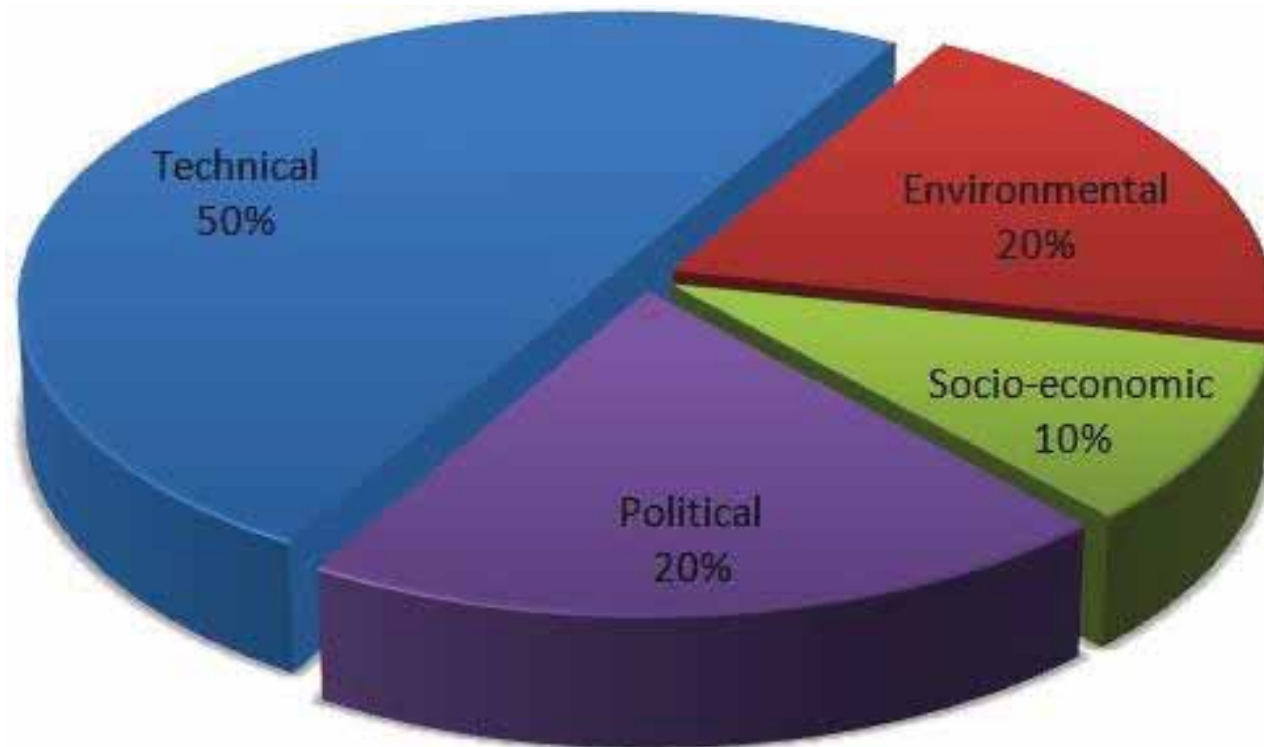
FRACTIONAL
Biomass/WTE
Potential



Biomass/MSW Sustainability Indicators

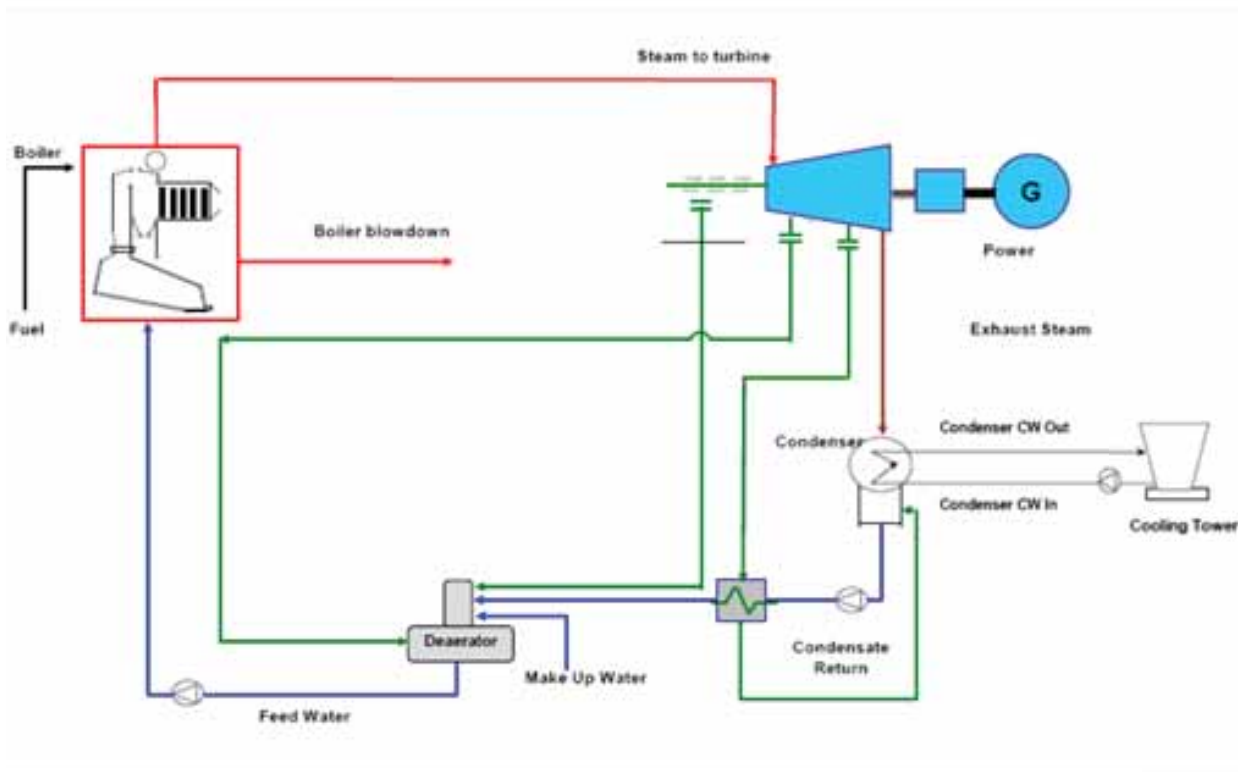
1. AVAILABILITY and sustainability of biomass/MSW feedstock materials for power generation
