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Biomass Conversion – Reality and Outlook

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Choice of Power Supply

- **Grid availability**
- **Fuel availability**
- **Consumers structure**
- **Electric power production reliability and costs.**

Heat & Syngas

- **The Forest Residue**
- **Free Field Residue**
- **Waste from Wood Processing Industry**
- **Urban Wood, Paper & Cardboard Waste**

Syngas & Biogas

- **Waste from Agricultural Products Processing Industry**
- **Organic Components in Town Waste**
- **Solid & Liquid Animal Manure**
- **Agricultural Plant Waste**

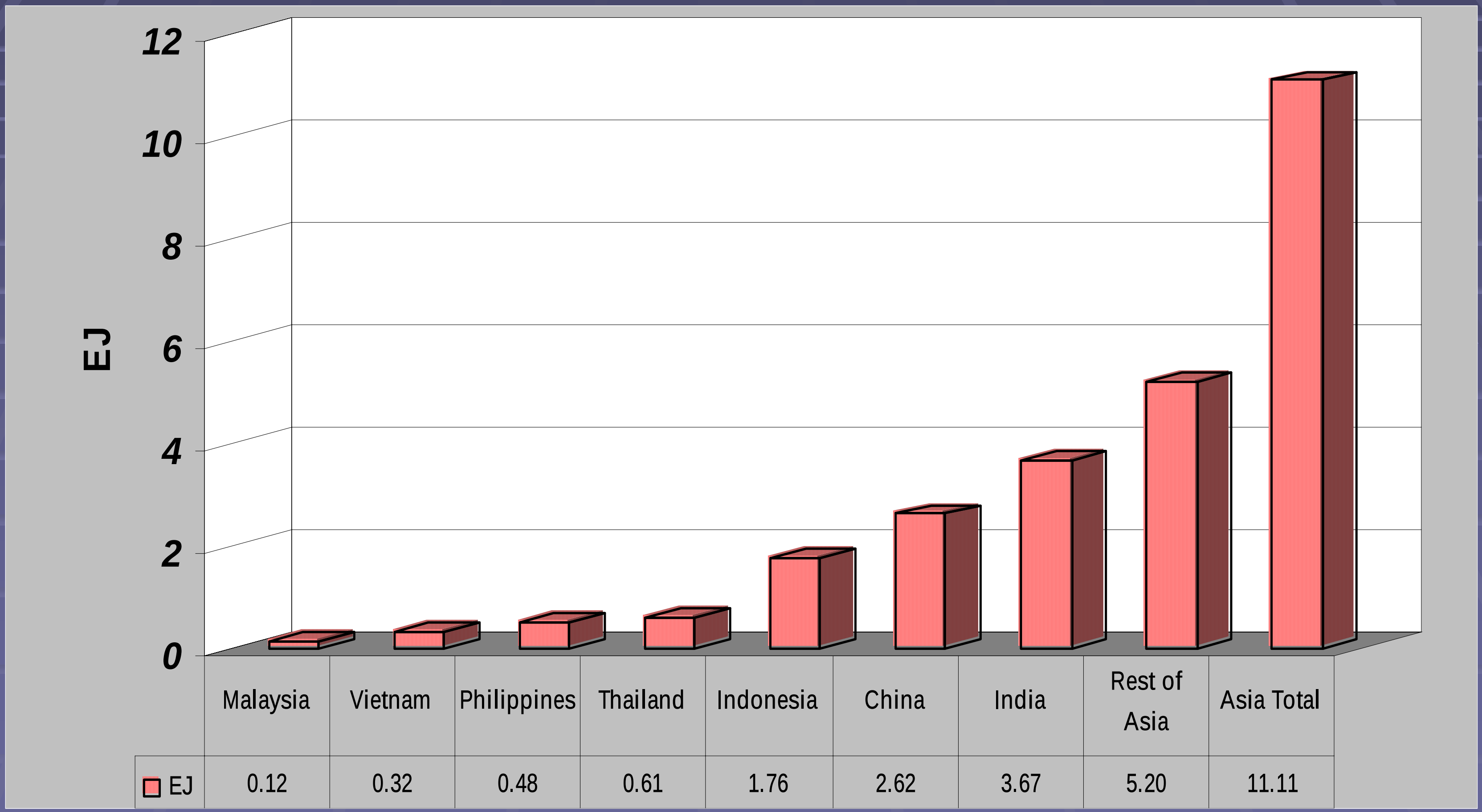
Biogas

- **Waste Waters**
- **Landfills**

Biomas
Environmentaly friendly source of energy

- **Biomass absorbs the same amount of CO_2 in growing that it releases when burned as a fuel in any form.**
- **Biomass contribution to global warming is zero.**
- **Biomass fuels contain negligible amount of sulphur, so their contribution to acid rain is minimal.**

Biomass Consumption in Selected Asian Countries



Conversion Technologies

- **Direct Combustion → Heat (Hot Water, Hot Air, Steam);**
- **Thermo-Chemical Conversion → Pyrolysis, Charcoal, Syngas;**
- **Bio-Chemical Conversion → Methanol, Ethanol, Biogas**

