Baltic University Urban Forum
City Status Report II

2

Energy Management

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Baltic University Urban Forum
Cities Status Reports

2. Energy management

Introduction

The city status reports in the BUUF project address ten key areas of city management, chosen at the outset of the project. These were later group in three areas of management, while integration was kept as a separate topic.

Material flows:
1. Water,
2. Energy,
3. Waste

Urban space:
4. Traffic and transport,
5. Green structures,
6. Built structures, especially brown fields

Socio-economy:
7. Education and information,
8. Economic development,
9. Urban-rural cooperation

Integration:
10. Integration of management

The areas were all discussed by the BUUF Scientific Advisory Council, which developed indicators for each of them. These indicators were later treated by the UBC Commission for the environment into a table, a short hand, for reporting indicator values. The indicator, the tables and the comments from the SAC are all found in the BUUF indicator book.

The reports
The city Status reports were/will be collected in the BUUF project at three occasions, 2004, 2005 and 2006. The reports will for each of the ten key areas, contain the following:

1. A description of the situation (collected 2004)
2. Basis indicator data (collected 2005)
3. Updating of indicator data. Comments on the choice of indicators. (2006)

The reports are edited for each area (water, energy etc) separately consisting of about 25 pages. The status descriptions consist of one page, with occasional additional pages for data diagrams etc, per city. The basic indicator data is collected in a table (one page) including all cities.

The Scientific Advisory Council members are asked to write benchmarking statements on these reports from the cities. The collected reports and benchmarking statements will be collected in a City status book from the BUUF project.

The cities
The cities have been organised in five groups according to character to make comparisons more meaningful. In each group there are representative from both "East" and "West". The list of cities then becomes as follows:

Group 1. Large port cities
1. Hamburg, Germany
2. Kaliningrad, Russia
3. Novgorod, Russia
4. Turku/Åbo, Finland

Group 2. Fairly large inland cities, metropolis issues
5. Lodz, Poland
6. Nacka, Sweden (close to Stockholm)
7. Minsk, Belarus
8. Örebro Sweden

Group 3. Medium sized inland university cities
9. Uppsala, Sweden
10. Tartu, Estonia
11. Jelgava, Latvia
12. Kaunas, Lithuania

Group 4. Small inland/coastal cities under economic restructuring
13. Livani, Latvia
14 Hällefors, Sweden
15. Norrtälje, Sweden
16. Sopot, Poland

Group 5. Small municipalities, ecovillage character
17. Enköping, Sweden
18. Tukums, Latvia
19. Kosakowo, Poland
20. Hågaby, Sweden

The data for the cites are thus listed in this order. There is also a table, which contain basic data for each of the cities.

1. Energy management indicators

Based on the audio conference on March 30, 2005.

Participants Jan Lemming, Uppsala, and Anne Ahtiainen, Turku, members of SAC

Anna Granberg and Kyösti Lempa, UBC office Turku,

Lars Rydén, BUP Secretariat, Uppsala University (taking minutes)

The indicators reflects the flow of energy from the sources through the municipality to its end products (dissipated heat and oxides such as carbon dioxide). The associated material flows are important in energy management. Thus waste produced in this flow should also be accounted for. In general it is difficult to report quantitative indicators on a municipal level, since most data are available on state level (and for each household). Still the energy sector is of critical importance in achieving sustainability, and thus we propose several unusual measures to get a grip of the situation on the municipal level. For each indicator several values are asked for. Not all indicators are quantitative. Care has been taken to reflect both environmental, economical and social properties of the energy system of the municipality.

The indicator list is in harmony with both the UBC indicator project and the European common indicators, both managed by the UBC Turku Office, but even more so to be useful in the development of municipal management.

Core indicators to be reported by everyone are underlined. It should be noted that much of the detail are needed to report core indicators, and they are thus close to an instruction on how to collect data for a core indicator.

