

CRIEPI Seminar

Biomass for global warming prevention

Evaluation of a suitable location for biomass power plants

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What is Biomass?

Biomass

1. (The primary meaning in ecology). Quantity of plants and animals in a particular area
2. Energy resource from plants and animals.
3. Industrial raw material from plants and animals.

Wood Mill



Food Factory



Livestock & Sludge



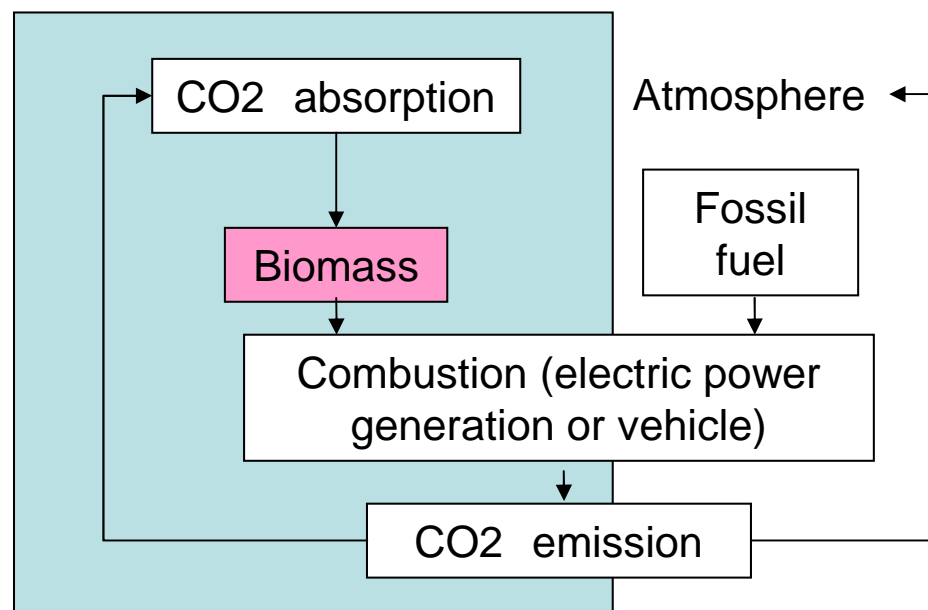
Agriculture



Why can Biomass be used for global warming prevention?

Biomass

1. Biomass is energy resource **without increasing CO₂**.
2. The total amount of biomass calorie is estimated at 39% of the primary energy in the world (2020 estimation).

