

WP 3.1

Czech Republic

Inventory and demo projects



Published by:

ENEA - Italian National Agency for New Technologies, Energy and the Environment

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December

2009

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1 Czech Republic, country description

1.1 Energy from Renewable sources of energy

The share of electricity generation from renewables in domestic gross electricity consumption amounted to 5,2 % in 2008. The national indicative target share for the Czech Republic has been set to 8 % by 2010. The share of electricity generation from renewables on total domestic gross electricity generation amounted to 4,5 %. The share of renewable energy sources in total primary energy sources was 5 % in 2008.

The highest proportion of renewable electricity production in 2008 comes from hydropower followed by biomass. Renewables share of total thermal energy production is about 7%.

The highest electricity production from renewables was realized by hydro powers (2 090 GWh). Then biomass (968 GWh) from which energetic black liquor usage has a significant proportion (475 GWh). As a significant source of electricity from renewables can be considered biogas usage (215 GWh) and wind power plants (125 GWh).

Waste incinerators (11,9 GWh), photovoltaic systems (2,1 GWh) and liquid biofuels (9 MWh) have only marginal importance.

1.1.1 Hydroelectric energy

Hydroenergy is the most important renewable source for the energy production, especially because of its suitable parameters for electrical system regulation. The CR, compared to other European countries, ranks among hydroenergy poor countries.

Gross electricity production from hydroelectric plants amounted to 2 024 GWh while the total installed capacity amounted to 1 045 MW. There are 1045 MW installed hydroelectric plants, from which 150 MW are hydroelectric plants which size is below 1MW_e, 141 with a size between 1 and 10 MW_e and 752 with size above 10 MW_e.

Hydroelectric energy share of gross energy production in the last year (2006) was 2.27%. Its share of green energy production was more than 61%. Predominant part of CR hydropotential is for a long time used primarily for electrical system regulation (as mentioned above). The utilization of remaining hydroenergy potential represents construction of about 100 MW installed capacity in small hydroelectric plants.

1.1.2 Geothermal energy

There is no production of geothermal energy in CR yet. Long term perspective to 2050 counts with 140 projects with installations of 5 – 30 MW_e.

Conservative estimation of available geothermal energy potential in the CR is 10 TWh of electricity and 26,9 PJ of thermal energy.

1.1.3 Wind energy

There were 66 aerogenerators with total installed capacity of 65,5 MW in 2006 in the CR. In the 2007 amount of them increased to 100 with total power of 114 MW.

By the end of 2008, 150 MW of aerogenerators had been installed in the Czech Republic. They have produced 245 GWh in 2008 (125,1 GWh in 2007). Key condition for wind energy functioning is satisfactory wind potential. From the technical and energy efficiency point of view wind powers are rather source of problems than competitive energy source in continental conditions.

The growth of installed power in the wind energy sector was obtained by high government subsidies (subsidised purchase price, investment support). Several aerogenerator construction projects of total capacity about 2000 MW exists already. But in fact we can envisage with construction of 350 aerogenerators of total installed capacity 800 MW.

1.1.4 Thermal Solar Energy

About 80 000 TWh of Sun energy catch the CR by the year, it is about 250x more then the annual energy consumption. Thermosolar systems are mostly used for hot water preparation.

Energy production of solar thermal collectors in 2008 was 202 TJ. Total area of glazed collectors was 165 000 m². In the years 1977-2008 was installed about 220 000 m² of glazed collectors with metal absorber. Supply of these glazed solar collectors was 35 000 m² in 2008, thus annual growth was 40%.

The end of 2008 the 125 000 m² of collectors have been installed in the households (family houses). Another 40 000 m² of solar systems have been installed out of households.

1.1.5 Photovoltaic energy

Installed power of photovoltaic energy sharply increase and practise since 2007 crucial part of total power is delivered to network.

1214 photovoltaic power plants was licenced in the end of 2008. Gross electricity production from photovoltaics was 12,9 GWh. Total installed capacity in 2008 amounted to 54,3 MWp (only systems with licence).

1.1.6 Biomass energy source

Gross electricity production from biomass amounted to 1 171 GWh in 2008 (annual increment of 203 GWh). Heat production from biomass amounted to 15 463 TJ (without households).

