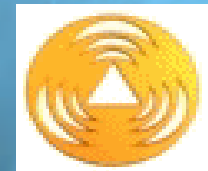




# Converting Agricultural Waste Biomass into Resource The Philippines Case



UNEP-DTIE-IETC in partnership with  
Development Academy of the Philippines





Largest province in Central Luzon Region; highest rice-producing province in the country



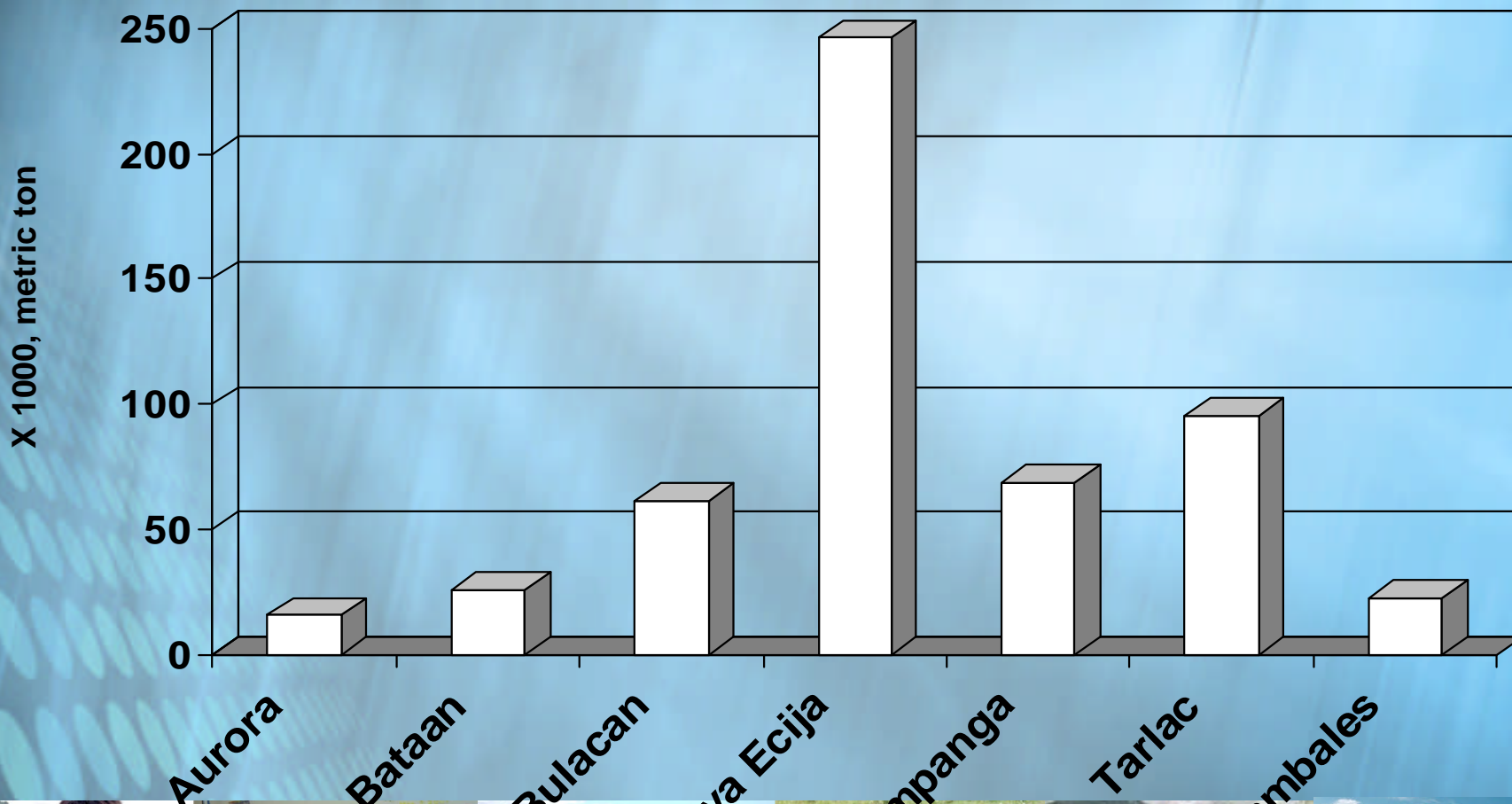
Cabiao has 5,749.90 has. (436,364 cavans @ 95 cavans per hectare)