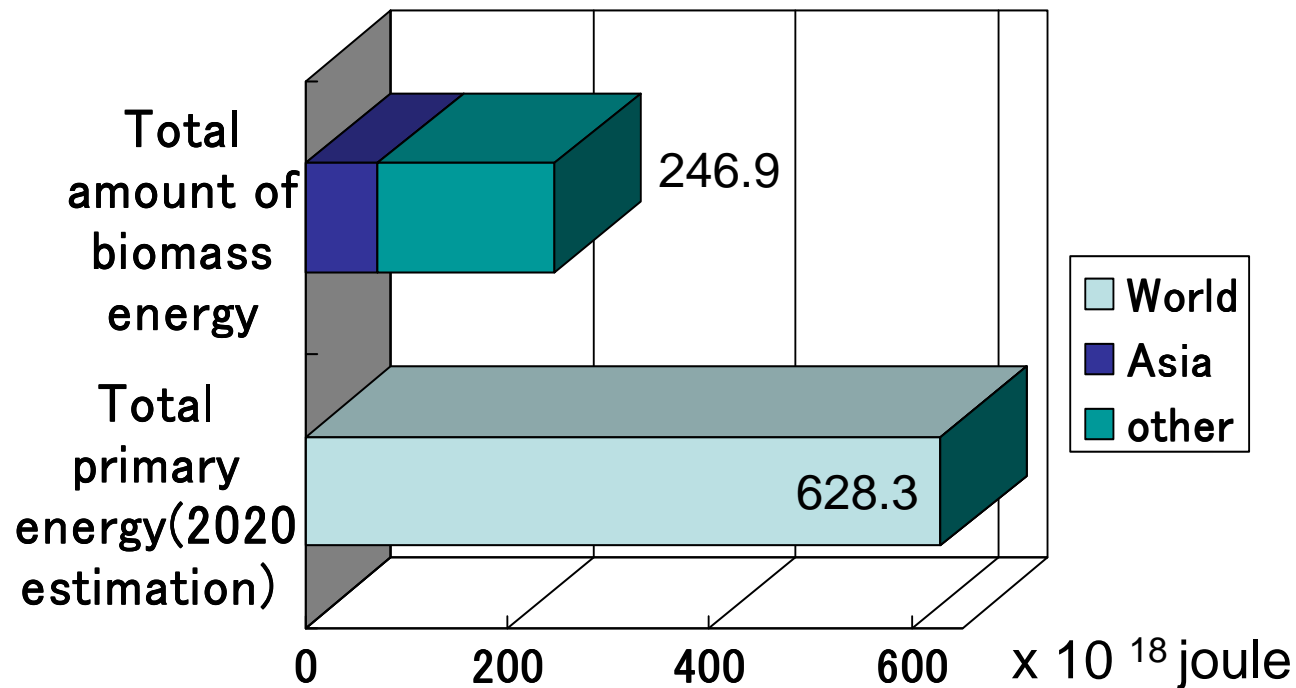


Carbon Neutral Cycle

Why can Biomass be used for global warming prevention?

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Reference:
NEDO(2000)

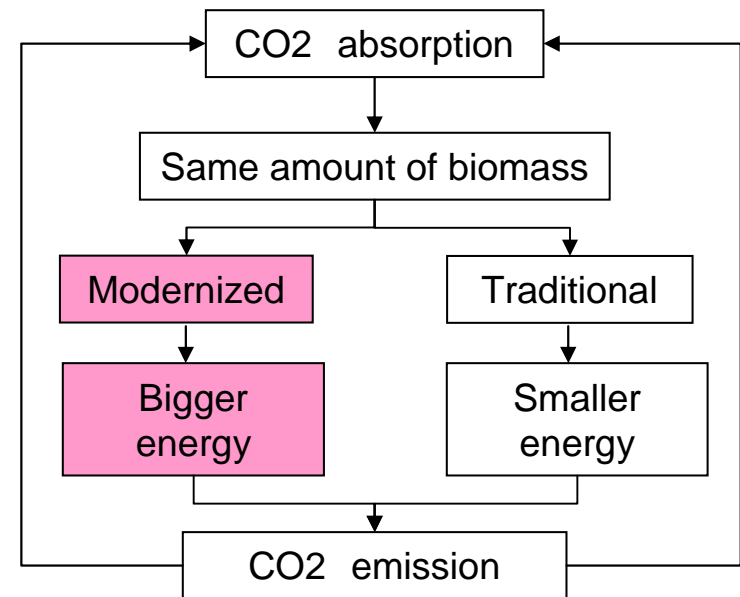
Traditional Biomass or Modernized Biomass

● Biomass technology (Electric Power Generation)