Beside „traditional“ fuels – wood waste, chips and wood chips (579 000 tons) and black liquor (224 000 tons) was in 2008 registered decrease of non-agglomerated plant biomass consumption (from 62 000 tons in 2006 and 16 000 tons in 2007 to 15 000 tons in 2008). Compared to that, consumption of plant material granules and briquets increased (from 16 000 to 24 000 tons). In the 2008 865 thousand tons of biomass were used for electricity production, it is

much more than in 2007. Growth was observed with wood waste, chips and wood chips consumption.

In the case of thermal energy statistical survey of 30 thousand biomass processing companies was done. In 2008 these companies produced 15 463 TJ of thermal energy, most of it was used in own factory. Black liquor (787 thousand tons) and category of wood waste, chips, bark, wood chips and logging residues (1 024 thousand tons) are mainly used. There is still low share of energy used non-agglomerated plant materials (22 thousand tons).

1.2 Technology Specific Figures:

The highest share of renewable electricity production in 2008 came from hydropower followed by biomass:

- Gross electricity production from **hydro** amounted to 2 024 GWh while the total installed capacity amounted to 1 045 MW.
- Gross electricity production from **biomass** amounted to 1 171 GWh in 2008 (annual increment of 203 GWh).
- The exploitation of **biogas** (267 GWh) can also be viewed as a significant source of renewable electricity.
- **Wind plants** produced 245 GWh in 2008. By the end of 2008, 150 MW of wind power had been installed in the Czech Republic.
- Gross electricity production from **photovoltaics** was 12,9 GWh. Total installed capacity in 2008 amounted to 54,3 MWp (only systems with licence).
- Energy production from **solar thermal** collectors was 202 TJ. Total area of glazed collectors in 2008 was 165 000 m².
- **Heat production from biomass** amounted to 15 463 TJ (without households).
- **Heat production from biogas** amounted to 1 065 TJ (including urban and industrial sewage sludge, biogas stations, landfill gas).
- In 2008, approximately 88 121 tonnes of biofuels (FAME) was placed on the market in the Czech Republic.

Tab. no 1: Primary energy sources in 2008

	Energy in fuel for heat production (GJ)	Energy in fuel for electricity generation(GJ)	Primary energy sources (GJ)	Total energy from RES (GJ)	Share on TPES	Share on RES
Biomass non-households	19 899 049,49	9 354 304,60	-	29 253 354,10	1,55%	30,98%
Biomass in households	44 165 424,00	-	-	44 165 424,00	2,34%	46,77%
Hydro power plants total	-	-	7 287 606,00	7 287 606,00	0,39%	7,72%
Municipal solid bio-deg. wastes	2 353 546,12	49 319,40	-	2 402 865,52	0,13%	2,54%
Other solid bio-deg. Wales and refined fuel	590 560,80	-	-	590 560,80	0,03%	0,63%
Biogas	1 650 715,24	2 111 654,86	-	3 762 370,09	0,20%	3,98%
Biofuels	0	0	4 640 948,8	4 640 948,84	0,25%	4,91%
Heat pumps			1 200 000,0	1 200 000,00	0,06%	1,27%
Solar thermal collectors	-	-	202 491,0	202 491,0	0,01%	0,21%
Wind energy	-	-	880 779,60	880 779,60	0,05%	0,93%
Photovoltaics	-	-	46 573,20	46 573,20	0,00%	0,05%
Total	68 659 295,65	11 515 278,86	14 258 398,64	94 432 973,15	5,00%	100,00%

(RES = renewable energy sources, TPES = total primary energy sources)
Ministry of Industry and Trade

Data source:

2 Demo projects (plants/systems) inventory

Introduction

Biomass is any material of biological origin. It means biomass involves a wide range of species including dendromass (wood biomass), phytomass (herbal origin biomass including agricultural crops) and animal origin biomass. One of the other types of biomass is biodegradable waste.

Power and heat production from biomass has the greatest technical utilizable potential of all renewables in CR. Biomass use is traditional, mainly in heat production sector. The electricity produced from biomass has not got problems with stability of electricity supply and its stability is possible to maximize by current use with fossil fuels.