1. Origin - sources of energy in the municipality

Indicators:
- Fossil fuel for the energy plant in the municipality (Oil, gas, coal, peat)
- Bio-energy fuel for the energy plant in the municipality
- Fossil fuel for households in the municipality (Oil, gas, coal, peat)
- Bio-energy fuel for households in the municipality
- Energy use in the public sector (schools, offices, hospital).
- Electricity sources (percentage of wind, water, combustion, nuclear, co-generated)
- Biogas used in the municipality
- Waste incineration in the municipality (heat)
- Solar (heat and photovoltaic)

Comments: Sources of energy is important for sustainability. With the figures asked for the percentage of renewable energy can be calculated. In most cases household data does not exist. The Council proposes that the universities may start a project where a survey of household energy management is made. The household and public sector energy use should be reported, while industry and transport is not included although they are main consumers of energy services.

2. System to run the energy management

Indicators:

- An energy plant in the municipality (yes/no % ownership by municipality) (MWh/year)
- A fermentation plant for biogas in the municipality (yes/no % ownership by municipality) (m3/year)
- A solar heat field/plant in the municipality (yes/no % ownership by municipality) (MWh/year)
- A district heating net in the municipality (yes/no % ownership by municipality)
- An gas net in the municipality (yes/no % ownership by municipality)
- Number (percentage) of energy efficient houses (indicate level of KWh per m2 per year)
- Number of houses with solar panels (number)

- Number (percentage) of households connected to District heating
Comments: Although there are many indicators they do not require work to be collected. As to the number of houses with solar panels and in general use of solar energy, this information has to be collected in a non-formal way.

3. Total amount of energy of various categories
Indicators:
- Consumption of heat by households (kWh/capita/year)
- Consumption of heat by public sector (kWh /capita/year)
- Consumption of electricity by households (kWh/capita/year)
- Consumption of electricity by public sector (kWh /year)
Comments: Again household statistics does not exist. The Council proposes that the universities may start a project where a survey of household energy management is made. The household and public sector energy use should be reported, while industry and transport is not included although they are main consumers of energy services.

4. Treatment of Energy Quality
Indicators:
- Renewable energy percentage in the municipality (a qualitative comment)
- Renewable energy percentage in public sector (a qualitative comment)
- Renewable energy percentage in households (a qualitative comment)
- Renewable energy percentage in transport (a qualitative comment)
- Renewable energy percentage in industry (a qualitative comment)
Comment: This information is crucial for sustainability, although it is very difficult to get precise data. Instead of producing data the council encourage the municipalities to estimate the percentage of renewables in each sector.

5. Energy efficiency
Indicators:
- energy efficiency in the public sector (a qualitative comment, e.g. as number of voluntary agreements to reduce the energy consumption in public buildings)
- energy efficiency in the households (a qualitative comment, e.g. as a questionnaire)
- energy efficiency in the transport (a qualitative comment, e.g. as the percentage of newer cars)
- energy efficiency in the industry (a qualitative comment, e.g. as the percentage of companies using environment management systems, ISO 14001 etc)
- Power plant efficiency (percentage, especially if there is cogeneration)
Comment: Again this is important but not easy to report. Some municipalities may wish to make a small project to look into this issue, perhaps together with a university student project.

6. Environmental impact of energy
Indicators:
- Carbon dioxide emission from the municipality (some ideas on how to find out)
- PM10 emissions, in the air (from traffic, heating of houses, incineration of waste etc)
- PM2.5 emissions, in the air (from traffic, heating of houses)
- SOx, NOx, CO, and VOC in the air (from traffic etc))
Comment: These data are all required according to existing EU environmental legislation. The CO2 value is the most important.

ENERGY MANAGEMENT

1. Percentage of electricity and heating energy originated from renewable sources as a fraction of total consumption, consumed in the whole city

• **Electricity**			**<20**	**20-40**	**40-60**	**60-80**	**80<**
Exact %: _____.	***OR***	Your estimate, %:	☐	☐	☐	☐	☐

• **Heating**			**<20**	**20-40**	**40-60**	**60-80**	**80<**
Exact %: _____.	***OR***	Your estimate, %:	☐	☐	☐	☐	☐

2. Sources of energy used in the municipality as a fraction of total amount

	Fossil fuel	**Bioenergy**	**Waste incineration**	**Wind**	**Water**	**Nuclear**	**Other**
Exact %	_____.	_____.	_____.	_____.	_____.	_____.	_____.
OR							
Estimate %	_____.	_____.	_____.	_____.	_____.	_____.	_____.