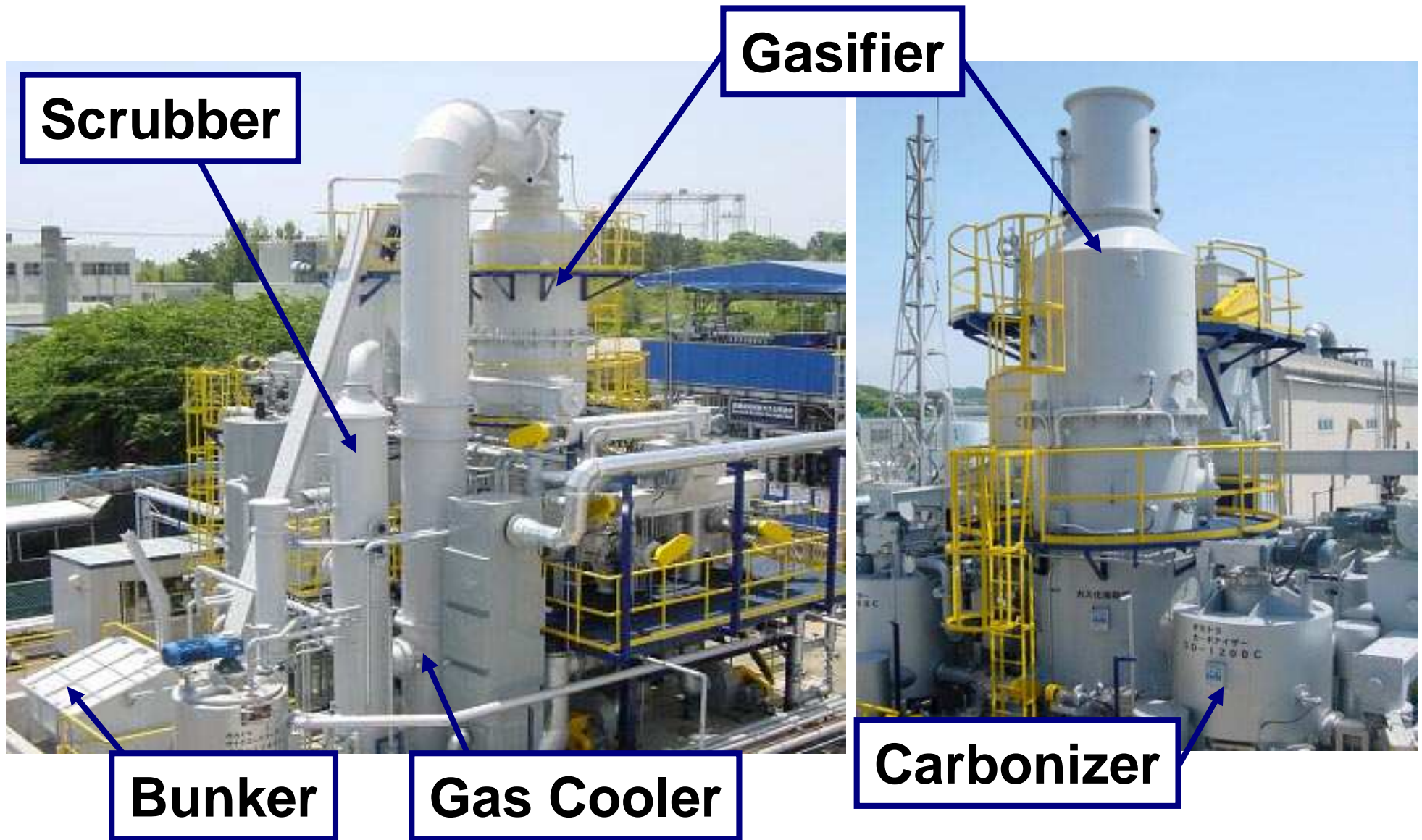
[Traditional] : Biomass (ex. Wood chip) -
> Direct combustion -> Steam turbine generator
(Efficiency: below 5%)

[Modernized] : Biomass (ex. Wood chip)
-> Carbonization -> Gasification -> Clean-up & Cooler
-> Gas turbine generator
(Efficiency: 23%, Technology by CRIEPI & KEPCO)

