Reduction of Greenhouse Gas Emissions through the Adoption of Renewable Biofuels in the Boiler House of OÜ Lihula Soojus, reflections on sustainability

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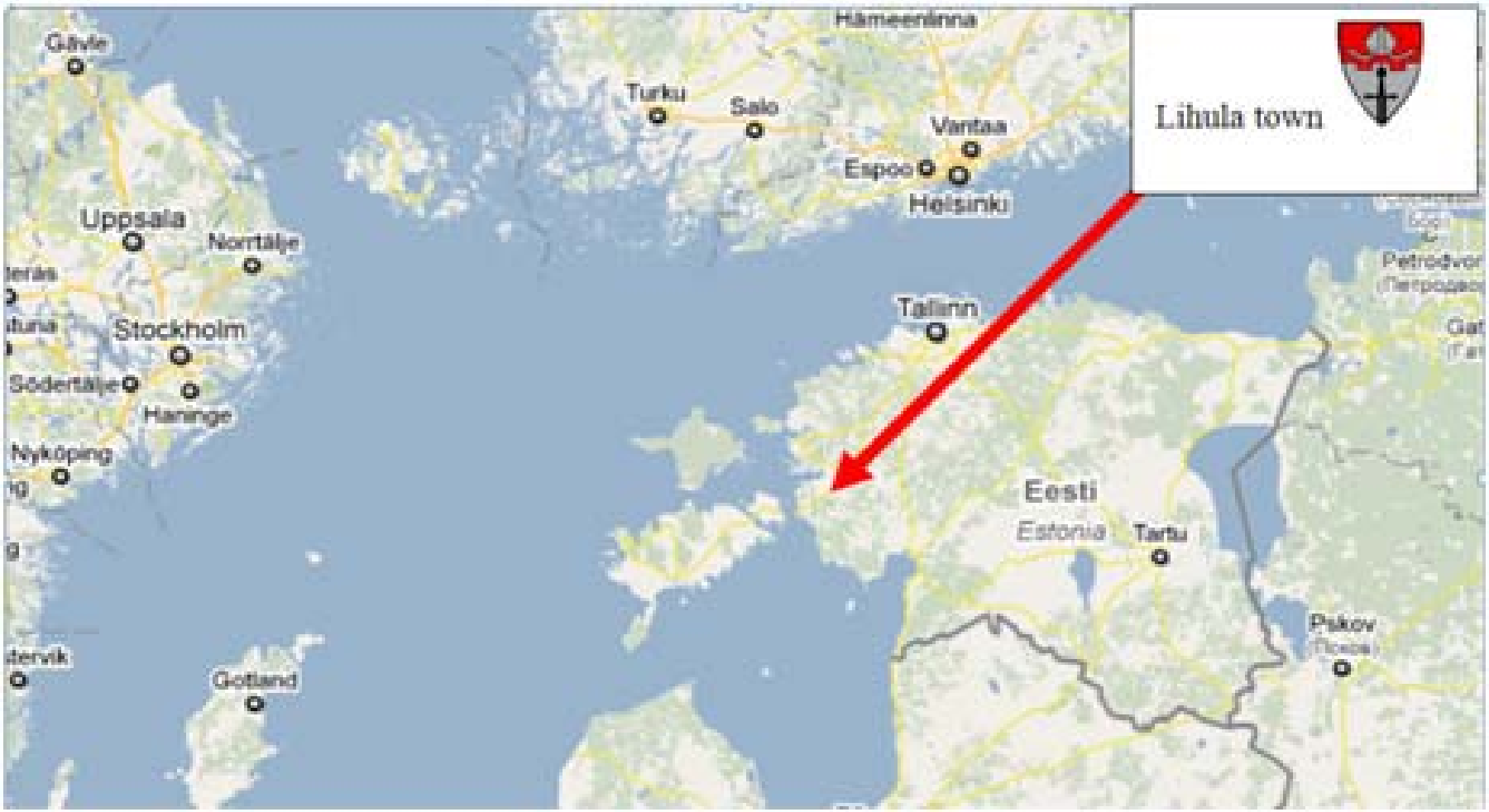
I. LOCATION