3. Annual CO_2 emissions per capita per year in the whole city (tonnes).

			<3.5	**3.5-5**	**5-7.5**	**7.5-10**	**10<**
Exact amount: _____.	***OR***	Your estimate:	☐	☐	☐	☐	☐

Main source of CO_2:	☐ Industry	☐ Buildings	☐ Transport	

4. Annual number of days when the limit value of SO_2 is exceeded (limit value: daily averages do not exceed 125 µg/m^3).

Exact number of days: _____.	***OR***	Your estimate:	_____.

5. Annual number of days when the limit value of NO_2 is exceeded (limit value: hourly averages do not exceed 200 µg/m^3).

Exact number of days: _____.	***OR***	Your estimate:	_____.

6. Annual number of days when the limit value of free particles (PM_{10}) is exceeded (limit value: daily averages do not exceed 50 µg/m^3).

Exact number of days: _____.	***OR***	Your estimate:	_____.

2. Energy management

Energy indicators

Numbers represent either exact or estimated values (Italic)

City	*Indicator #*	*1*	*1a*	*1b*	*2*	*2a*	*2b*	*2c*	*2d*	*2e*	*2f*	*2g*	*3*	*3a*	*3b*	*3c*	*4*	*5*	*6*
	Title/Values either exact or estimated (Italic)	Percentage of electricity and heating energy originated from renewable sources as a fraction of total consumption, consumed in the whole city.	a) electricity	b) heating	Sources of energy used in the municipality as a fraction of total amount	Fossil fuel	Bioenergy	Waste incineration	Wind	Water	Nuclear	Other	Annual CO_2 emissions per capita per year in the whole city (tonnes).	Source of $CO_{2\ Industry}$	Source of $CO_{2\ Buildings}$	Source of $CO_{2\ Transport}$	Annual number of days when the limit value of SO2 is exceeded	Annual number of days when the limit value of NO_2 is exceeded	Annual number of days when the limit value of free particles (PM10) is exceeded
Hamburg			*<20*	*<20*		*37*	*12*	*17*	*5*	*2*	*22*		*3.5-5*	Yes			6	3	6
Kaliningrad			0	*<20*		*14*	0	0	0	0	*86*	0				Yes	*<4 (in 2003);* *<5 (in 2005)*	*50 (in 2003);* *50-60 (in 2005)*	*>100 (in 2003);* *>150 (in 2005)*
Veliky Novgorod			50	50		50											0		
Turku			53 (2003) *20-40* (2004)	24,4 (2003) *<20* (2004)		*81,5*	*4,5*	*1,5*		*1,5*	*9*	*2*	10,1 (2003) 10,5 (2004)		Yes		0	0	7
Lodz						100											0	0	140
Nacka													2,8			Yes	0	0	0

Minsk																		
Örebro			*40-60*	*60-80*		*58*	*40*	*2*					*4*			Yes	0	0	24
Uppsala			*40-60*			21	43	32				4	4,2			Yes	0	60	42
Tartu			*<20*	*60-80*		*25*	*75*	0	0	0	0		1		Yes		0	0	*10*
Kaunas																	0	11	
Jelgava																		43	
Livani			*<20*	*40-60 (2003);* *60-80 (2005)*		*40*	*60*							Yes		Yes			
Hällefors																			
Norrtälje			*40-60*	*60-80*		*30*	*10*	*0*	*0*	*30*	*30*	*0*	*2*			Yes	*0*	*0*	*0*
Sopot			*<20*	*<20*		*30*						*70*	*1*			Yes	0	0	
Enköping			28,2	100		44	28	0		*10*	*10*	8	3,5			Yes	*0*	*0*	*0*
Tukums																			
Kosakowo																			
Hågaby																			