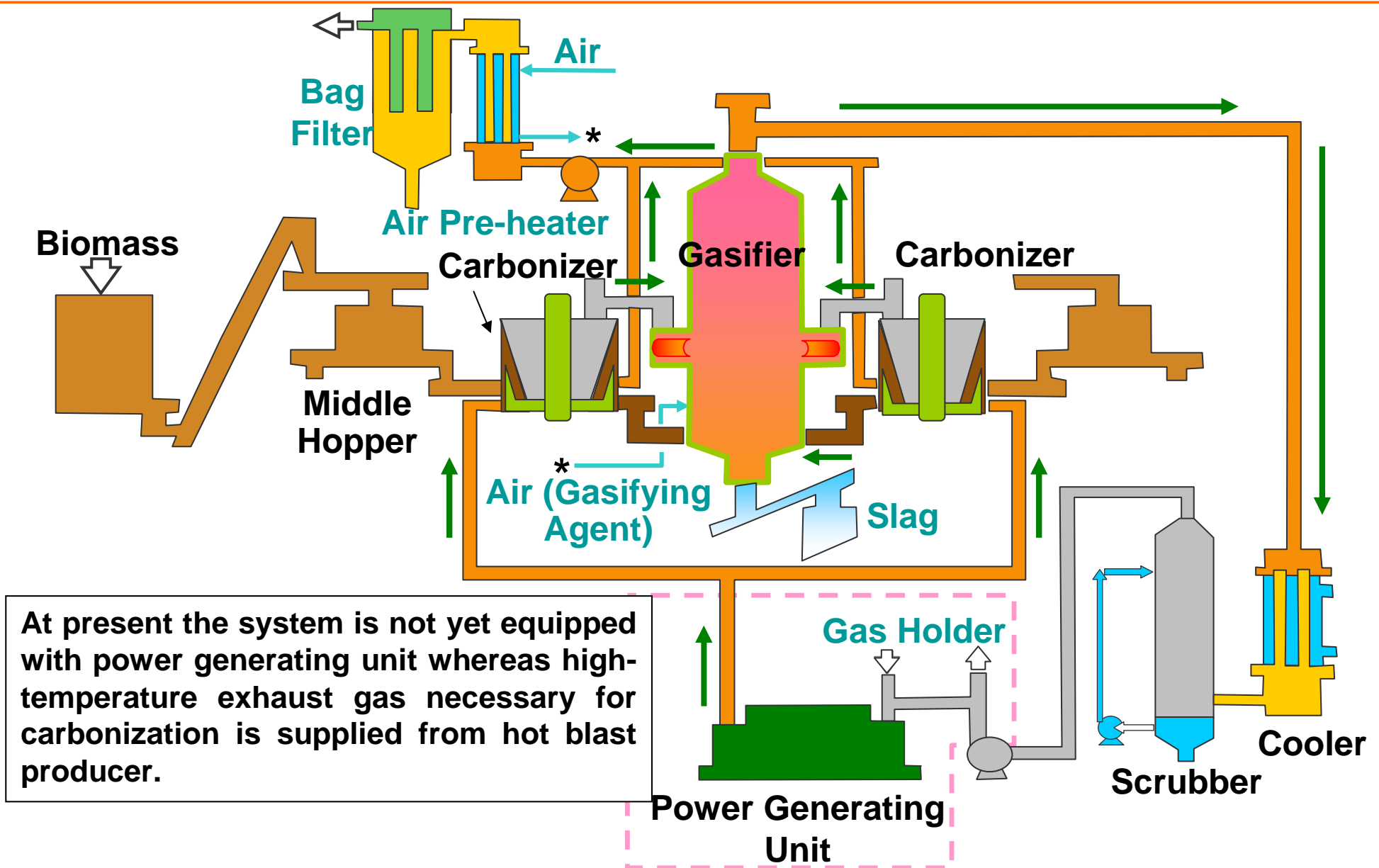
-> Saving Biomass resource.



Carbonizing Gasification Technology



Carbonizing Gasification Technology



Edible resources (food) or inedible resources

● Biomass technology (Vehicle liquid fuel)

[Biomass from **edible** resources]

ex. Vehicle fuel from sugar, corn, or vegetable oil

[Technology] Low cost

[Price per unit] high

[Influence to food market] big

[Biomass from **inedible** resources]

ex. Vehicle fuel from straw of rice, wheat and corn, or wood.