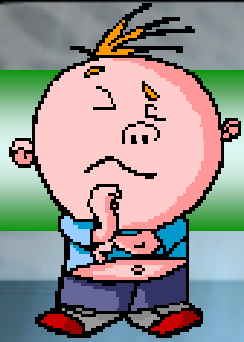
Rice straw: 209MT (2009)

# Biomass Resources in Region 3



# Rice hull production in Central Luzon for the year 2006

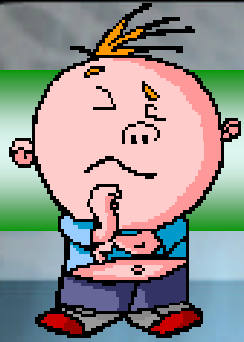




# Rice as Biomass Resource

- Abundant sources of rice straw and rice hull but under-utilized





# Rice Straw in Cabiao

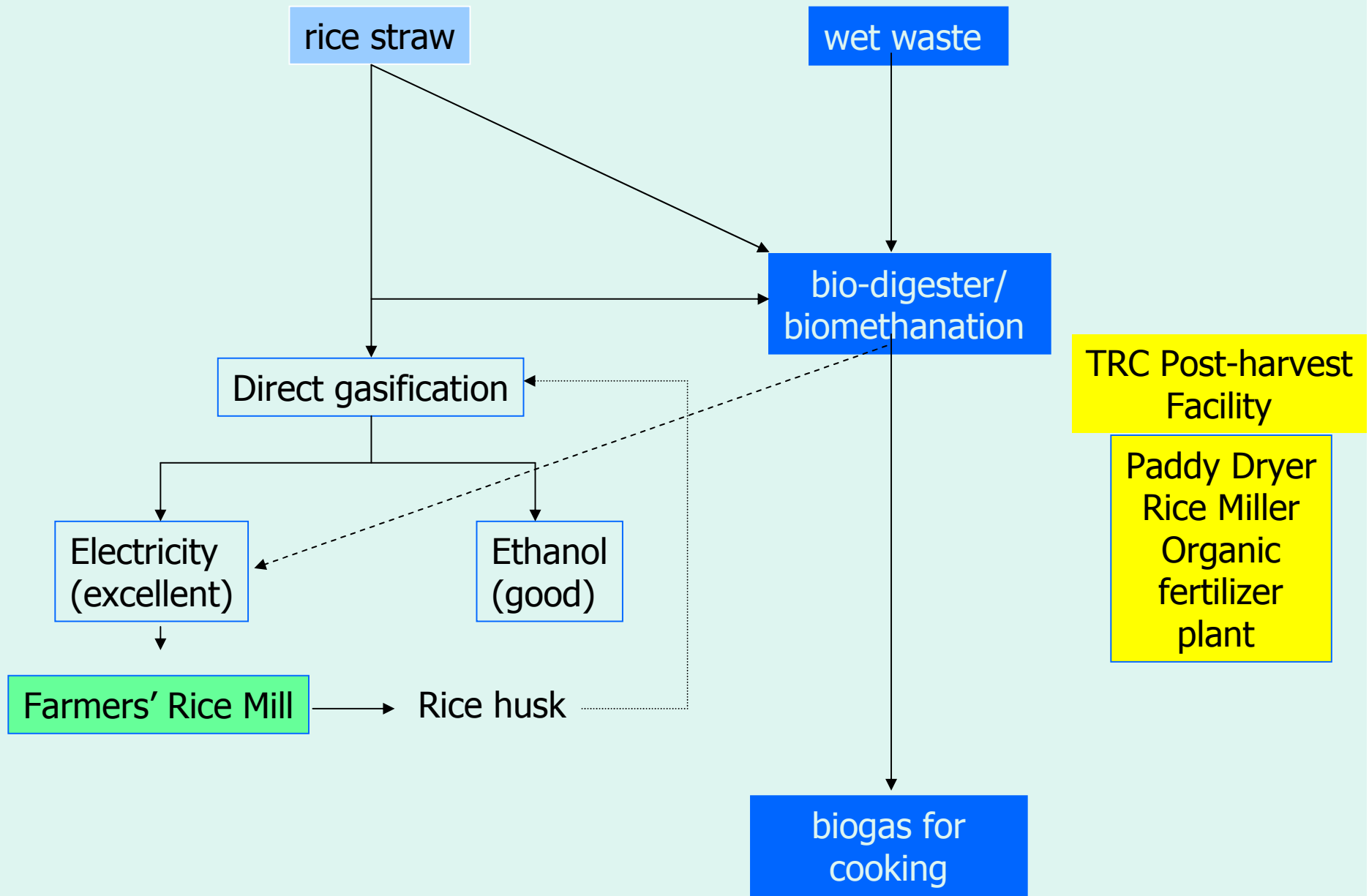
- Varies from 0.4 tons per hectare to more than 3.0 tons per hectare
- Total availability in the field is proportional to the grain yield
- Ratio of rice straw to rice grain in the field varies from 0.8:1 to 1.2:1
- Depending on variety and harvesting method, its length ranges from 30-120 centimeters