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING AND RENEWABLE ENERGY
Hamburg, Germany **Large port city 1** Total surface area of municipality 755,3 km^2 1,7 mln inhabitants The number of staff in the municipality administration - 14000	The main electricity suppliers to all households in Hamburg are the Hamburg Electricity Works (HEW) (Vattenfall Europe). Electricity and heat are generated in their own works as well as independent companies commissioned by them. Sun and wind are also employed as alternative sources of energy, apart from classic primary sources of energy, such as coal, gas, oil and nuclear fuel. Concerning their management of environmental issues, the HEW strives to adjust and to optimise the generation of electricity in line with a growing awareness of the environment.	To a large extent, households are supplied with heating by the so-called e.on-Hanse (Gas) or HEW-Fernwärme (remote heating). For the supply model of the western Harbour-City, HEWFernwärme (remote heating) is developing a model that takes into consideration renewable energies in order to reduce the CO_2-balance by 30% that is opposit to the conventional gas-supported supply models.		Hamburg realised many years ago that the field of energy management contains great potential for the use of renewable and environmentally friendly forms of energy. "Solar Initiative North", established within the framework of "Initiative Work and Climate Protection" and the bundling of competences following the initiative of the government, entitled "Renewable Energies and Fuel Cell Technology" boost up numerous projects, together with the economy and the energy suppliers. Housing projects, such as "The House of the Future" or "Solar Project Karlshöhe“, introducing the ways to save energy, have already been realised, and they provided a starting point for future projects. Congresses on solar energy or platforms for applicants are designed to create awareness of the topics concerning the use of energy, which does not deplete resources and which is renewable. e. Hamburg also organises the largest international specialist fair, "WindEnergy". Together with the Chamber of Trade and Commerce, Hamburg has initiated the co-operation with Environment Partnership Hamburg to improve the environmental balance, long-term economic management with the view to saving resources and to make ecologically sound investments in the economy. The Environment Partnership appeals to all Hamburg companies who are involved in the voluntary protection of the environment.

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Kaliningrad, Russia **Large port city 2** Total surface area of municipality 223,0 km^2 425 600 inhabitants The number of staff in the municipality administration – no data **ADDITIONAL INFORMATION IN APPENDIX, Figure**	The energy consumption in Kaliningrad region and especially in Kaliningrad city was significantly increased due to the recent economic development and this tendency is continue. Energy consumption in the Kaliningrad region is constantly growing. In 2004, 93% of energy (3259.7 mln. kilowatt-hours) was bought at the FWEPM (Federal Wholesale Electric Power Market), 7% (260 mln. kilowatt-hours) was generated by the electric power sources of the local energetic public joint-stock company "Yantarenergo". Effective issue of the electrical energy in 2004 amounted to 2067 mln. kilowatt-hours, it is 4% more than in 2003. Effective issue of the heat energy in 2004 was 968 thousand gigacalories. There is no technical opportunity to connect to the existing grid (6-10 kV) of Kaliningrad city, because of the ultimate load of the grid. The construction of the new cable lines and substations 10 (6)/0,4 kV is required. The enlargement of the EU poses	The heating for the communal and domestic consumers in the city are mainly provided by the large district heating installations. Other demands are provided by small boilers mainly working on coal. Many of these boilers have out-dated equipment; thus, they significantly contributes to the air pollution in the city. The new Heat-Electric Generation Plant-2 (HEGP-2) is expected to give the energy independence to the Kaliningrad region. It works on the basis of the up-to-minute technology using the gas-steam cycle with the efficiency 51.5% (while the efficiency of the usual steam power plants does not exceed 40%). It allows to save up to 20-25% of the fuel and to reduce the harmful air pollution for one third. This plant is the second gas-steam plant in Russia (the first one is situated close to St.Petersburg). To start the first unit of the HEGP-2 (for the subsequent energy receiving), 8 substations were modernized and 42 km of the 110 kWt power line were constructed. The first unit of the HEGP-2 was started on the 28th of October, 2005. Its capacity is 450 MWt, total capacity of the whole plant when the construction is finished reaches 900 MWt. The construction must be completed in 2009. Afterwards the energy resource of the HEGP-2 is supposed to be entirely sufficient for	The natural gas is supplied to the city through the branch of the gas-main pipeline Ivancevichi-Vilnius-Riga to two gas-distribution stations. The provision of the work of the new Heat-Electric Generation Plant-2 requires the construction of the new pipeline, which is now in the process of design. The reconstruction of the existing gas pipe-line and the increase of its capacity are expected as well.	

