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PEATLAND RESOURCES AND THE USE OF ENERGY PEAT IN FINLAND

Kimmo Virtanen
Geological Survey of Finland, Easten Finland Office; kimmo.virtanen@gtk.fi

SUMMARY

One-third of the land area in Finland is covered by mires and peat. It is 9.3 million ha. The development of mires has led to three main types: raised bogs in Southern Finland, aapa mires in Ostrobothnia and Lapland, and palsa mires in Northern Lapland. Peat layers are deepest in southern Finland and partly in the southern Finnish Lake area, the Region of North Karelia and in central Lapland. The mean depth of mires is 1.41 m and the thickest drilled peat is 12.3 m.

The national peat reserve totals 69.3 billion m^3 *in situ* (mire > 20 ha). The dry solids of peat are estimated at 6.3 billion tonnes. *Sphagnum* peat accounts for 54% and *Carex* peat for 45% of feasible peat reserves.

Peatlands that are technically suitable for the peat industry cover a total area of 1.2 million ha and contain 29.6 billion m^3 of peat in situ. Slightly humified *Sphagnum* -peat suitable for horticultural and environmental use totals 5.9 billion m^3 *in situ*. The energy peat reserve is 23.7 billion m^3 *in situ* and its energy content is 12 800 TWh.
At present, peat is used in around one hundred applications in the inland cities and towns co-generating electricity and heat. The broadly-based Finnish energy economy, with various energy sources, is the best in the EU according to the EU Commission. As a fuel, peat fulfils the goals of the EU energy policy in Finland well: it is local, its availability is good and the price is stable and the use of peat also enhances national security.

KEY WORDS: *peat, energy peat, peat resources, Finland*

INTRODUCTION

Geological Survey of Finland has investigated 2 million ha of the 9.3 million ha area covered by peatland in Finland. (Fig.1.). The geological data of peat contains about 16 000 single peatland basins and 1.5 million study points. In Finland, there is a total of some 33 500 mires exceeding 20 hectares and 100 000 mires all together. Based on these data, the present study assesses the peat resources of Finland and their exploitability. At present, around 30,000 ha of peatlands are annually inventoried.

Study methods

Firstly, on the basis of aerial gamma radiation data and maps, the thickness of the peat deposit and the suitability for further field investigation can be determined. The gamma data can be used to locate different peat deposits, and to differentiate peat deposits with regard to the depth of the peat layer in them. In the field, observations are made on the stratigraphy of the peat layers and the topography of the peatland, including the type of vegetation cover. Through coring, peat samples are studied for their botanical origin (macroscopically)(Carex, Sphagnum, Bryales, Phragmites, Equsetum etc.) and the degree of humification (according to von Post). Note is also made of other organic sediments (gyttja, lake mud etc.) and of the mineral sediments at the bottom (clay, sand, till etc.). Peat layers consist of the remains of ancient plants. Long ago, the plants in question formed mire plant communities, i.e. mire site types, and they in turn formed mire complex types Laboratory samples are taken from places which as well as possible represent the useable peat layer of the site. Laboratory samples are taken with a piston sampler designed for coring volumetric peat samples, enabling accurate estimates of the energy content of the peat deposit. Soil radar is used to complement the data on the depth of the peat.

The Geological Survey of Finland uses a relatively sparse survey map (c. 2 to 5 study points per 10 ha) in basic peatland inventory. On the basis of this inventory, the characteristics of the peat types for different modes of utilisation, such as energy generation or horticulture, are established. Similarly, the size of the areas suitable for peat production, the amount of peat and the energy content are determined. Additionally, the environmental impact of the introduction of peat production is assessed.

Peat resources

In Finland, the investigation and classification of mires has identified several mire complex types and three main types: raised bogs in Southern Finland, Lake Finland and along the coast of Ostrobothnia; aapa mires in the region of Suomenselkä, North Ostrobothnia and Lapland; and palsa mires, where the core of the palsa hummock is frozen throughout the year, in Northern Lapland.

Raised bogs typically have a thick and poorly-decomposed *Sphagnum* moss-dominated peat layer, which may often also include the remains of hare's-tail cottongrass (*Eriophorum)*, deer grass (*Trichophorum)* and rannoch-rush (*Scheutzeria),* along with *nanolignids* (the remains of dwarf shrubs). Thin decomposed layers are further typically found inside poorly-decomposed peat.

The peat strata of aapa mires are characterised by the variability of the peat types. The most common peat types occurring in aapa mires are dominated by *Carex* grass, with additional factors regularly including the remains of bog bean (*Menyanthes*), horsetail (*Equisetum*), rannoch-rush (*Scheutzeria*), common reed (*Phragmites),* and of wood and dwarf shrubs. Peat dominated by the remains of *Sphagnum* and brown mosses is also common in aapa mires, and likewise a combination of all the peat types. Brown moss peats are particularly found in the bottom parts of peat layers, and especially in the mires of central Lapland.