However biomass utilising has its limits. It is particularly transport accessibility. Cultivation of biomass for energy use is effective only in 50 kilometer radius around the considered area.

Energy use of biomass means plant and wood material burning, black liquor included.

Followed kinds of biomass are used for electricity production:

- sawdust, bark, chips, wood waste
- plant material
- pellets
- black liquor

The comparison of electricity and heat production from biomass shows, that 80% of energy used biomass is consumed for heat production. Mostly waste biomass in the form of sawdust, chips and black liquor. Part of energy utilizable biomass is exported from CR.

In 2008 more than 700 thousand tons of biomass suitable for energy purposes have been exported abroad. It is more than 20% (more than in 2007).

Part of produced electricity (38%) has been added to the electricity network, 58% of electricity has been consumed in the own factory. Only 4% of gross electricity production represented direct sales to the third subjects. About 80% of energy used biomass is employed for the heat production in the CR.

3 Bioenergy state of the art

Biomass can be in energy terms considered as accumulated sunlight. It is estimated, that about 30% of biomass production is used as a food or feed and 20% represents forest production. Biomass is currently the most relevant renewable energy source.

Energy use of biomass in CR is connected to startup of support programmes in the second half of the nineties.

Currently part of agricultural production can be used for energy purposes. For example, by an „Independent expert commission for the estimation of CR energy requirements“ report, 2/3 of CR arable land are sufficient to ensure food security. According to 2001/77/ES EU directive was estimated indicative goal of renewables rate in electric energy consumption of 8% in 2010. Plant biomass should contribute two-thirds to ensure this target. The new directive 2009/28/ES set obligatory target 13% of renewables share in 2020.

In addition to „traditional“ fuels – wood waste, sawdust and wood chips (579 thousand tonnes) and black liquor (224 thousand tonnes), decline of non-agglomerated plant material consumption was registered (from 62 thousand tonnes in 2006 and 16 thousand tonnes in 2007 to 15 thousand tonnes in 2008). Consumption of plant material pellets and briquetts increased (from 16 to 24 thousand tonnes). In 2008 total amount of 865 thousand tonnes of biomass was used for electricity production, which is significantly more than in 2007 (by 200 thousand tonnes). Increase was mainly noted in wood waste, sawdust and wood chips.

Table no. 2 : Electricity generation from biomass in 2008 (fuel input)

	Number of companies	Electricity generation (MWh)	Own consumption including losses (MWh)	Grid (MWh)	Direct sales (MWh)	Fuel input (tonnes)
Chips, waste wood	21	603 047,9	131 813,6	471 234,4	0,0	579 384,1
Black liquor	2	458 468,7	436 656,7	21 812,0	0,0	224 342,2
Plant materials	7	23 085,2	2 722,2	20 363,0	0,0	15 120,4
Pellets and briquets	7	84 535,6	18 006,2	66 529,4	0,0	44 924,6
Other biomass	1	1 390,0	0,0	1 390,0	0,0	1 345,0

Data source: Ministry of Industry and Trade

Other biomass means special fuel produced from biomass and biodegradable waste fall within „supported“ fuels. In the above mentioned table no. 2 the number of respondent doesn't correspond to total number of them, because part of companies use several different types of biomass.

3.1 Heat production

Overall 15 463 TJ of thermal energy was produced in monitored segment of companies. Produced energy was mostly utilised in own factory.

Table no 3: Heat production from biomass in 2008 – non-households

Fuel	Number of companies	Gross heat production (GJ)	Own consump. (GJ)	Direct sales (GJ)	Fuel input (tonnes)
Chips, waste wood	699	8 297 771,9	7 208 516,8	1 089 255,1	1 023 815,9
Firewood	520	355 809,9	355 351,2	458,7	34 718,8
Non-agglomer.en.plants	51	258 500,6	74 955,1	183 545,4	22 390,4
Briquetts, pellets	85	211 316,4	78 331,2	132 985,2	16 402,8
Black liquor	2	6 339 164,8	6 019 045,4	320 119,4	787 471,4
Other biomass	0	0,0	0,0	0,0	0,0
Total	1 186	15 462 563,5	13 736 199,7	1 726 363,8	1 884 799,3

Data source: Ministry of Industry and Trade

Black liquor (787 thousand tonnes) and category of „wood waste, sawdust, bark, wood chips, residues from logging“ (1 024 thousand tonnes) are the most used sorts of biomass. Low share of energy used non-agglomerated plant materials is especially surprising. It amounts negligible 22 thousand tonnes, which is the same amount as in 2007.