	new threats towards the electric power supply to Kaliningrad region. To solve these problems, the federal and regional authorities have proposed to construct the large Heat-Electric Generation Plant-2, which will use gas as fuel. The construction has being conducted in the South-eastern part of Kaliningrad city.	the whole Kaliningrad region. Besides, it will possibly allow reducing the energy tariff for the population which is one the highest in the country now (1.48 RUR per 1 kilowatt-hour). During the first year of exploitation, the HEGP-2 functions in the test and industrial mode. Every summer the municipality prepares the city for the next heating season, for example the dilapidated parts of the heating system: about 20 km in 2004 and about 20 km in 2005. 3 km of those pipes in 2005 were bought for Kaliningrad by SIDA. SIDA also paid 800 thousand Euro (80% of the project's cost) for the reconstruction of the small boiler-house using coal as a fuel and for converting it to the gas. The rest 20% was allotted from the city budget. Altogether 11 small coal boiler-houses were scheduled to be closed down in 2005 and only 6 were really closed by now.		

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Large port city 3 **Novgorod, Russia** Total surface area of municipality 89 km^2 223 000 inhabitants The number of staff in the municipality administration – 500		Municipal Unitary Enterprise "Teploenergo" is the main supplier of district heating and hot water services in Veliky Novgorod. The company's main customers are the population, budget and commercial organizations, and a number of industrial enterprises. At present, the company owns 65 boiler plants, including 375 steam and hot water boilers with a total capacity of 994,881 Gcal/hour. District heating system includes 245,4 km of pipes; hot water is supplied to boiler plants through 45 central substations, 5 individual substations and 34 hot water supply units. District heating and hot water system are distributed into five network districts. In 2003, the company produced 1 641 164 Gcal of heat energy. Sales volume has amounted to 1 440 000 Gcal. Annual profitability rate has equaled 2,7%. At present, 1 210 employees are working in the company. MUE "Teploenergo" has technically equipped with facilities for maintenance and repair of the majority of equipment. Company's adjustment service is responsible for hydraulic calculations, commissioning and testing of steam and hot water boilers, control and measuring devices and automatic equipment. The emergency and dispatching service operates 24 hours a day. MUE "Teploenergo" is constantly increasing the efficiency of production and distribution of heat energy and introducing new technologies. In 2002, the company commissioned a shop for the manufacturing of prefabricated pipes with polyurethane insulation. In 2003, the first automated boiler plant with German boilers of higher efficiency (92%) was opened. At present, Teploenergo is working on the introduction of frequency converters aimed at decrease of energy consumption. The enterprise is also actively involved in the implementation of institutional changes within the project financed by such international financial agencies as SIDA, NIB and NEFCO. This includes the development and the implementation of a corporate development plan, changes in the organizational and managerial structure of the enterprise, introduction of new forms of reporting. In the April of 2004, a feasibility study aimed at the development of short and long-term investment strategies started in the company.		