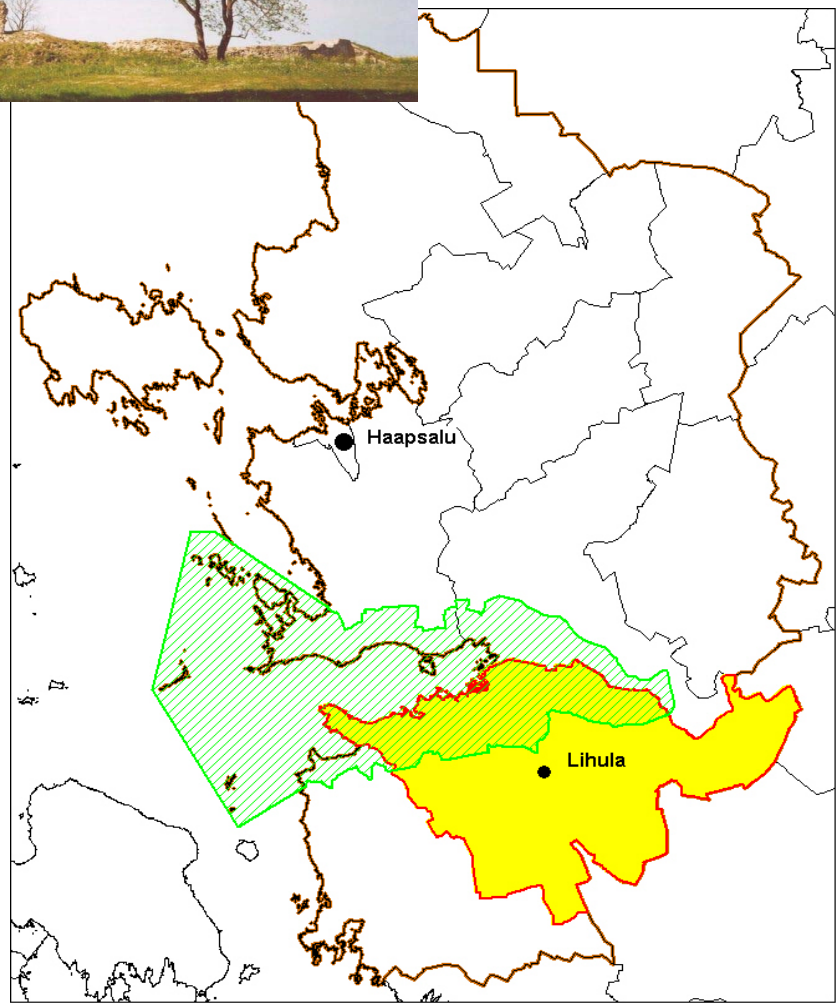

Lihula town
Hämeenlinna
Gävle
Turku
Salo
Vantaa
Espoo
Helsinki
Uppsala
Norrtälje
Stockholm
Södertälje
Haninge
Nyköping
Tallinn
Eesti
Estonia
Tartu
Pskov
Gotland

II. LIHULA RURAL DISTRICT

Area	384 km^2
Inhabitants	2 852
incl. Lihula town	*1 579*
Harvesting land	9 000 ha
Natural grassland	6 000 ha
Forest land	13 000 ha
Other land	10 000 ha

Nature protected land 47% of total area

Matsalu Bay estuary Foto by Tiit Kaljuste



III. LIHULA SOOJUS Llc. – Aia street 16 Boiler House

Lihula Soojus Llc. is 100% Lihula rural district owned district heating company. The main boiler house is located at Aia street.16, Lihula.