According to the „Independent expert commission for the estimation of CR energy requirements“ report the total theoretical biomass potential in CR is 700 PJ energy by year, while using of all agricultural land, annual dendromass increments and utilization of all secondary raw materials. Technical available potential amounts 276 PJ, agricultural biomass share is 194 PJ, forest biomass 50 PJ and residual is 32 PJ. Currently use of biomass range around 100 PJ.

Table no. 4: Energy utilized biomass – balance 2008 (tonnes)

Fuel	For electricity generation	For heat production	Total
Chips, bark, waste wood etc.	579 384	1 023 816	1 603 200
Firewood	-	34 719	34 719
Non-agglomerated energy plants	15 120	22 390	37 511
Briquetts and pellets	44 925	16 403	61 327
Black liquor	224 342	787 471	1 011 814
Other biomass	1 345	0	1 345
Total	865 116	1 884 799	2 749 916
Biomass in households			3 397 340
Export			719 503
Total used or exported energy biomass			6 866 759

Data source: Ministry of Industry and Trade

Wood briquetts production in CR developed since the early nineties and pellets production since second half of nineties. From 2004 processing of „alternative“ plant pellets from agricultural waste is sharply increasing (especially pellets Ekover). In 2007 big company for pellets production (Leitinger Bio Pellets Paskov s.r.o.) has been opened. Production of briquetts and pellets from other materials (cannabis, purposely grown energy crops) is unimportant yet.

Table no. 5: Balance of briquetts and pellets from biomass (2008)

	Briquetts (tonnes)	Pellets (tonnes)
Capacity of processing plants	133 767	395 786
Domestic production	76 622	193 896
Import	6 922	1 819
Export	47 010	112 763
Own consumption of producers	2 640	822
Stat.diff. and stock changes	18 347	- 837
Inland consumption	52 241	81 293
Consumption in large companies	5 215	56 135
For electricity generation	1 645	43 279
For heat production (incl.producers)	3 570	12 856
Stat.diff. and stock changes	20	2 336
Consumption in small companies and households	49 666	23 649

Data source: Ministry of Industry and Trade

The import in 2007 amounted to at least 7 500 tonnes. The briquetts were imported from Austria, Poland and Germany. Briquetts and pellets were imported from Ukraine and Slovakia. Both products are mostly exported to Austria, Germany, export to Italy is increasing.

The production and inland consumption of briquetts and pellets from biomass in recent years has increased sharply. Plant pellets are used more for electricity production. These fuels play a less important role for small consumers, in households. Especially wooden pellets use in households is compare to Germany and Austria very low yet.

Table no. 6: Briquetts and pellets consumption in 2004 – 2007 (tonnes)

	2004	2005	2006	2007
Briquetts	2 183	2 426	8 702	11 730
Pellets	1 375	3 617	21 620	34 686
Total	3 558	6 043	30 322	46 416
for electricity generation of it	1 227	2 726	15 518	24 321

Data source: Ministry of Industry and Trade

In 2008 more than 700 thousand tonnes of biomass suitable for energy purposes have been exported. It is more than 20% higher amount than in 2007. Most of this increase involved raising briquetts and pellets export.

Table no. 7: Energy biomass – external trade statistics (tonnes)

	2007		2008		Index	
	Import	Export	Import	Export	Import	Export
Firewood	7 125	76 875	3 053	68 675	43%	89%
Chips etc.coniferous	36 862	101 032	25 460	129 804	69%	128%
Chips etc. non-coniferous	1 219	72 820	1 249	125 451	102%	172%
Sawdust	6 893	137 964	7 862	123 336	114%	89%
Wood waste	12 911	100 934	23 372	70 074	181%	69%
Briquetts and pellets	7 591	102 115	9 500	202 163	125%	198%
Total	72 601	591 740	70 496	719 503	97%	122%

Data source: Ministry of Industry and Trade; Czech Statistical Office

There is significant increase in burned biomass volume for electricity production (especially wood chips and wood waste). Export increased as well. Particularly firewood and wood briquetts and pellets were exported. Biomass consumption for heat production (in non-households sector) is steadily declining. Less fuels were supplied to households.