Fixed Bed Combustion Systems

System	Fuel size mm	Max. Moisture Content %	Fuel Supply	Ash Removal
Static Grate	∅ 100 x 300	50	Manual / Automatic	Manual / Automatic
Underscrew	< 40x 30 x 15 >20 x 20 x 10	40	Automatic	Manual / Automatic
Through Screw	< ∅ 50 x 100	40	Automatic	Automatic
Inclined Grate	< 300 x 100 x 50	50	Automatic	Automatic
Sloping (moving) Bed	< 300 x 100 x 50	50	Automatic	Automatic
Suspension Burning	< 5 x 5 x 5	20	Automatic	Manual / Automatic
Spreader-stocker	< 40 x 40 x 40	50	Automatic	Manual / Automatic

Gasification Systems

Type	Technology	GT Power Output MWe	ST Power Output MWe	Fuel Input Ton / hour	Specific Costs US$ / kW
FBC	Fluidized Bed Combustion	0	5	5-10	2600
FBG	Fluidized Bed Gasification	3.3	1.7	4-8	2800
ADB	Anaerobic Digestion-Biogas	<1.0	<0.9[1)]	2.5[2)]	3000-4500

1) 0.9 MW_{th} (Net Available Heat Energy)
2) Assumptions: Biomass LHV=8 MJ/kg,
35% Power / 45% Heat Generation / 20% Internal Consumption

Anaerobic Digestion Process Parameters

Digestion Process	Description	Advantages	Disadvantages
Dry	Dry solids content of > 25-30 %	Compact, lower energy input, better biogas quality (<80 % CH_4), maintenance friendly	Restricted mixing possibilities
Wet	Dry solids content of < 15 %	Better mixing possibilities	Higher energy input, lager reactor
Mesophilic	Digestion temperature between 25°C and 35°C	Longer process time, slower rate	Low energy input
Thermophilic	Digestion temperature between 50°C and 70°C	Shorter process time, higher degradation, faster rate	Higher energy input
Batch	Substrate in closed reactor during whole degradation period	Suitable for small plants with seasonal substrate supply	Unstable biogas production
Continuous	Reactor is filled continuously with fresh material	Constant biomass production through continuous feeding	

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Risk Aspects

- **Biomass Supply →** There is a risk that biomass supply could be impaired, thereby decreasing the output of the project and in addition, issues such as the logistic of biomass supply (low heating value = high quantity), the storage, treatment processes to convert it into usable fuel must be taken seriously into consideration.

- **Biomass Price →** There is a potential risk that increases in the biomass price can adversely affect project cash flow. Major concern is that the biomass has an affordable value at project beginning but there is no certainty how the price tag will look like in a few years.

Conclusions

Modern biomass utilization technologies, mainly the gasification and anaerobic digestion, give the advantage of separating the toxious substances and providing clean gas for combustion.

- The life cycle of biomass has a neutral effect on CO_2 and SO_2 emissions.
- Large-scale use of biomass for power generation enables closure of the mineral and nitrogen cycles.

- **Biomass can be used as a decentralised source of energy, where conversion to heat or electric power can take place close to production. This can lead to social stability at the regional level.**

- Around 10 to 15 new jobs can be created per one MW installed electrical power generation capacity.

- Translating this number to the situation in Europe, where 5% of energy demand must be derived from biomass, results in 160,000 new jobs.

- **Large agricultural land and land areas with marginal production possibilities that are available worldwide, can be used for the production of biomass for energy production.**

- **The growing interest in biomass utilization for power and heat generation in the late 1990's is the result of a combination of some of following underlying factors:**

- Rapid changes in the energy market worldwide, driven by privatisation, deregulation and decentralisation.
- Greater recognition of the current role and future potential contribution of biomass as a modern energy carrier.

- **Biomass worldwide availability, versatility and sustainability.**
- **Better understanding of its global and local environmental benefits and perceived potential role in climate stabilisation.**

- Growing concern with global climate change that may eventually drive a global policy on pollution abatement.

- **Growing recognition among established international organizations & conventional institutions of the importance of biomass energy (UNO, UNIDO, WB, ADB, FARE, e.g).**

- Expected increases in energy demand, combined with current rapid growth crude oil prices.
- Growing introducing of specific policies in support of renewable energies (also biomass) in many countries worldwide.

- **Environmental pressures may increase the price of fossil fuels as the cheaper sources are depleted.**

- **Biomass utilization technology is evolving rapidly and the new technologies development time-span is being reduced.**

For biomass based energy to have a future, it must provide people with what they want, e.g. reliable electrical power and proper environmentally acceptable fuels at an affordable price.

The worst thing that can happen - will happen - is not energy depletion, economic collapse, limited nuclear war or conquest by a totalitarian government.... the one process that will take millions of years to correct is the loss of genetic and species diversity by the destruction of our natural habitats.

This is the folly our descendants are least likely to forgive us. Humans would not survive more than a few months if all the insects and other land-dwelling arthropods were all to disappear ". E.O.Wilson, Professor at the Harvard University.

THANK YOU

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