Sphagnum peat accounts for 54% and *Carex* peat for 45% of feasible peat reserves in Finland (Fig. 2). The remaining 1% is composed of *Bryales* peat, the bulk of which is encountered in the North Finland area. The highest values for the degree of humification are located in Lake Finland (central Finland), where wood remains often also occur in peat. Chance often influences the physical properties of peat: for example, a brook bed may become blocked and the ash content can thus increase (Fig.3.). The average ash content is 3.4% of dry mass, the sulphur content 0.20% (ca. 0.09 – 10%) of dry mass and the dry bulk density 87 kg/m^3 (ca. 40 – 220 kg/m^3) in the peat layer *in situ*. (Virtanen & al. 2003, Virtanen & Valpola 2011)

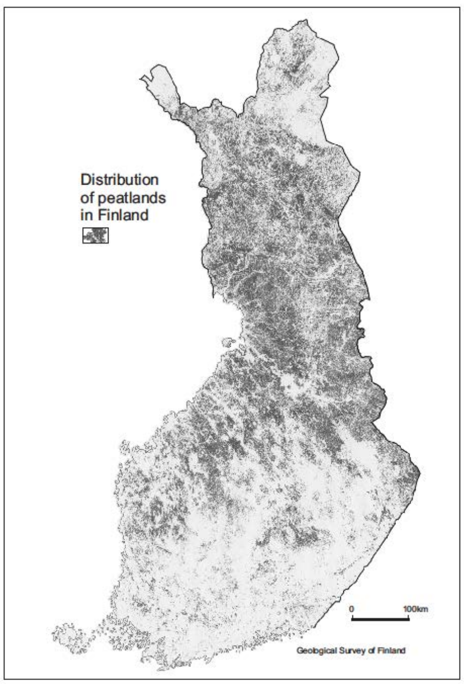

Fig.1. Distribution of peatlands in Finland.

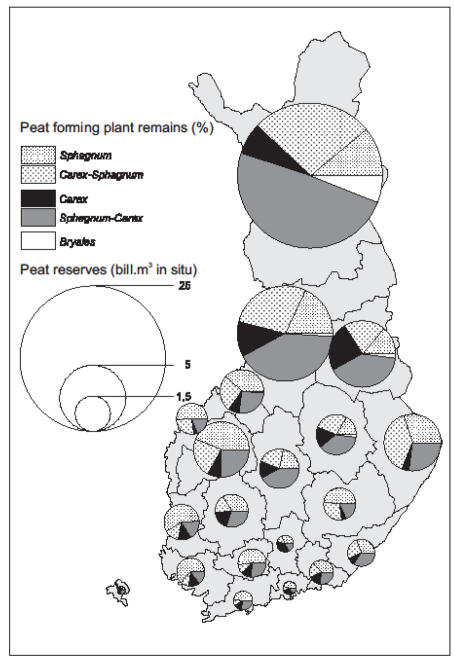

Fig.2. Peat forming plant remains (%)

Peat layers are deepest in southern Finland (Uusimaa and Kanta-Häme regions), and partly in the southern Finnish lake area, the Region of North Karelia and in the area of central Lapland. The average depth of mires is often more than 3 metres. The mean depth of geological mires is 1.41 m. The thickest drilled peats (12.3 m peat) are located in SW-Finland. The shallowest peatlands lie in the west coast area of Finland and in North Ostrobothnia. The average depth of mires in this area is often less than 1 metre. In the area exceeding 1.5 m in depth, the peat layer is 2.50 m thick on average. Altogether, 37% of Finnish mires, i.e. 1.9 million ha, have a peat layer thicker than 1.5 m. (Fig.4.)

According to the peat investigations, the national peat reserve totals 69.3 billion m^3 *in situ*, including peatlands larger than 20 hectares. One-third of peat reserves are located in Lapland, one-third in the Regions of Northern Ostrobothnia and Kainuu and one-third in southern Finland. The dry solids of peat are estimated at 6.3 billion tonnes, while the carbon storage of Finnish mires totals 3.2 billion tonnes. The average carbon content of peat is 51.5% (Virtanen & al. 2003, Virtanen & Valpola 2011).

Peatlands that are technically suitable for the peat industry cover a total area of 1.2 million ha and contain 29.6 billion m^3 of peat *in situ* (Fig. 5). Peat production takes place on 0.06 million hectares of the peatland area. Slightly humified peat suitable for horticultural and environmental use totals 5.9 billion m^3 *in situ*. The reserves of horticultural peat lie in the southwestern part of Finland. The energy peat reserve is 23.7 billion m^3 *in situ* and its energy content is 12 800 TWh. This is comparable with the remaining oil reserves of Norway, 1 008 million tonnes of crude oil with an energy content of about 11 700 TWh (World Energy Council 2009).