3.1.1 Heat production – households

Biomass in this statistics means firewood obtained in the forest, from the city and village green maintenance, obtained by self-gathering or by the purchase of fuel dealers. Whole wood waste – sawdust, old pallets or furniture, utilized wood

is included there as well. Pellets, briquetts and plant material represent so far only margin share of this consumption.

Table no. 8: Estimation of annual development

Year	Consumption (tonnes)	Energy in used fuels (GJ)	Heat (GJ)
2003	2 653 477	34 495 195	21 820 358
2004	2 827 363	36 755 715	23 250 277
2005	2 852 206	37 078 678	23 454 572
2006	3 087 549	40 138 138	25 389 871
2007	3 585 103	46 606 334	29 481 407
2008	3 397 340	44 165 424	27 937 379

Data source: Ministry of Industry and Trade; Czech Statistical Office

3.2 Bio-degradable wastes and refined fuels

Energetic utilization of waste means solid residential, hospital and industrial waste combustion.

Thus produced electricity is not object of government subsidies according to act no. 180/2005 code about support of electricity production from renewables.

Table no. 9: Energy utilisation in 2008 (GJ)

	For electricity generation (GJ)	For heat production (GJ)	Total (GJ)
Municipal Solid Bio-degradable Wastes	49 319,4	2 353 546,1	2 402 865,5
Animal products	0,0	285 698,4	285 698,4
Solid Bio-degr. Refined Fuels	0,0	304 862,4	304 862,4
Total	49 319,4	2 944 106,9	2 993 426,3

Data source: Ministry of Industry and Trade

3.3 Liquid biofuels

In september 2007 mandatory addition of FAME to diesel (minimal amount 2% of the total volume) has started in CR. From 1. 1. 2009 mandatory addition of FAME increased to 4,5 volume percent of total amount.

Duty of biofuel addition to the petrol has been valided from the 1.1.2008. From 1. 1. 2009 mandatory addition of FAME to petrol increased from 2% to 3,5% of total petrol volume.

Table no 9: Balance of production, export and import of FAME – fatty acids methyl ester (tonnes)

	2003	2004	2005	2006	2007	2008
Production	113 500	85 144	126 894	110 574	81 806	76 672
Exports	43 500	52 414	131 536	110 515	53 572	43 657
Imports	60	3 120	7 811	22 532	8 339	34 352
Inland consumption	70 060	35 850	3 169	22 591	36 573	88 121
Production capacity	198 075	202 000	194 500	194 500	346 000	333 000

Data source: Ministry of Industry and Trade

3.4 Biogas

Biogas utilisation has a long tradition in CR in face of anaerobic fermentation as a part of waste treatment plant technology. Biogas produced there is mostly used for own consumption.

Biogas plants construction pass through dramatic development currently. Its dynamic exceeded landfill gas use development, which was dominant in the past. In 2007 150,5 mil. m³ of biogas have been used for energy purposes. It is about 20% more then in 2006 (122,9 mil. m³).

In 2008 175,6 mil. m³ of biogas have been used for energy purposes. Main reason of this increase is biogas plants production, volume of produced gas increased from 28 to 51 mil. m³.

Table no.10: Energy utilization of biogas in 2008

	Number of companies	Number of plants	Biogas consumption (m ³)
Urban sewage sludge gas	48	96	57 857 277
Industrial sewage sludge gas	12	13	3 624 054
Other biogas (agricultural, co-digestion)	48	49	51 382 715
Landfill gas	24	58	62 705 698
Total	132	216	175 569 744