Before the project:

Boilers: two E/19 0,65 MW water-steam boilers (installed 1980), Danstoker Multimaiser 1,23 MW hot water boiler (installed 1995).
Fuel: oil shale oil (Estonian origin)
Energy consumption: annually 3,2-3,5 MWh
Avarage consumption capacity 0,4-0,9 MW, peak load 1,8 MW
Average efficiency: 67%
CO2 emission: 1350 t/y

IV. 6. DRIVING FORCES FOR CHANGES

1. In order to preserv the natural diversity in Matsalu National Park the meadows and flood-plain have to be mowed each year

2. Availability of renewable energy recources in considerable capacities

3. Rapidly growing fossil fuel prices and continuous stress for rising the price for distruct heating clients

4. Need to cut down CO_2 emissions and have cleaner environment in Lihula

5. Fuel availability, pre-feasibility and feasibility studies where carried out and confirmed that with grant co-financing it would be feasible and technically possible to introduce local renewable biofuel based district heating supply in Lihula town

6. Possibility to apply for EEA Grant for co-financing technically and sustainably very reasonable but economically not so feasible project

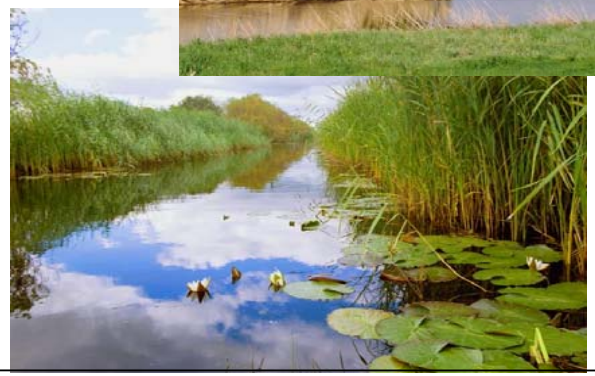
IV. 1. MATSALU NATIONAL PARK

Matsalu National Park was founded in 1957, mainly to protect nesting, moulting and migratory birds.

A total of 275 bird species have been recorded in Matsalu, among which 175 are nesting and 33 transmigrant waterfowl. 49 species of fish and 47 species of mammals are registered in the area of the nature reserve, along with 772 species of plants.

Matsalu National Park covers a 486.4 km² land and water area encompassing Matsalu Bay along with The delta of the Kasari river and the surrounding areas —floodplain and coastal meadows, reedbeds and woodlands.

Reedbeds	3 000 ha
Floodplain	4 000 ha
Costal meadows	2 300 ha



IV. 2-1. RENEWABLE ENERGY RECOURCES

The mowing is carried out by local farmers. Pictures have been taken in autumn2007 .
Due to nesting birds the period for mowing is strictly regulated and limited.

IV. 2-2. RENEWABLE ENERGY RECOURCES

Kasari river flood-plain, September 2008

10-12 km distance from Lihula Soojus Llc. boiler house

IV. 2-3. RENEWABLE ENERGY RESOURCES

Matsalu National Park is considered as main resource for biofuels, especially herbacious biofuels for Lihula Soojus Llc.

Biofuel potential

	Area	Annual heat value
	ha	GWh
Reed	2000	9,1
Wood	400	0,7
Hay	1000	1,5
Total	3400	11,3

Lihula district heating network consumes 3,2 – 3,5 GWh, fuel requirement app. 4 MWh.

Lihula boiler house requires app. 1 200 – 1 500 tonns of biomass anually.

VI.3. FUEL PRICES

Oil shale oil (Estonian origin) price:
At the time of applying for the EEA Grant in 2006 127,8 EUR/t
2010 price 278,8 EUR/t

District heating energy price in Lihula:
01.01.2006 43,46 EUR/MWh
01.01.2009 69,25 EUR/MWh

