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Suggestion for a presentation on the CONBIOT int. Conference
„Combustion & Gasification Biomass and Wastes“, 19-22.05.2003

Organic residues for cofiring in a coal fired CHP-Plant - a case study on markets and energetical potentials in Baden-Württemberg, Germany

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Abstract:

Bioenergy in future may substantially contribute to Germany's energy supply and at same time it helps to reduce greenhouse gas emissions: Burning biomass sets free the same quantity of CO_2 as was sequestered before from atmosphere while growing the fuel. Besides mere combustion of biomass in power- or CHP-plants principally also cofiring in hard coal CHP's can be an option.

Following this goal the "Heizkraftwerk Pforzheim GmbH" carried out a study in collaboration with IER, focussed on the search of feasible biomass fuels for cofiring in a fluidised bed hard coal CHP plant. As frame conditions for cofiring it was set that

- a substitution of 25 % of hard coal, equivalent to about 20.000 tons should be achievable
- the currant costs of energy supply should remain, e.g. fuel costs should be comparable to hard coal
- the biomass fuels should be available in Baden-Württemberg
- Waste wood, meat and bone meal generally were excluded in the first run but studied also later-on

Besides evaluation of availability also fuel properties like water content, nitrogen, sulfur and chlorine content, available quantities, currant prices and ways of processing/disposal were studied. A first evaluation of former similar studies turned out, that especially residues from the food industry were not investigated intensively before. Thus, on this kind of biomass a special focus was set: Malt houses, breweries, fruit and vegetable juice industries, pectin manufacturers, sugar industries, jam manufacturers, tinned fruit manufacturers, coffee and tea producers, convenience food producers, oil mills, wood working industries, forestry, agriculture and carcass disposal plants were studied on their market situation, production processes and occurring organic residues.

For all investigated organic residues it was stated, that they would not be applicable in the CHP-plant under the restrictions set above. Dependent on the residue

- The market price actually achievable by existing ways of use was too high
- The water content - provided no further treatment like drying - was too high
- The available quantities were too small
- The substrate was excluded as biofuel by the definitions set above

As consequence cofiring was cancelled, but a biomass-fired CHP-plant is in realisation now. Instead, quite a number of the biomass residues investigated was generally applicable for agricultural biogas production, due to their high water content. Thus, all biomass residues studied were calculated for their theoretical energy production potentials, using direct combustion and biogas production capacity as basis respectively (lower heating values from fuel and biogas).

By this way proven theoretical potentials of energy supply from selected organic residues for Baden-Württemberg were calculated/evaluated as 4.230 GWh by combustion or 4.700 GWh from biogas production alternatively. Some examples are given in the table below:

Organic residue	**Annual amount** (t FM / t dried)	**Theoretical energy potential**	
		Combustion (GWh LHV)	**Biogas** (GWh LHV)
Brewer's grains	142.961 (FM) / 31.420 (dried)	144 (dried)	126 (FM)
Sugar-beet chips	63.975 (FM)	256	-
Grape marc	86.707 (FM) / 39.000 (dried)	192 (getr.)	67 (FM)
rape seed cake	174.000 (FM)	860	492
Meat and bone meal	43.000 (FM)	227	-
Animal fat	18.000 (FM)	183	-

For the application of organic residues within future energy markets the pricing will be crucial - not only for the residues but also for energy supply as a whole. Actually almost the whole potential found in the food processing industry is used in the animal food industry. Encouraging steps were done in Germany by implementing the "renewable energy act" (EEG) but still have to be improved with respect to the bioenergy sector.