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Turku/Åbo, Finland **Large part city 4** Total surface area of municipality 306,4 km^2 175 000 inhabitants The number of staff in the municipality administration – 13695		About 86 percent of all residents live in houses, which are heated by district heating. Most of the district heat is produced with fossil fuels. The district heating network is not growing much anymore, and the biggest investments have been made on district cooling system. New investment is also a heat pump which uses the heat of treated waste water. The pump will be ready in 2008 when it will be producing heat for annual need of four thousand detached houses. Bio-heating plant, which uses partly gas which is taken from city dump is also a new investment on sustainable energy production.		One of the goals of the city of Turku is to reduce greenhouse gas emissions. This means also that energy production has to be changed into more and more sustainable form. At this point, fossil fuels are the main source of municipality's energy supply. The City of Turku has signed in to so called Energy Saving Company programme which gives economical subsidies for energy saving solutions and investments. Concrete energy conservation goal is the reduction of specific consumption for building heating by 11 % from the 1996 level by the year 2010

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Lodz, Poland **Large inland cities 1** Total surface area of municipality 294,4 km^2 770 800 inhabitants The number of staff in the municipality administration - 1935 **ADDITIONAL DATA IN APPENDIX, Table 1 and 2**		In the period 1998 – 2003, heat production in Łód was significantly reduced by 17,4% for hot water and by 38% for technological steam production (see Table 1 in appendix). The current actual indicator of the Power Plant customers' power demand for heating purposes, as per cubic capacity unit of heated facilities, for dwelling buildings now averages 23 W/m^3. The City's major heat supplier is the Zespół Elektrociepłowni (Power Plant Group), which is also the proprietor of the heat distribution network. In Poland, Łód is the only conurbation, which has no own heating network. The local authorities have committed themselves to acquire, through a parliamentary act, the urban heating network and road lighting elements managed by the Power Plant Group. The length of the heating network within the city's boundaries is: for hot water - 689,98 km and for technological steam - 83,5 km. In the recent years, the households' electric power consumption has insignificantly risen by 2% (see Table 2 in appendix).		

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Nacka, Sweden **Large inland city 2** Total surface area of municipality 95,4 km^2 78 000 inhabitants The number of staff in the municipality administration – no data				The share of bio fuel in the district heating system in Nacka is increasing, and it is now 16%. The hospital in Nacka is heated with "pine oil". The inhabitants in Nacka are choosing termal and air heat pumps for heating their houses. In 2003, the number of such houses was tripled to 240 households. Nacka has a full time adviser who gives free of charge information on energy to inhabitants.

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING AND RENEWABLE ENERGY
Minsk, Belarus **Large inland city 3,**	No data			

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Örebro, Sweden **Large inland city 4** Total surface area of municipality 1380 km^2 126 288 inhabitants The number of staff in the municipality administration – 14 000				We have few low energy houses, but there are no statistics or indicators. Figures on renewable fuels are included in the report from year 2000. (See Energi i Örebro kommun 2000). Figures on district heating are included in the report from year 2000 (See Energi i Örebro kommun 2000). All non composted solid waste is incinerated and used for district heating. The waste water treatment plant produces 13 GWh of biogas yearly. The municipal landfill produces about 18 GWh yearly. The biogas is used for heating and steam production at the hospital and Arla Foods.

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Uppsala, Sweden **Meadium sized univer-sity cities 1** Total surface area of municipality 2189 km^2 182 076 inhabitants The number of staff in the municipality administration – 5 688	The largest private plant is Vattenfall AB, which produces both electricity and heat. As fuel for the energy production, Vattenfall AB uses wood products, household and industrial waste, peat litter, coal and oil.	The distant heating is well built out of the city and it includes 97% of the houses in Uppsala. In 2003, there were ca 8 500 subscribers connected, from which 1 500 were large properties. The population growth of the next ten years is estimated to be managed within the capacity of the existing heating plant.		About 60 % of fuel is renewable. Peat stands are 20 % of the total fuel use. A new oven is built for energy extraction from household waste. It means that the extraction from waste in the whole plant is going to rise from 35 % to 50 %. The Uppsala plant treats 10 % of the waste from Swedish households. The carbon dioxide discharge will also be reduced, because coal and peat is replaced as fuel. The carbon dioxide in energy production is coming mostly from peat, oil, coal and plasters in the waste. The electricity production from Vattenfall AB gives 25 % of the city's electricity need. The rest products from the combustion – ashes and slag – are deposited at Hovgården (Uppsalas waste establishment). Vattenfall AB runs a water pump plant, which regains heat from the treated waste water and then supplies the heat to the distant heating net. In addition, it extracts cold in form of cold water, which is stored in a high tower, and deliver when industries are in need of cold. The plant regains about seven times as much as the water treatment plant uses. Districts outside the city have either local distant heating or private solutions with oil, electricity or bio fuel. The biogas project was initiated in 1994. The biogas plant was built in 1996 at Kungsängen farm nearby Uppsala city. The intention with the project was to take care of and to putrefy the different types of organic waste, to bring back the nutrients to the nature and to extract the energy from the waste. Yearly there are 50 000 tons of manure, butchers and organic waste from industries, shops, restaurants and larger kitchens used as fuel. The plant produces bio manure (fertilizer), which are delivered and spread on fields, and biogas, which is used as fuel for approximately 20 buses (and some cars). In the second part of the project, the plan has to use the waste from households to produce biogas.