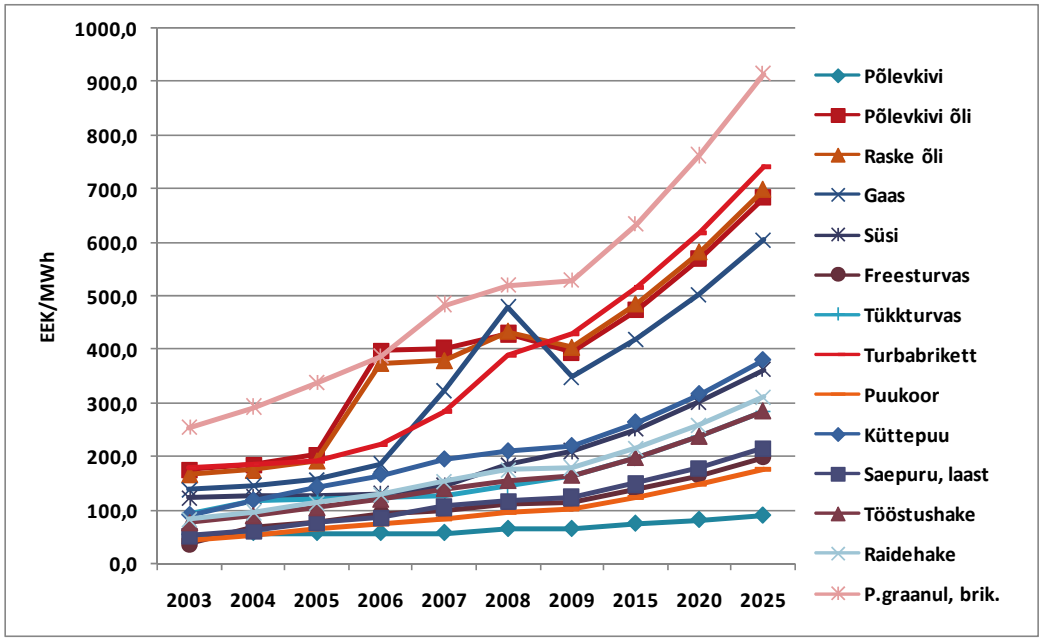
October 2, 2009 – May 1, 2010 Lihula Soojus used only renewable fuels:

1000 t hay (35,2 EUR/t)

200 t wood chips (10,5 EUR/m^3)

<u>The objective is to maintain the current price during the loan period.</u>

2009/2010 heating period was excepcionally cold and favourable for Lihula Soojus. The calculated price in January was 65,2 EUR/MWh.



IV.4. REDUCTION OF EMISSIONS

Lihula Soojus Llc. used oil shale oil as main fuel till May 2009.

With the adoption of renewable biofuels in October 2010, oil shale oil is used only as reserv fuel.

Oli shale oil is produced in Estonia, transportation distance app. 250 km.

The oil shale (fuel) oils are used in boilers and in industrial furnaces. In comparison to similar petroleum derived fuels, it is characterised by low viscosity, a low pour point, and a low sulphur content.

	Unit	Before reconstruction
Oli shale oil consumption	t/a	450
CO_2 emissions	t/a	1350
SO_2 emissions	t/a	20

** Oil shale oil CO_2 emission - 264 t CO_2 per t oilsshale oil*

IV.5. FUEL AVAILABILITY AND FEASIBILITY STUDIES

The decision for adoption of renewable biofuels at Lihula Soojus Llc. Lihula boiler house based on following studies:

1999 – Biofuel potential and availabilty in Matsalu National Park
2005 – Prefeasibility study – Possibilities of using reed and other biomass from Matsalu National Park for energy generation at Lihula Soojus Llc. boiler house
2005 – 2006 Feasibility Study - Feasibility and technology study for renewable biofuel based energy generation at Lihula Soojus Llc. boiler house

Main conclusions:

1.Sufficient biofuel resources are available;
2.Wether conditions are the main risk to herbacious fuels supply;
3.Wood chips should be introduced as second renewable fuel alternative;
4.CHP technology would nort be feasible due to small capacity;
5.Two biofuel boilers should be installed (1 MW herbacious biofuel and 0,8 MW wood chips boilers), oil shale oil boiler shall remain as reserv fuel;
6.Grant co-financing should be applied to improve the low feasibility of the renewable biofuel adoption at Lihula Soojus Llc. Boiler house project .

VI.6-1. AVAILABILITY OF GRANTS

Grant application within the frames EEA and Norwegian Financial Mechanism for individual projects in the field of sustainability and emission reduction was launched in 2006.

Lihula Soojus Llc. presented its grant application August 2006 for the proejct "Reduction of green-house gases with adoption of renewable biofuels at Lihula Soojus Llc. Boiler house". Total estimated budget 653 816 EUR with the implementation deadline October 2010.

November 13, 2007 Lihula Soojus Llc. recieved Grant Offer Letter with confirmation for EEA Grant in the amount of 326 909 EUR.

April 14, 2008 Grant Agreement was signed.