[Technology] High cost

[Price per unit] low

[Influence to food market] Small

Field biomass (Inedible **low-cost Biomass**)

Field biomass (ex. straw from rice, wheat and corn)

● For plant owners (or planners)
Wants lower price resources

● For farmers
Want to sell at higher price

Lower price
Profits rise high

They don't have incentive

Higher price
They don't have incentive

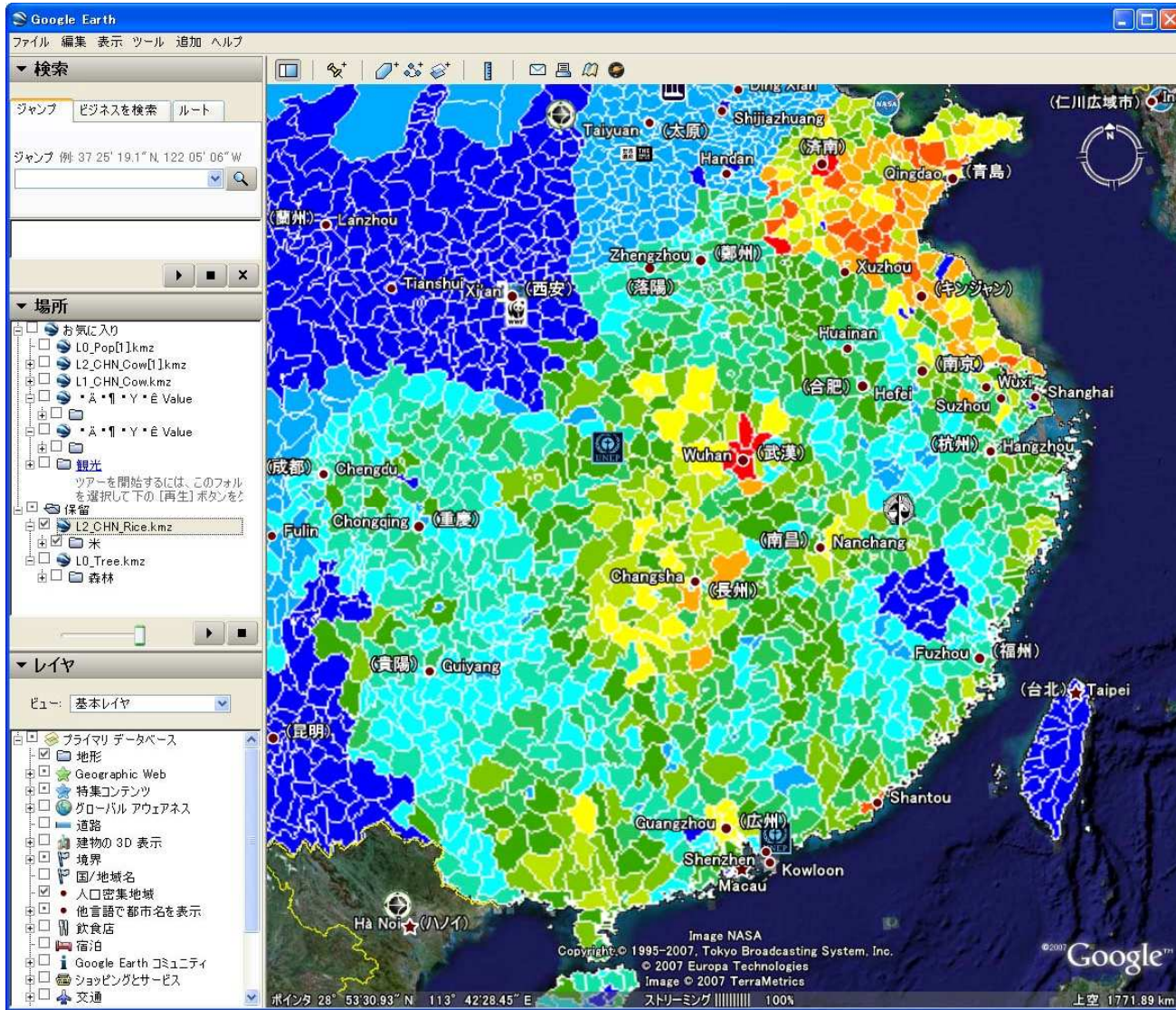
Sell large amount

Lower transportation cost
Profits rise high

They can sell higher price

Win – Win situation

Database of Asian biomass (CRIEPI)