Data source: Ministry of Industry and Trade

Table no. 11: Electricity generation from biogas in 2008

	Number of companies	Number of units	Installed capacity (kW)	Electricity generation (MWh)	Own consump. (MWh)	Grid (MWh)	Direct sales (MWh)
Urban sewage sludge gas	31	72	17 206	74 036,3	59 312,5	14 723,8	0,0
Industrial sewage sludge gas	6	9	1 029	4 016,4	3 176,4	840,0	0,0
Other biogas (agricultural, co-digestion)	47	99	28 946	91 580,0	15 608,3	72 239,8	3 731,9
Landfill gas	24	80	23 850	97 235,6	8 324,8	88 910,8	0,0
Total	108	260	71 031	266 868,3	86 422,0	176 714,4	3 731,9

Data source: Ministry of Industry and Trade

Table no. 12: Heat production from biogas in 2008

	Number of companies	Number of units	Installed capacity (kW)	Heat production (GJ)	Own consumption (GJ)	Direct sales (GJ)
Urban sewage sludge gas	48	194	89 691	690 251,9	690 251,9	0,0
Industrial sewage sludge gas	12	20	9 174	62 232,3	58 232,3	4 000,0
Other biogas (agricultural, co-digestion)	42	96	28 812	226 451,9	149 591,9	76 860,0
Landfill gas	5	19	7 541	86 454,3	24 629,9	61 824,4
Total	107	329	135 218	1 065 390,3	922 705,9	142 684,4

Data source: Ministry of Industry and Trade

Produced thermal energy is mostly used for own consumption. This is due to the location of landfills, waste treatment plants and other biogas plants out of villages.

Table no. 13: Biogas plants in CR (2001)

Locality	Fermented material (m ³ /day)	Fermentor volume (m ³)	Biogas production (m ³ /day)	Fermentor temperature (°C)	Biogas utilisation	Investment costs (thousand CZK)	Year of initialization
WT Třeboň	P/S 200/40	3200 + 2800	4000-6000	39-41	cogeneration	42 000	1973
Kroměříž	P/S 180/100	2x9802x3500	3800	35-40	heat		1985
CF Kladruby	P/M 100	2x1200	2200	39-41	cogeneration	36 000	1989
Plevnice	P/He 70/10	2x1100	1700	39-41	cogeneration	11 481	1993
Mimoň	P 120	2x1800	3500	42-45	cogeneration		1994
Šebetov	P 120	2x2200	2000	39-41	cogeneration		1993
Rabbit a.s. Trhový Štěpánov	P/B 10/10	1x700	1000	42-44	cogeneration	17 740	1994
CF Jindřichov	Sm/M 21 tonnes	6x85	600	35-40	cogeneration	5 500	1989
CF Výšovice	Sm/M 11 tonnes	8x180	350	35-40	heat	3 500	1987
CF Hustopeče	Sm/M 44 tonnes	8x170	1200	35-40	heat	8 500	1986
Skalice	B/P 170	2160	2700	37		48 000	1993

(WT- wastewater treatment, CF- collective farm, P - pig liquid manure, B- beef liquid manure, He - hen excrements, S - sewage sludge, Sm - straw manure, M - manure)

Data source: Czech energy agency

3.4.1 Biogas – demonstration projects

3.4.1.1 Electricity production from biogas in a.s. RABBIT in Trhový Štěpánov

Status quo:

Technology line for biogas production from liquid manure and slaughterhouse waste with total capacity of processed waste about 28 m³/day. Parts of technology line:

- concrete liquid manure tank of 72 m³ capacity with equipment
- metal reactor for liquid manure anaerobic utilization of 700 m³ capacity
- gasholder of 500 m³ capacity
- two steel above-ground tanks for fermentated liquid manure á 1 250 m³ including equipment

Liquid manure and waste utilisation run constantly, electric energy production takes about 18 hours.

Biogas production per day: 980 – 1020 m³

Heating power of biogas: 22 MJ/m³

Service data

Biogas production facilities have been finished in november 1994 and plant operates from 1995. Produced electric energy is, except own consumption, supplied to collective farm Trhový Štěpánov at the price of 2,20 CZK/kWh.

Table no. 14: Electricity production development in biogas plant

	1995	1996	1997
Electricity production (kWh)	499 122	540 198	606 276
Own electricity consumption (kWh)	113 265	114 008	146 408
Supply to Trhový Štěpánov collective farm	385 857	426 190	462 868

Heat from engine is used in addition to its own methanization process to heating rearing of poultry from 1997. It is about 13 thousand heads of poultry of average weight 2 kg. Heating costs amount 1,5 CZK/kg of bodyweight. Next heat recovery is in skin drier (savings in energy are about 120 thousand CZK/year).