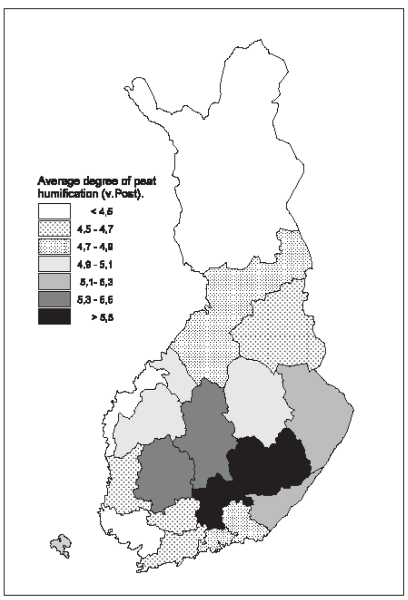

Fig. 3. Average degree of peat humification (v. Post)

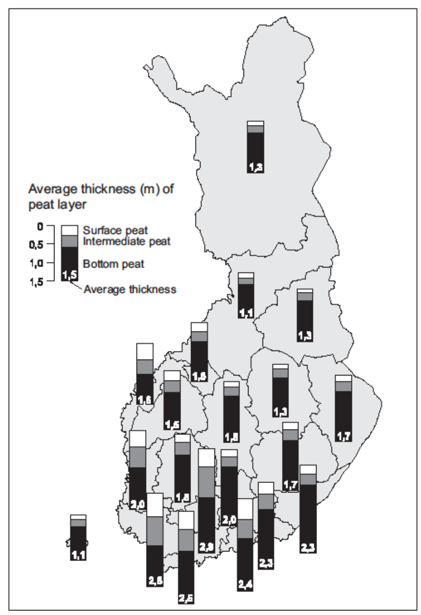

Fig 4. Average thickness (m) of peat layer

The energy density of the mire areas appropriate for energy peat production is 0.54 MWh m^3 *in situ*. The peat reserve technically suitable for industrial purposes includes all peatlands in Finland. The economic and environmental limitations have not been taken into account in the previous assessment.

CONCLUSION

The broadly-based Finnish energy economy, with various energy sources, is the best in the EU according to the EU Commission. As a fuel, peat fulfils the goals of the EU energy policy in Finland well: it is local, its availability is good and the price is stable and the use of peat also enhances national security.
In Finland, peat is mainly used in energy generation or in horticulture. Energy peat accounts for 90% of the total peat production and horticultural peat for around 6-7%. Some peat is used in municipal sludge and biowaste composting plants and as biofilters; as litter material in animal husbandry; as oil-absorbent; in textiles; and in balneology.

Because of the cold climate, Finland has been forced to develop an efficient and flexible energy production structure to supply population centres with the energy these demand. Around 6 % of Finland's primary energy, and some 20 % of district heat, is generated from peat. Annual peat production amounts to 25 million m^3. (Fig.6)

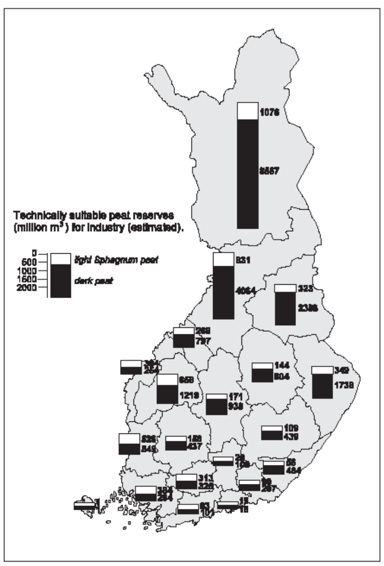

Fig. 5. Technically suitable peat resources (million m^3) for industry

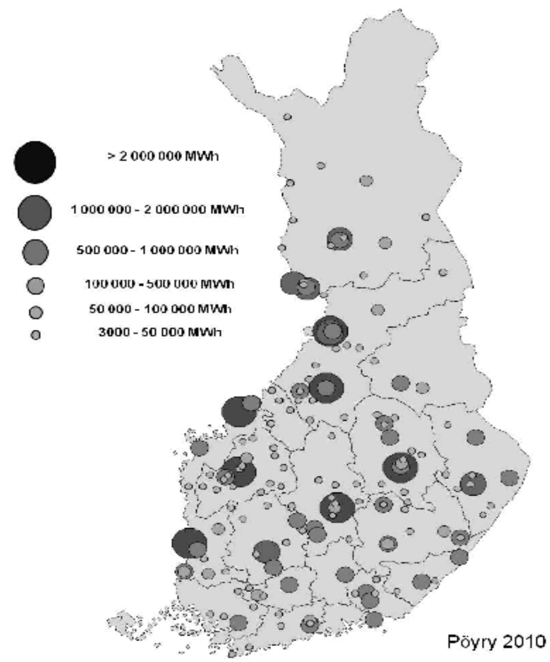

Fig. 6. Consumption of energy peat (million m^3in situ) 2010.

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