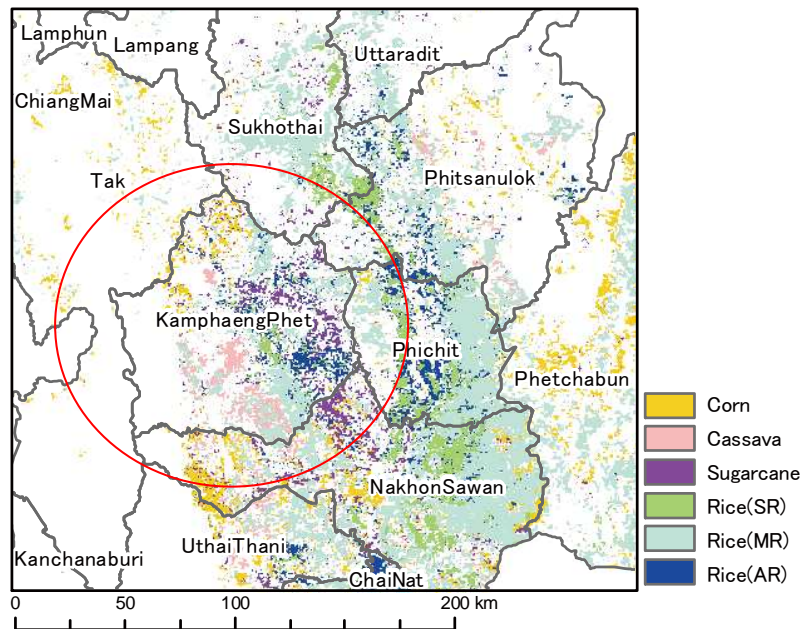
The database includes 13 types of biomass for 21 Asian countries.

URL:
<http://asia-biomass.com/>

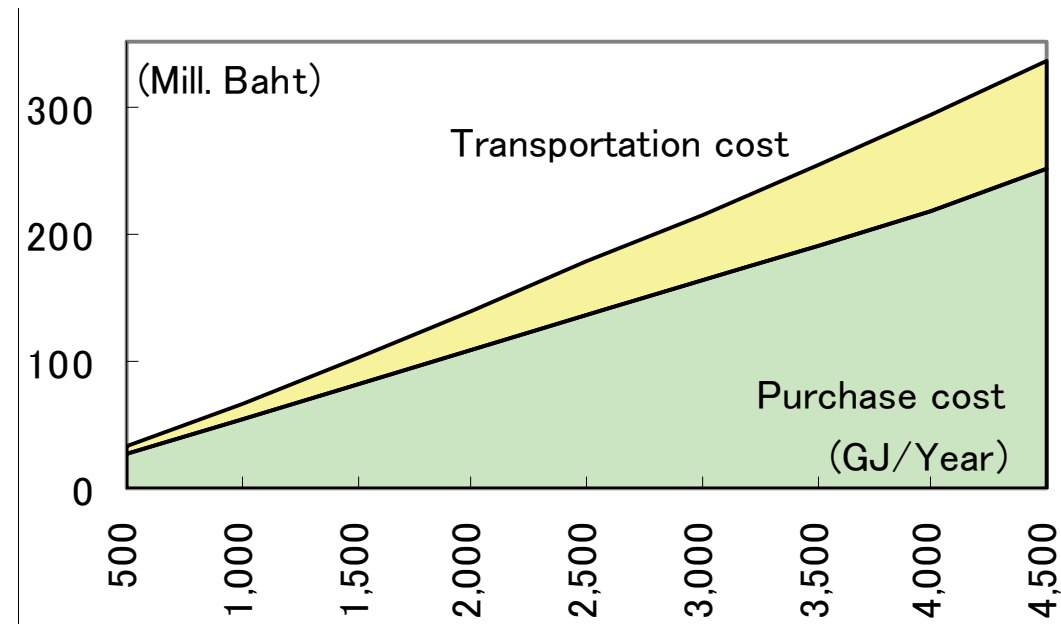
Case study in Kamphaeng Phet, Thailand

The lowest total cost with the size of field biomass-use plant calculated by SPBPtool (CRIEPI)

We found that the ratio of resource to transportation costs become higher as the plant size increased, but only slightly.