2. PRICING of biomass/MSW feedstock
2. DISTANCE of power plant from feedstock sources
3. ENVIRONMENTAL, Health and Safety Compliance of the whole facility

CRITERIA for Project Site Selection

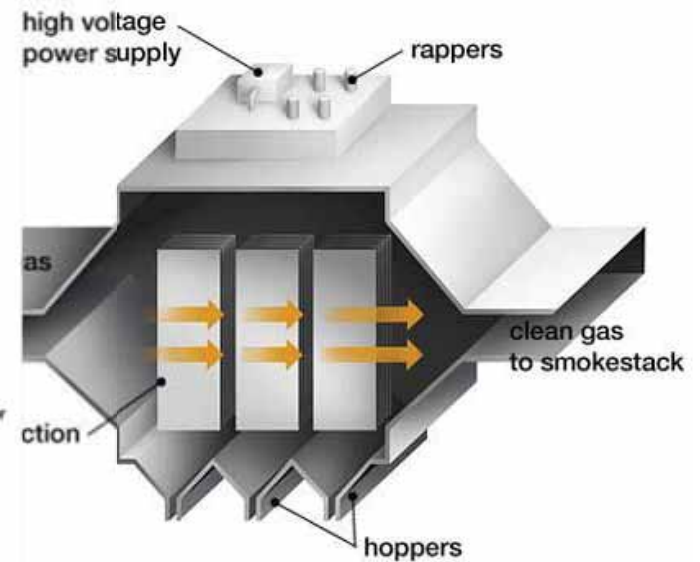


Biomass/WTE Facilities are Clean!

