

Efficient conversion of Wood Energy to Electricity / GIZs experiences with producing electricity from woody biomass

Role of *electricity from biomass* in a sustainable energy system

Transformation Technologies

Potential Providers, Users and Uses

GIZ Experience

Lessons learned



The Role of Electricity from Biomass in a Sustainable Renewable Energy System

In former times or very isolated sites:

- sometimes the only available source (e.g. sawmills in forest areas)

In times with cheap and reliable PV and other RE systems:

- A ~storable and ~adjustable source of RE
- However: expensive, technologically complicated, danger of environmental threats.

Motivation and most frequent reason to think about energetic use of woody biomass:

- Available material / energy source
- Interest of project developers and construction companies.



Transformation Technologies

- Biogas (biomass with high moisture content) not or hardly appropriate for woody biomass
- Combustion and direct thermoelectric process: Seebeck / Peltier. Only for pico-applications, very low efficiency
- Combustion and boiler with steam engine or steam turbine
Co-firing in existing (coal) plant
- Gasification and transformation of the gas in external or internal combustion engine (diesel or gas engine)



Potential Providers, Users and Uses

Industry with own woody biomass as waste: Sawmills, timber and furniture industry, sugar producers (bagasse), rice mills, palm oil mills

- Auto-consumption in the industry for energy demanding processes
- Sale of excess electricity to neighborhood

Local energy provider, utility: rice husks, coconut shells, peanut shells, bamboo, wood from forest, ?woodlots

- Feed into national grid or local mini-grid



GIZ project experience

No direct support to biomass plants

However, in several countries discussions about electricity production from woody biomass:

- Vietnam: certification of pellets
- Namibia: Support to de-bushing. Energetic use of bushes
- Serbia: Development of a sustainable bioenergy market in Serbia pellets for heating, no electricity
- Bosnia and Herzegovina: Biomass energy (Pellets and wood for heating national and export)
- Thailand: discussion about support for gasification projects
- Ghana: feasibility study for biomass plant (6 MW el., daily input of 200t biomass: cocoa pod husk 7,8 Mio t/a + waste timber industry 50t / day)

Several feasibility studies / surveys and concept papers



Lessons learned

The boiler / steam turbine is a proven conversion technology.

- However, profitable only for larger plants.
- Electricity production from woody biomass might be a solution for industry that holds big quantities of own biomass (waste).
- The seasonal variation of electricity production in industries does not always correspond to the needs of neighbors
- In most cases the availability of the biomass is more limited than perceived at first glance.
- Prices and hence availability of the biomass increase rapidly if a profitable value chain is on the horizon.
- Co firing (e.g. in coal plants) is a frequent solution

Gasification / combustion engine is feasible for smaller plants (~ 10kW – ~ 500 kW).

- However, reliable only with homogeneous appropriate fuel
- Many toxic by products (condensates) can be a severe threat to the environment and working conditions
- Solutions overcoming these difficulties are expensive and know- how intensive