Distribution map of biomass resources



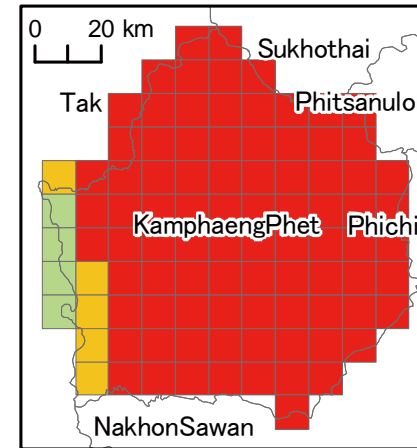
Variation of biomass purchase cost and transportation cost with the plant size (on NQBF)

Suitable map created by SPBPtool (CRIEPI)

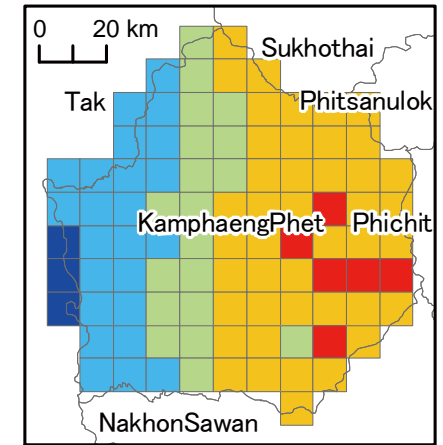
Because there is mountainous terrain in the western part of Kamphaeng Phet that has less biomass, the overall distribution of the biomass resource is predominantly to the east. Therefore the ratio of the grids in the east part is relatively higher regardless of the plant's size.

Cost differences between grids become larger as the plant size increases.

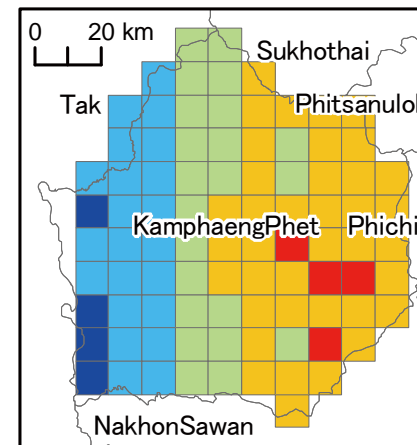
* Plant-size on supposition that the plant is direct combustion power generation system. (Combustion efficiency : 0.2, Hours of operation: 365day/year, 24hour/day) , the exchange rate (2006)



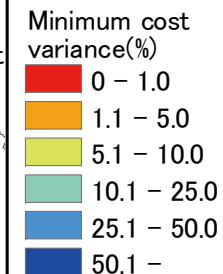
NQBF: 50GJ/yr (1.1MW*)
 1% ≙ 0.03 Million Baht
 ≙ 0.09 Million Yen



NQBF: 2,000GJ/yr (45.7MW*)
 1% ≙ 1.39 Million Baht
 ≙ 4.48 Million Yen



NQBF: 4,000GJ/yr (91.3MW*)
 1% ≙ 2.94 Million Baht ≙ 9.47 Million Yen



Conclusion

- Because biomass is estimated at 1/2 of the world's total energy use, and can be used without increasing CO₂, it's a promising answer to the struggle with global warming.
- There is traditional biomass and modernized biomass. The modernized biomass can establish the carbon neutral cycle easily. Improving from traditional biomass to modernized can contribute to stopping global warming.
- If we establish a biomass utilization facility, we have to consider the traditional cycle (particularly, food market) of biomass resource.
- Field biomass is the one of the biomass resources which doesn't disturb the traditional market. By using technique to decrease the transportation cost, field biomass has an advantage to the biomass facility owner and farmers.

Challenge

- Resource which are able to be used as biomass, vary according to climate, culture and society. So the biomass use system must be established according to context of the region.
- A long term plan must be take into consideration and agreed by all stakeholders.