- Pollution Control System (ESP)
- Water Treatment System (demineralization)
- Steam Turbine-Genset (re-circulating water)



Steam Thermal Cycle, BTG



Example: Flue Gas Emission
(Particulate Matter, PM₁₀)
controlled by ESP

By-Product: Organic Fertilizer Production



**Biochar/
Ash**

**Agricultural
Uses**

**Industrial
Uses**

**Soil Reformer
Or Fertilizer**

**Soils For Seed-Beds
And Flower Pots**

Replenishing Silica

Softening Soil

High Water Retention

Reforming Acid Soil

Protecting Against
Disease

Paddy

Vegetables, Fruits,
Flowers

Deodorizer / Purifier

Heat Insulation of Steel

Humidity Regulator

Inclusive Drivers of Bioenergy Development: Business Perspective

1. **POLICY**, laws, rules, and regulations
2. **PRICING** biomass feedstock
3. **PERMITTING** and licensing procedures
4. **POLITICS**: favorable environment
5. **PROFIT** for all (LGU & community)
6. **PATIENCE** capital
7. **Faith**



DOE Approved RE Projects: Grid-Use



RESOURCES	AWARDED PROJECTS		POTENTIAL CAPACITY MW		INSTALLED CAPACITY MW	
	Grid-Use	Own-Use	Grid-Use	Own-Use	Grid-Use	Own-Use
Hydro Power	343	1	7,390.42	1.50	139.49	-
Ocean Energy	7	-	26.00	-	-	-
Geothermal	43	-	750.00	-	1,906.19	-
Wind	51	1	1,168.00	2.187	426.90	-
Solar	93	12	2,544.81	6.42	131.90	1.90
Biomass	40	25	249.07	5.80	191.55	152.93
Sub-Total	577	39	12,128.30	10.107	2,796.03	154.83
TOTAL	616		12,138.41		2,950.86	

DOE Approved RE Projects: Own-Use

RESOURCES	PENDING PROJECTS		POTENTIAL CAPACITY MW		INSTALLED CAPACITY MW	
	Grid-Use	Own-Use	Grid-Use	Own-Use	Grid-Use	Own-Use
Hydro Power	191	-	2,696.37	-	176.11	-
Ocean Energy	2	-	-	-	-	-
Geothermal	2	-	60.00	-	-	-
Wind	11	-	240.00	-	-	-
Solar	61	-	2,001.55	-	-	-
Biomass	5	-	33.90	-	1.00	-
Sub-Total	272	-	5,031.82	-	177.11	-
TOTAL	272		5,031.82		177.11	

Source: DOE website, as of 31 Oct 2015



Example of RE Biomass Project: 1

iPower



12 MWe Rice Husk-Fired Power Plant

San Jose City,
Nueva Ecija

Investment:

