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Feasibility study Biomass – wood-chip heating Grambow

PROJECT: RES-CHAINS
PROGRAM: SOUTH BALTIC PROGRAM
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BASED ON CONCEPT FOR GRAMBOW, BY TRIGENIUS GMBH
FOR: SOUTH BALTIC PROGRAM USERS
DATE: JULY 2013

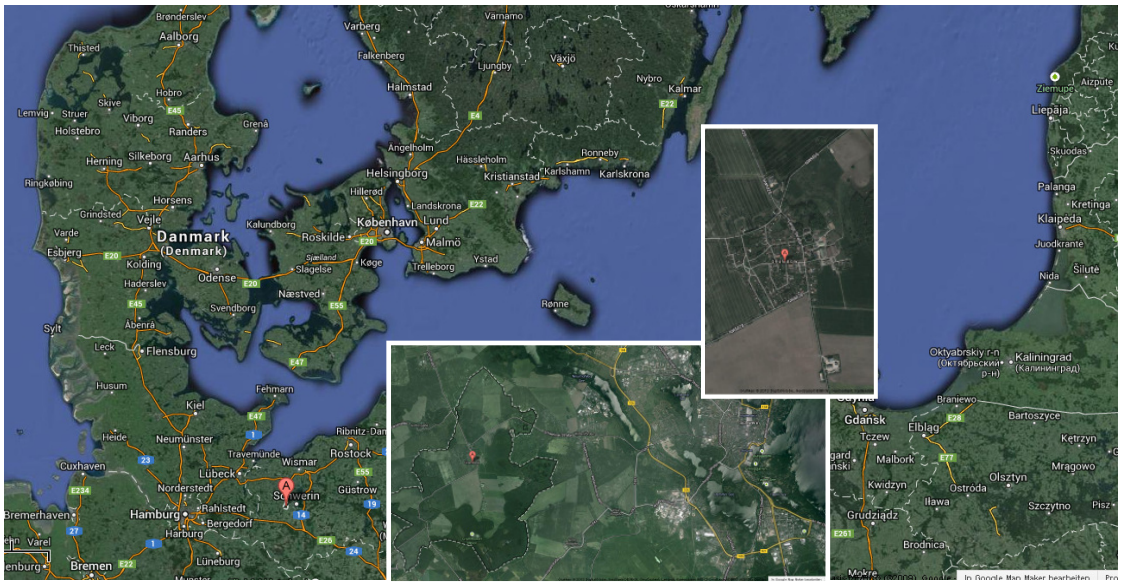
Study for village Grambow, concept for energy (potentials and using of RES)

THIS PROGRAM IS PART FINANCED BY THE SOUTH BALTIC PROGRAM AND THE EUROPEAN UNION.

Summary

Grambow is one of eight villages in rural area of North West Mecklenburg, which take part in federal project of (Bio)Energy Villages. Therefore municipal council made a energy concept, which shows potentials of RES and different options of using Solar, Biogas and/or Biomass for a small district heating system in Grambow. This feasibility study shows the biomass option (option 3 in concept) with wood chip local heating.