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Tartu, Estonia **Medium sized university city 2** Total surface area of municipality 38,8 km^2 100 148 inhabitants The number of staff in the municipality administration – 290	Some strategic aims of Estonian energy management are: • achieve 20% of electricity made in CHP-s to 2020 • achieve 5,1 % of renewable electricity from total consumption to 2010 • keep the use of primary energy at the level of year 2003 until 2010	The energy saving potential in Tartu is quite high, we use 25-30% more energy for heating per one m^3 of room than in Helsinki. 40% of small dwellings use wood for heating purposes; others use gas, coal, fuel oil, or briquettes. About 75 % of the population have district heating in their houses and flats. District heating is made compulsory for the citizens in some (densely populated) regions with master plan of the city. Today, there are two heating companies in Tartu – Fortum Tartu (80% of the heating clients) and Eraküte (Dalkia Group). There are 11 boiler houses with the capacity over 10 MW. Annual heat generation by big boiler houses is about 430 GWh/y. 60-70 % of the annual heat consumption is produced from (slowly) renewable resources- peat, wood, bark, sawdust. Now some experiments of waste incineration is going on in one boiler house.		

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING
Jelgava, Latvia **Medium sized university city 3** Total surface area of municipality 60,32 km^2 66 088 inhabitants The number of staff in the municipality administration – no data	No data			

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Kaunas, Lithuania **Medium sized university city 4** Total surface area of municipality 157 km^2 368 917 inhabitants The number of staff in the municipality administration – no data		The district heating is the most popular type of heating in Kaunas. The area heated by district (centralized) heating makes 7 694 thousand m^2 (77 %) in residential houses and 8936 thousand m^2 (90 %) in public houses. The district heating network covers about 40 % of entire area of the city, mostly in the City Centre, multi-storied residential districts and big industrial areas. Total length of centralized heating pipes network is 434,7 km, the length of city importance network is 96,6 km, the length of district importance network is 271 km. The main heat supplier is "Kauno energija" company, which owns two biggest heating plants, Petrasiunai and Naujasodis thermal electric power plants, and two smaller district heating plants. Fuel used in plants is natural gas, as a substitute is used fuel oil.		The Kaunas Hydro-electric Power Plant has been constructed on the Nemunas River in year 1958, and modernized in year 1990. It produces 100 000 kW per hour. There is only one experimental wind engine constructed in year 1995, and there are no houses heated by solar panels. Thus, except water energy, renewable fuels are not almost used. There are no solid waste incinerators in Kaunas. The biogas production plant is planned to build in Lapes, at the city landfill area. The investor for biogas production plant has been selected, and construction works will be started soon. The low energy houses have been built in Kaunas since year 1992, when regulations on house insulation were made stricter. Most of the low energy houses belong to single-families. Total number of flats are 2200, but it is still very small percentage, makes only 1,2 % of all new built flats and houses.