US\$ 25 M

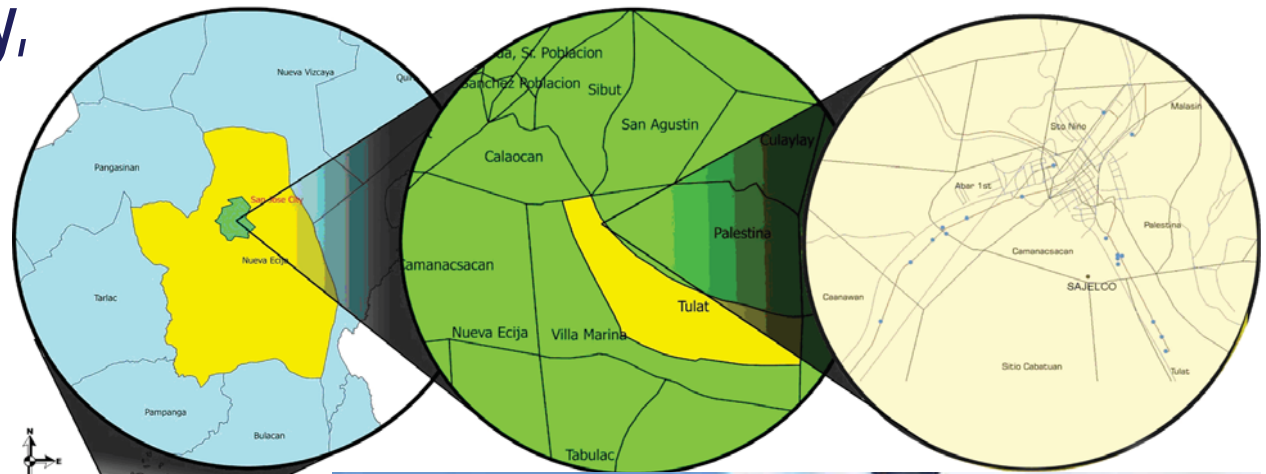
Equity: 20%

Loan: 80% BDO

Groundbreaking: Oct 2012

COD: Dec 2014

GHG ER Potential: 30,000 tCO₂/y





ISABELA BIOMASS ENERGY CORPORATION

Example of RE Biomass Project: 2



20 MWe Rice Husk-Fired Power Plant Burgos, Alicia, Isabela

Investment: US\$ 40 M

Equity: 20%

Loan: 80% BDO

GHG ER Potential: 42,976 tCO₂/y

Groundbreaking: March 2013

COD: October 2015



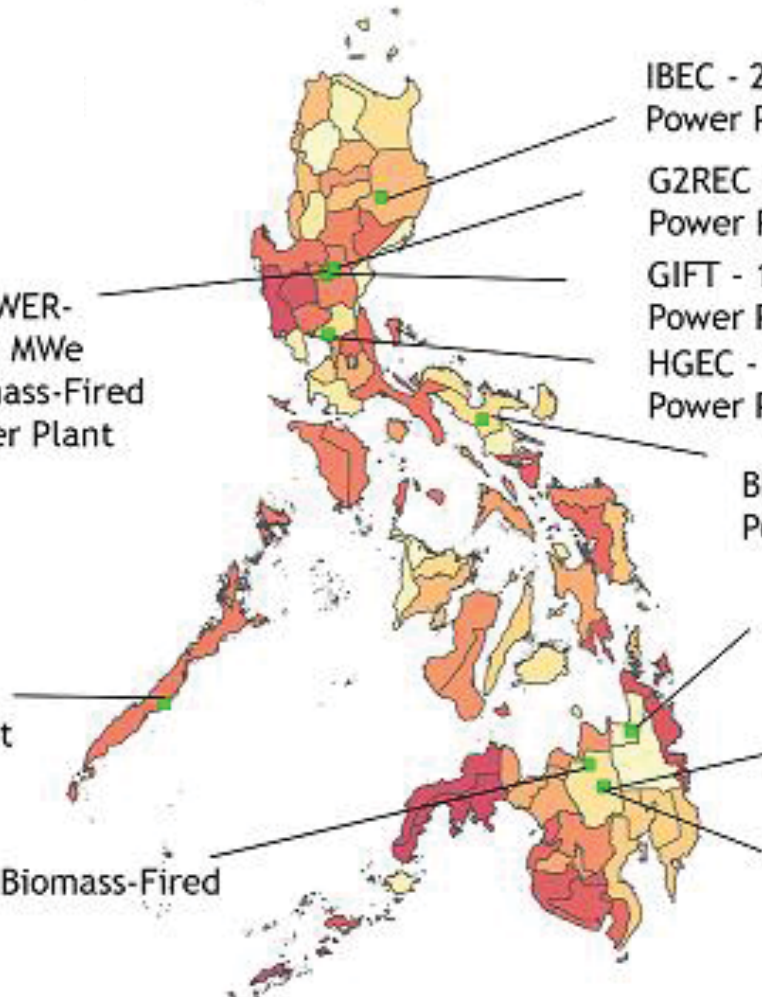
Involvement of our Company in RE Projects



I-POWER-
2X12 MWe
Biomass-Fired
Power Plant

CPREC - 6.5 MWe
Biomass-Fired Power Plant

MAFRECO - 12 MWe Biomass-Fired
Power Plant



IBEC - 20 MWe Rice Husk-Fired
Power Plant

G2REC - 12 MWe Biomass-Fired
Power Plant

GIFT - 12 MWe Rice Husk-Fired
Power Plant

HGEC - 12 MWe Rice Husk-Fired
Power Plant

BBEC - 5 MWe Rice Husk-Fired
Power Plant

BREC - 12 MWe Biomass-Fired
Power Plant

MREC - 12 MWe Biomass-Fired
Power Plant

MBEC - 12 MWe Biomass-Fired
Power Plant



Renewable Energy is a Sunrise Industry!