# Rice Straw in Cabiao

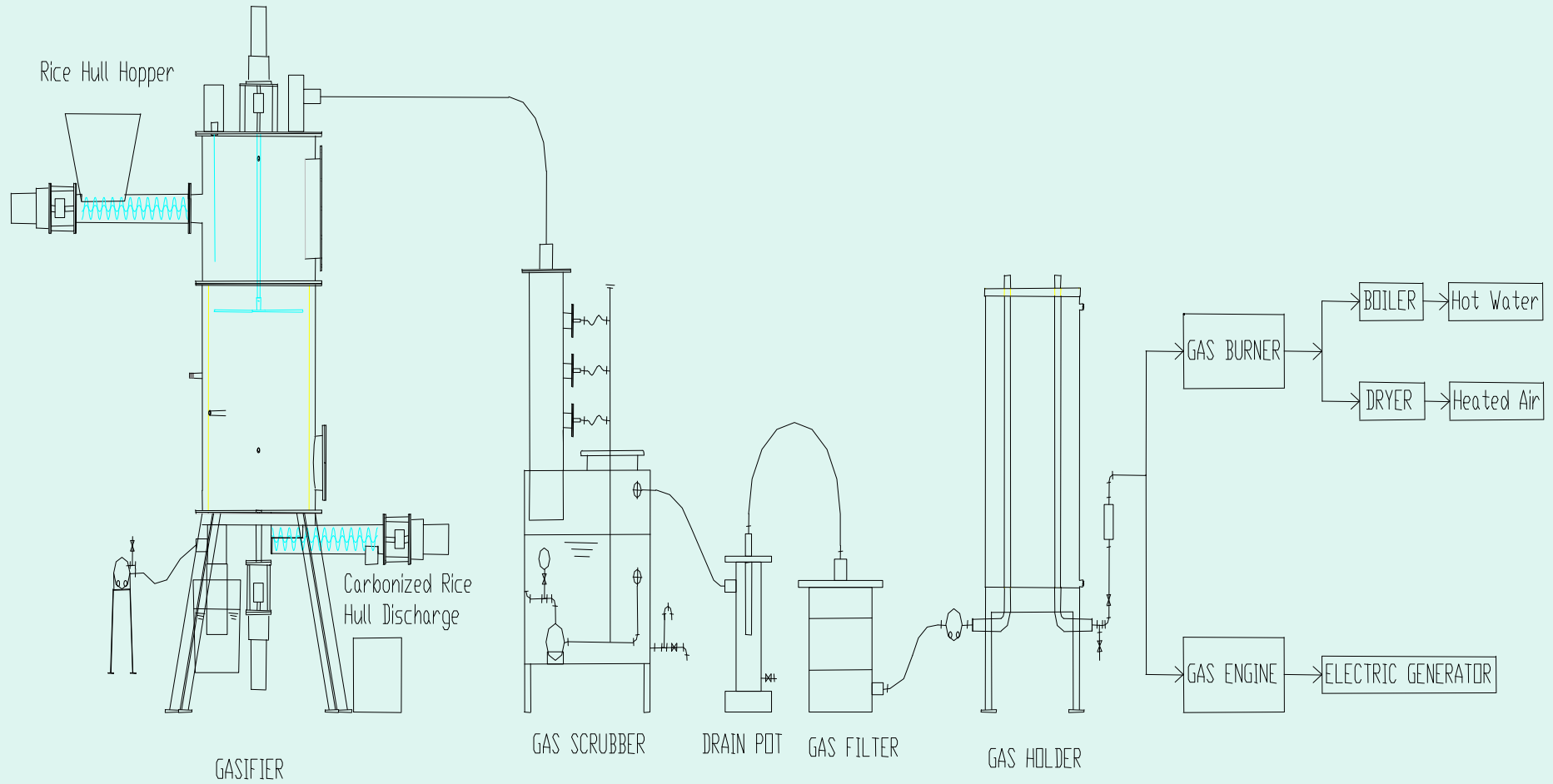
- At harvest, moisture content of rice straw is usually more than 60% of a wet basis
- In dry weather, straw can quickly dry down to 10% to 12% moisture content.