Current situation

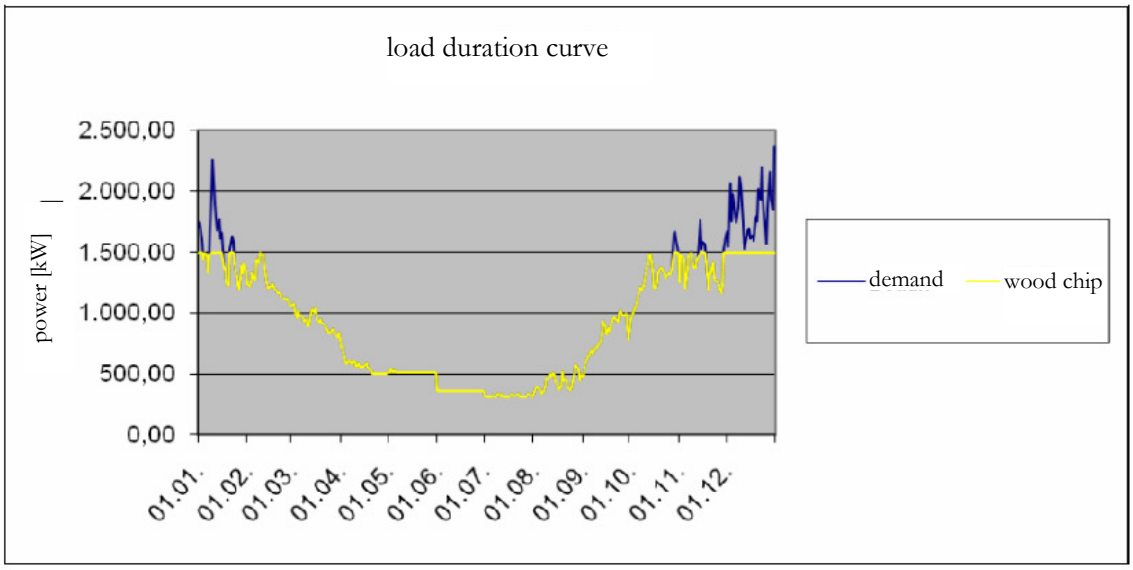


Grambow is a small village with 627 inhabitants, only 8 kilometre distance to the federal capital Schwerin, so it is and will be a good place for living. With reliable support of and affordable energy as part of Services of General Interest (SGI) the municipality is a stakeholder in energy chance. So in 2011 municipal council decided to make a concept to became (bio)energy village. At same time a famers starts to built a biogas plant, so one option was using surplus heat of this plant. Certainly in concept are more options analysed to supply heat, like a version with solar or with wood chips. In 2012 and 2013 municipality is working on setting up a organisation to build and operate a grid, since 2013 even to produce heat by wood chips. In this time runs no further detailed technical studies, mandatory are clear financial and legal framework for a planned operating organisation owned (partly, if inhabitants want to be part of it) by municipality. So the challenge is finding a suitable operating model for al small village without budget, not technical aspects.

Facts of planned installation

Boiler

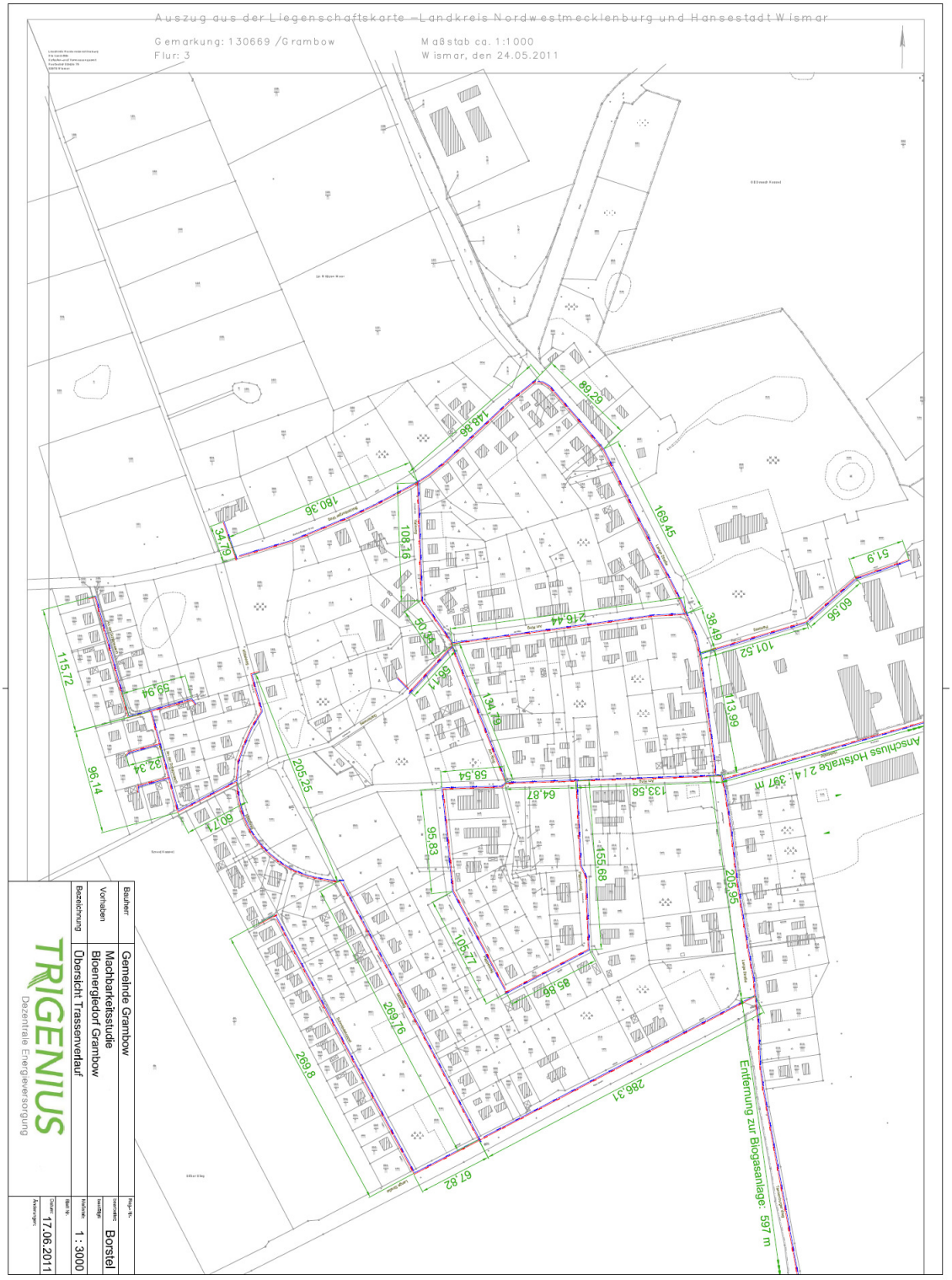
	power range [kW]	heating [MWh/a]	part of producing [%]	operating [h/a]
wood chip boiler	1.500,00	7.850,32	95,75	5.233,55
gas boiler	3.500,00	348,61	4,25	99,60
total heating system	2.997,83	8.198,93	100,00	2.734,96



