EUROPEAN COMMISSION

Community research

Estonian Wetlands Biomass Resources for Energy Production

Most of the fuels used to transform thermal and electrical power are non-renewable. Biomass is the most suitable and available renewable energy resource in Estonia. Until now, one type of biomass plants of wetland has remained almost unused. There are plenty of wetlands in Estonia that have reasonably high productivity of biomass. The area of Estonian natural wetlands is approximately 26 000 hectares. Wetlands are characterized by rich flora, which gives a remarkable amount of biomass. Reed beds (Fig. 1) as well as cattail and natural bushes are the most suitable raw material for energy. So far reed has been used only for roofing and insulation materials. Harvest and handling residues have been burned on the basis of one time license.

Figure 1. Reed bed

The largest reed beds of Estonia are situated in Lake Peipus and Võrtsjärv, in Matsalu region (in the delta of Kasari river) and in Väike Väin. The area of reed bed of Matsalu wetlands are approx. 3 000 ha (some data refer to 4 000 ha). In Võrtsjärv, the areas of reed bed are approx. 1 200 ha. In Saare county, the reed harvest from ~1 000 ha is assessed as potential (Fig. 2).

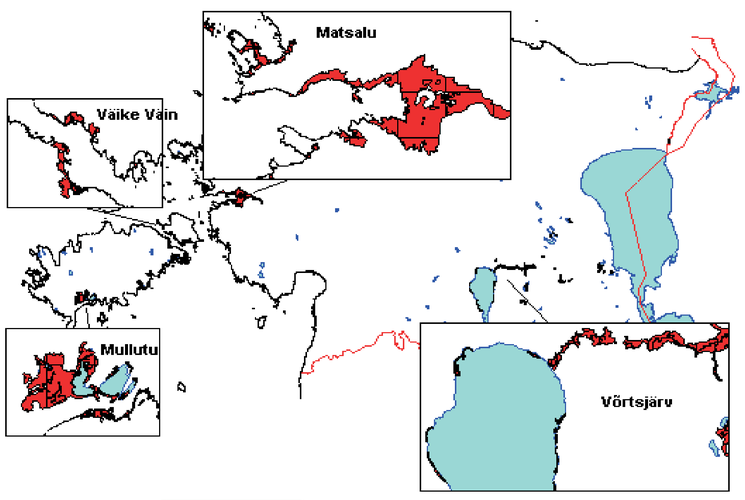

Figure 2. Estonian reed beds

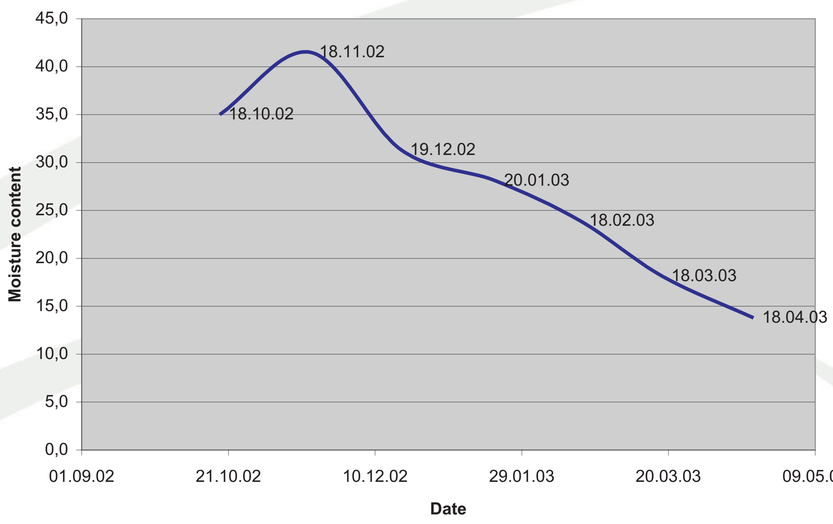

Figure 3. Monthly changes of moisture content

The harvest of biomass from 1 hectare of reed beds depends on several circumstances, for example the location of reed beds, the components of soil etc. (Fig. 3). Investigations have shown that approx. 1-1.5 kg dry substance per 1 m^2 is growing in the natural wetlands, but with additional nutrients the productivity can reach up to 4 - 5 kg/m^2 in a year (table 1). That amount of yield can be expected from artificial wetlands (wetland cleaners), where sewage of settlements or farms is processed.
One advantage of the use of wetland plants (reed, cattail) in energy production is the fact that these plants will be dehydrated by the end of their growth period and require no extra drying.
There could be significant reduction in the emission of solid particles into the atmosphere, if the biomass of wetlands would be used to produce thermal and electrical power

Nr	Plant	Date	Moisture, %	Calorific value, MJ/kg		Energy content, MWh/t	
				Q_a^{tarb}	$Q_ü^{tarb}$	E_a^{tarb}	$E_ü^{tarb}$
1	Reed	18.10.02	35.0	10.5	12.26	2.92	3.41
2	Reed	18.11.02	41.5	9.2	11.03	2.56	3.06
3	Reed	19.12.02	31.3	11.23	12.96	3.12	3.60
4	Reed	20.01.03	28.1	11.87	13.56	3.30	3.77
5	Reed	18.02.03	23.9	12.71	14.35	3.53	3.99
6	Reed	18.03.03	18.11	13.86	15.44	3.85	4.29
7	Reed	18.04.03	13.80	14.72	16.26	4.09	4.52

Table 1. Moisture content, calorific value and energy content of reed in the years 2002/2003, monthly.

Moisture $W^t = 10 – 16$ %,
ash content $A^k = 4 – 6$ %,
calorific value $Q^t_a = 14 – 15$ MJ/kg,
energy content $E^t = 3,9 – 4,2$ MWh/t

Figure 4. Reed fuel

Reed as a fuel (Fig. 4) is fairly specific and therefore needs special furnaces and burning techniques, but it can well be burned in straw boilers.
However, when burning plain reed in a furnace, the amount of remaining ash is rather big in volume, thin and with framework structure, which prevents it from falling without mechanical stirring (Fig. 5). This may cause problems with ash removal from the furnaces of wood fuel or straw burning boilers. Therefore, the ash removal systems of the existing boilers may require re-equipment.

Power stations and boiler houses running on wetland biomass should be installed in the districts, where collection and storage of biomass is optimal. In such stations wood wastes; straw, hay and reed can be burned directly, mixing them or in refined form.

One possibility could be to refine the biomass through granulation or hydrolysis (result is ethanol) or pyrolysis and selling it to small consumers, to mainland or abroad.

Figure 5. Ash

References
1. Kask, Ü., Kask, L.Biomass Energetics Potential of Wetlands at Saare County. Investigation and Usage of Renewable Energy Sources. Third conference proceedings. Tartu, Estonia 2002.
2. Maddison M. Biomass ja selle kasutamine. Keskkonnatehnoloogia projekt. Tartu: 2003. 50 lk.
3. Ü. Kask, A. Paist, L. Kask. Resources and Burning Characteristics of Reed and Possibilities to Use it in Energy Production. The Nordic-Baltic Reed Seminar, Salo, Finland, 21-22. 08 2003