- (>100 gallons/ton of rice straw)
- Floyd Myers Marsh Power Plant convert about 200,000 tons of rice hulls and straw a year to 29 megawatts of electricity

# The Gasification System



# Performance Indices of the Gasification System

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Hour of operation	8 h
Total input of rice husk	431 kg
Feed rate	53.9 kg/h
Total discharge of CRH	92.6 kg
Discharge rate of CRH	11.6 kg/h
CRH conversion ratio	21.5 %
Temperature of combustion zone	600-750 °C
Gasification efficiency	46 %
Power generation	13 kW
Generation efficiency	9.2 %

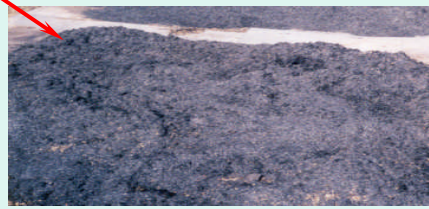
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# 10-20 kW Rice Husk Gasifier

Develop modular small scale cleaner production resource recovery systems  
Produce gas, heat, mechanical and electrical power  
Produce by products such as CRH and liquid materials for soil conditioning, organic fertilizer, and natural pesticide (smoke vinegar), among others.



Smoke vinegar



Carbonized Rice Hull (CRH)



# Small-scale Rice Milling Machines

- Model 1 (China)
  - Power - 5.5 kw
  - Productivity – 400-600 kg/hr
  - Cost – USD320-340
- Model 2 (China)
  - Power – 11 kw/hr
  - Productivity – 500-650 kg/hr
  - Cost – USD320-340
- Model 3 (Australia)
  - Power – 7.5-11 kw/hr
  - Productivity – 500-900 kg/hr
  - Cost – USD800++



# ***Rice Hull Gasifier –Engine –Pump System (2006-07)***



- **6.5 kg RH load/batch; 1.5h operation**
- **6 min start-up & firing time**
- **3-in pump; 6.5 hp engine; 6-9 L/s**

# Technology Resource Center Post-Harvest Facility in Cabiao

- Constructed in late 1980s
- Unable to take off
- White elephant
- What it can do?
  - Rice milling
  - Solar drying
  - Boiler for drying
  - Storage



# Public-Private Partnership

- Partners:
  - Technology Resource Center (TRC)
  - Ecological solid waste advocate NGO
  - Local entrepreneur, organic farmer
  - DAP as technical support provider
- Main Purpose:
  - Waste conversion cum organic fertilizer plant
- Secondary Purpose:
  - Rehabilitate the paddy dryer & rice mill



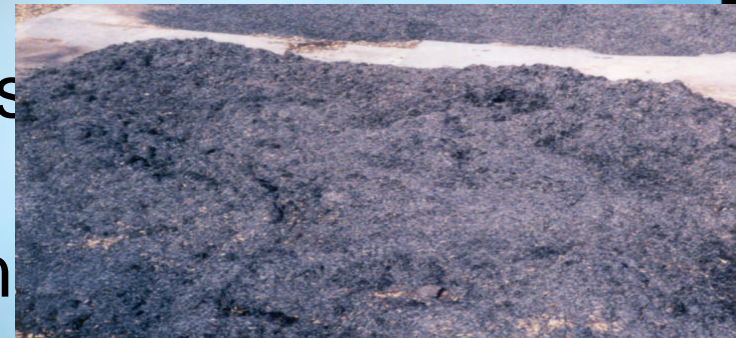
# Capacity of the Post-Harvest Facility

- Paddy dryer
  - Output: 2,400 cavans of 50 kgs./day
  - Fuel: rice husks/hull
- Multi-Pass Rice Mill
  - Output: 1,000 cavans of 50 kilos/day
- By-product: Carbonized Rice Hull (CRH)



# CRH as Soil Conditioner

- Retains heat from sunlight
  - increases soil & water temperature
- High air permeability
  - ability to replenish air in the soil
- Enhances water retention
- Sterilized & free from pathogen
- Excellent host for beneficial microorganisms
- Excellent ingredient for bio-organic fertilizer
- Reduces the population of golden apple snail in flooded rice fields (Source: PhilRice)



The background is a monochromatic blue scene. On the left, there is a grid of circular patterns, possibly a ceiling or a wall panel, which is slightly out of focus. To the right, there are vertical lines and a blurred architectural structure, suggesting a modern building interior. The overall lighting is soft and diffused, creating a clean and professional atmosphere.

**Thank You**