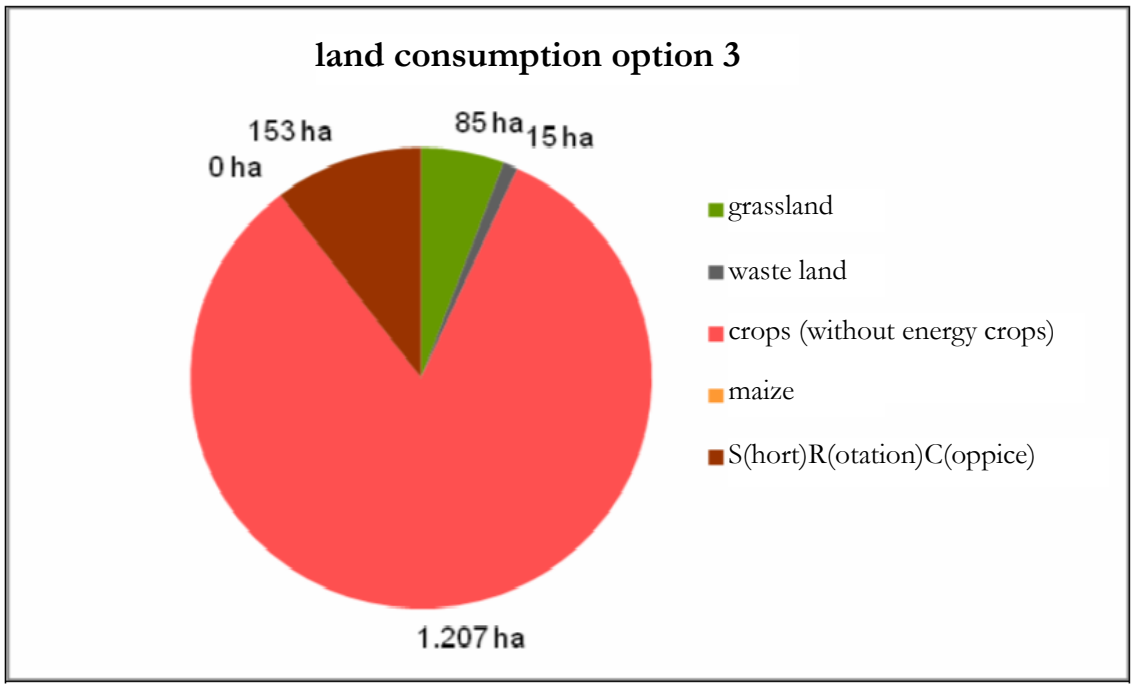
energy demand

	in MWh/a	in sm³/a
wood chip	9.023	10.026
(bio) natural gas	410	
auxiliary energy	131	

map of grid


Auszug aus der Liegenschaftskarte - Landkreis Nordwestmecklenburg und Hansestadt Wismar
Gemarkung: 130669 / Grambow
Flur: 3
Maßstab ca. 1:1000
Wismar, den 24.05.2011
Anschluss Hofstraße 2 L: 337 m
Entfernung zur Biogasanlage: 597 m
TRIGENIUS
Dezentrale Energieversorgung
Bauherr
Gemeinde Grambow
Vorhaben
Machbarkeitsstudie Bioenergiedorf Grambow
Bezeichnung
Übersicht Trassenverlauf
Gemarkung
Borstel
Maßstab
1 : 3000
Datum
17.06.2011

Impact on environment and climate



In option 3 is for a reliable heat supply a use of 153 ha of farmland by short rotation coppice needed. This are 10.48% of all cultivable land in Grambow. This is conform to the regional energy concept of West Mecklenburg region, with a advice not above 15 % energy crops using. Calculation dealing with assumption, that all available (not theoretical) potential of woody biomass from forestry are used for this heating system.