IV.6-2 AVAILABILITY OF GRANTS

Signing of Implementaion Agreement 23.05.2008.a. at Lihula Cultural House

The Ambassador of Royal Norwegian Embassy H.E. Mr. Stein Vegard Hagen

(from right) on behalf of: The Minsitry of Environment Ms. Katre Eljas-Taal, The Ministry of Finance, Minster Mr. Ivari Padar, Lihula Soojus Llc. Director Tõnu Teesaar

V. 1. RECONSTRUCTION

AS a result of 2 Public Procurement processes in summer - autumn 2008 and technology change approved by FMO (initially planned 1 MW and 0,8 MW boilers were replaced with one 1,8 MW multi fuel boiler) 19.12.2008 “turn-key” contract was signed with Tamult Ltd. With the due date for completing all works 31.08.2009. The reconstruction works begun May 4. 2008.

V. 2. RECONSTRUCTION

V. 3. RECONSTRUCTION

V. 4. RECONSTRUCTION

VI. 1. THE OUTCOME

Lihula Soojus Llc. boiler house was fully (except administration part) reconstructed:

- Old E-type oil boilers were dismounted,

- Danstoker'i multi fuel boiler for burning either herbacious biomass (humidity <18%) or wood chips (humidity <45%) 1,8 MW main load boiler was installed,

- An elargement was constructed to guarantee suffieciently high and large biofuel storage with necessary crane and feeding systems,

- In order to guarantee efficient and safe functioning of the boiler house new water treatment systems were installed, piping was renewed, operating systems and automation systems installed, modern fire protection systems installed

- Existing oil boiler Danstoker Multimaiser 1,23 MW was preserved for reserv and emergency situations

VI. 2. THE OUTCOME

With the successful adoption of renewable biofuels at Lihula Soojus Llc. Boiler house in Lihula, no longer exists need for using fossil fuels for heat energy generation. Renewable biofuel shall be used as main fuel. The existing oil burning boiler shall be kept as rererv in case of emergency or maintenence.

The following goals have been achievd versus pre reconstruction situation:

	Unit	Before reconstruction	After reconstruction
Oli shale oil consumption	t/a	450	0
CO_2 emissions	t/a	1350	27
SO_2 emissions	t/a	20	0,4
Energy generated with renewable biofuels	GWh/a	0	4,2
Istalled biofuel boilers	MW	0	1,8

VI. 3. THE OUTCOME

Re-opening of the reconstructed Lihula Soojus Llc. boiler house October 2. 2009.a.

Lindi lõikasid läbi OÜ Lihula Soojus juhataja Tõnu Teesaar, Norra Suursaatkonna I. Sekretär Ingrid Susanne Farner, Lääne Maavanem Neeme Suur, Keskkonnaminister Jaanus Tamkivi, Riigikogu liige Aleksei Lotman ning Lihula Vallavanem Anu-Lii Jürman

VI. 4. THE OUTCOME

The installed 1,8 MW multifuel boiler allows to burn either herbacious biofmass with the humidity of up tp < 18% or wood chips with the humidity of up to <45%.

VI. 5. THE OUTCOME

During 2009/2010 district heating period 02.10.2009 – 1.05.2010 only renewable biofuels were used for heat energy generation. Average energy generation efficiency was 85%.

VI. 6. THE OUTCOME

During 2009 – 2010 district heating period 1000 t of hay from Matsalu National Park, flood-plain of Kasari river was used for energy generation in Lihula Soojus Llc.

VI. 7. THE OUTCOME

One package of hay weighs app. 330 kg. At full load burns for about 1 hour and calculated energy output 1 MWh.

<u>Fact:</u>
The actual energy output based on experience was higher than calculated!

VI .8. THE OUTCOME

With the adoption of local renewable biofuels 3-5 indirect jobs were created around Lihula, mainly connected with biofuel supply.

VI. 9. THE OUTCOME

The ash from burning biofuels shall be used by local farmers for fertilizing the neigbouring feelds.

VI. 10. THE OUTCOME

The PVC material used for covering the roof and upper walls of the biofuel storage allows daylight to enter the room – additional electrical energy saving has been achieved.

Thank you!

Anu-Mai Levo
Foxia Llc.

Position in the project: Project Manager

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