Economic data

Total investment costs:	17 740 000 CZK
including construction:	4 487 837 CZK
Technology:	12 697 177 CZK
Material costs:	138 912 CZK/year
Reparation, maintenance:	61 863 CZK/year
Depreciation of tangible assets:	940 467 CZK/year
Wages, social and health assurance:	246 344 CZK/year
Total costs:	1 387 586 CZK/year
Sales:	
liquid manure storage:	180 000 CZK/year
electricity production:	1 018 310 CZK/year
heat production:	354 000 CZK/year
Total sales:	1 552 310 CZK/year
Total costs:	1 387 586 CZK/year
Gross profit:	164 724 CZK/year

Gross profit will increase according to the extent of redundant heat from engine cooling recovery.

3.4.1.2 Biogas plant LUHA zemědělská a.s., Jindřichov

Biogas plant operates from 1989 and it was originally planned for manure (600 heads of cows) utilization. Today LUHA has got 250 heads of cows and pasture rearing heifers.

There are two enginegenerators – S 110 GEB 50, ČKD Hořovice. During the summer time engines work 12-14 hours/day, during the winter 8 hours/day on the average. About 150 thousand kWh of electricity produced per year is used for own consumption.

Surpluses of produced electricity are supplied to the grid for very low price 0,72 CZK/kWh. Waste heat is recovered for timber drying in wood drier. They are able to dry about 300 m³ of wood per year by average price of 900 CZK/m³.

3.4.1.3 Waste treatment plant Tábor, 1998

Basic information:

Waste treatment plant Tábor is mechanical-biological sewage with process of sludge fermentation with consequential biogas production. Conditions of biogas evolution is sludge heating to a temperature of 40°C. Primary heat source was gas boiler with total production capacity of 1200 kW, with three boilers SIGMA SLATINA VVP 400. Two boilers has biogas burners, third one has natural gas burners.

Waste water treating is intensive energy process. Total electrical installations output is 450 kW.

Course project

Construction of cogeneration unit with three biogas engines GEB 50 allow permanently cover of own energy consumption (90-100 kWe). The heat from engines and hot gasses cooling is used for sludge heating and heating. During the summer waste biogas is burned in „residual gas burner“

Table no. 15: Equipment specification

machine unit		
type		GEB 50
service capacity	elektrical	50 kVA (40 kW)
	heating :	73,5 kW
proportions	l x w x h	2065 x 995 x 1210 kg
weight		2100 kg
engine		
type		4S 110 G
service capacity		45 kW
drilling		110 mm
stroke		150 mm
cooling		water
alternator		
type		A 250 M 04
service capacity		45 kW
voltage		400 / 231 V
frequency		50 Hz

Basic information

Cogeneration unit was finished in september 1998 and after test operation end is unit in normal operation from 31. 12. 1998.

All produced electrical energy is consumed in the operation of waste water treatment plant. In a period of operation (from 1.10. 1998 to 23. 9. 1999) was produced about 529 774 kWh.

Table no. 16: Costs

investments costs	5 299 thousand CZK
from that construction	635 thousand CZK
technology	3 770 thousand CZK
advance and project working	730 thousand CZK
test operation	164 thousand CZK
government subsidies	660 thousand CZK

Evaluation

Cogeneration unit is in operation from september 1998 but during the winter time (december 98-april 99) reconstruction of waste water treatment plant sludge management took place. It limited biogas production and electricity production from cogeneration units.

The estimated annual electric energy production at continuous operation could be 790 thousand MWh.

At the price of electricity per 1,32 CZK/kWh it represents annual saving of 1 042 thousand CZK. Service costs of cogeneration units are 237 thousand CZK per year.

estimated annual savings	805 thousand CZK
recovery of investment	6,5 years

Biogas production is higher than consumption of cogeneration units. Residual biogas is at present burned on the residual gas burner without benefit. So there is still a space for another cogeneration unit installation.

Inconsiderable importance of this project is reduction of primary fuels consumption (natural gas for intenzification of waste water digestion process etc.).

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