Financial aspects

estimation of invest

Invest, net of tax [Euro]	
boiler house	150.000,00
grid	4.420.050,00
equipment	986.900,00
reserve	477.405,00
additional building costs	630.174,60
total	6.664.529,60
potential subsidies	2.819.157,15

heat generation costs

Heat generation costs		
costs of capital	244.725 €/a	37,9 %
administration costs	42.576 €/a	6,6 %
costs of operation	109.715 €/a	17,0 %
fuel costs	248.027 €/a	38,5 %
available heat output	6594,6 MWh/a	
heat generation costs per consumer	97,81 €/MWh	

comparison of heat generation costs per option

	Add biogas heat, 100% connection	Add biogas heat, 60% connection 2	Only wood chips, 100% connection
cost of capital in €/a	227.108,49	180.072,00	244.724,80
financing heat supply			
rate of interest	3,30%		
term	20 a		
amount in €	6.287.129,60	4.970.298,94	6.664.529,60
subsides (grant) in €	1.726.215,15	1.393.418,80	1.850.757,15
subides (discharge of residual debt) in €	950.400,00	684.660,00	968.400,00
life cycle			
biulding	50 a		
grid	30 a		
equipment	20 a		
fixed operation costs in €/a	40.066,72	31.818,59	42.576,43
operation costs in €/a	95.489,04	75.369,14	109.714,53
operation and cleaning in €/a	2.800,00	2.800,00	2.800,00
service and maintenance in €/a	76.943,25	60.838,38	82.604,25
chimney sweeps in €/a	125,00	125,00	125,00
ashes removal in €/a	3.667,20	1.844,27	7.218,68
auxiliary energy (electrical power) in €/a	11.953,58	9.761,49	16.966,59
consumptions costs in €/a	285.206,63	182.546,13	248.026,74
natural gas (53,10 €/MWh) in €/a	51.972,86	17.990,35	22.442,84
wood chips (25 €/MWh) in €/a	114.600,12	57.633,42	225.583,90
heat from biogasplant (35 €/MWh) in €/a	118.633,66	106.922,36	-------
total full costs in €/a	647.870,89	469.805,86	645.042,50
annual demand of available heat in MWh/a	6.594,63	3.957,26	6.594,63
heat generation costs in €/MWh	98,24	118,72	97,81

Conclusion

Generally for Grambow a use of RES potentials even up to 100% heat supply is possible. By comparison of option with and without heat of biogas plant (build and operate by a farmer) is shown, that already with costs of 3,5 ct/kWh (typically waste) heat of a bio gas plant, a pure wood chip system is favourable.

Even that a RES-heating-grid-system is more economical than a reconstruction of a conventional local heating with oil or gas is analysed with local data.

single family house	Small heat demand		High heat demand	
	Heizöl	Erdgas	Heizöl	Erdgas
full costs [€ ct./kWh]	14,87	14,71	11,61	9,70
annual costs [€]	2.030	2.008	3.948	3.298
energy concumption [l, kWh]	1.706	15.167	4.250	37.778
energy value [kWh/l]	10	0	10	0
efficiency factor	0,80	0,90	0,80	0,90
heat demand [MWh/a]	13,65	13,65	34	34
power demand [kW]	6	6	15	15
net costs [€]	0	155	0	155
energy price [€/MWh,l]	0,70	0,055	0,70	0,055
basic costs [€]	-	155	-	155
consumption costs [€]	1.194	834	2.975	2.078
chimney sweeps [€]	70	70	70	70
service and maintenance [€]	100	100	100	100
operational electrical power [€]	50	50	50	50
liability insurance [€]	20	20	20	20
operational & consumption costs [€]	1.434	1.229	3.215	2.473
purchase, set up, installation [€]	6.500	8.500	8.000	9.000
life cycle [a]	15	15	15	15
amortisation [a]	15	15	15	15
average fix capital [€]	3.250	4.250	4.000	4.500
rate [%]	5%	5%	5%	5%
fixed cost of capital [€]	596	779	733	825

In concept are furthermore recommendations about economical facts by different connection rates, because the connection should be free of compulsion (which is possible for municipalities, but loss subsidies), it is suppose that after starting grid supply house owner waits till repair or replacement time is reached by it's own local heating to put up with install house connection.

As a alternative version concept analysed solar thermal, it suggested more efficiency houses in order to avoid enormous invest costs. So that could be a future option, because here a no additional consumption costs anymore. But meanwhile invest costs higher than avoided consumption costs during life cycle.

Due to these facts municipality council is implement this concept, working on financing and legal bearings of the project.