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Livani, Latvia, **Small cities economic restructuring 1** Total surface area of municipality 306,06 km^2 9 500 inhabitants The number of staff in the municipality administration - 40	One private enterprise working in energy production sector in Livani is Ltd. "Mezrozite", which produces hydropower and supplies with it the national energy production enterprise-Ltd."Latvenergo".	Heat supply in Livani is provided by municipality's enterprise Ltd. „L v nu siltums" (Livani Heat). The steam-shop of the enterprise is the resource of heat supply in the town. Natural gas and woodchips are used as fuel now. Previously mazut/oil was used very much, but not any more. Last heating season, 60% of the heat was produced by woodchips and 40% by natural gas. Woodchips are bought from local woodworking enterprises (around 20 woodworking enterprises are working in Livani district). If the temperature outside is not very low, it is possible to supply the necessary heat using only woodchips. Main public institutions and most of the living houses are connected to Livani district heating system. 65% of town's inhabitants are living in the apartments connected to district heating system. Total heating area is 131 726 m² in Livani. Yearly distribution of thermal energy is 24703 Gcal, 75% of total heat is consumed by the inhabitants, 15% - by the budged institutions, 10% - by others. Heat supply is provided by two pipe systems. The total length of heat network is 12,72km. The utilized capacity coefficient of the heat network is around 2,4 MW/km including maximum capacity of hot water load. However, hot water supply has been stopped in Livani town several years ago due to the inhabitants' low solvency.		*Renewable energy.* Neither biogas nor bio fuel are produced in Livani district at the moment. . One of the local private enterprises - Ltd "RNS – D" has a project idea to start production of bio fuel in Livani municipality territory. The disincentive factor for the enterprise now is lack of human resources, which could manage this kind of project and the establishment of the production, and its management later. As a future idea for sustainable energy management, "Solar project" or Solar Collector Production Pilot project should be mentioned here. It will consist of three main parts: education of Latvian solar team in Sweden, establishment of solar collector production pilot plant in Livani and experimental mounting of collectors in Livani municipality, national sale and international export of solar collectors. *Energy saving.* Some small low energy houses have been started to build in private sector mainly. New municipality objects are also built to large extent as low energy houses, but they are not many.

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Hällefors, Sweden **Small city economic restructuring 2**	*Cooperation with the Steel factory Ovako* Our energy company, Hällefors värme AB, is cooperating with the Steel factory Ovako during two years. Before the cooperation, the company heated up the raw material up to 1000 C° using gas in the roller plant. . The surplus of power went through the chimney. Today, they have connected the roller plant to the municipality heating system, thus they could use the surplus of energy.	Our municipality has today three district heating plants. They are located in in Hällefors, - in Grythyttan and in a small village called Loka Brunn		The Municipality of Hällefors has together with four other Municipalities (Nora,Ljusnarsberg and Lindesberg) two persons employed for helping people and smaller companies to save energy. They help people to get their houses more energy efficient. All plants use bio-energy derived from saw dust, briquettes of shavings from the plane factories around our area. The company, which runs the business, sells equipments to private households. There are a lot of private households using these equipments to heat their houses.

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Norrtälje, Sweden **Small cities economic restructuring 3** Total surface area of municipality 5700 km^2 16311 inhabitants The number of staff in the municipality administration – no data	The main part of the consumed energy (85 – 90 %) is delivered from the outside of the community and this energy consists of electricity and the different kind of fossil fuels. Hallsta Paper Mill is our largest industry and consumer of electricity and fossil fuels. Another large user of fossil fuels is the traffic. The amount of fossil fuels for warming of the different kind of houses has been significantly reduced during the last ten years due to the building of the district heating plants. The use of fossil fuels causes emissions of sulfur dioxide, carbon oxide and nitrogen oxides. The nitrogen oxides cause eutrophication of soil and water. The municipality of Norrtälje has some local goals for the energy issues. For example, a larger amount of energy should be produced locally and the amount of renewable energy should be increased.	Only a smaller part of the totally energy consumption (10 – 15 %) in Norrtälje is produced inside the community. The district heating plants in Rimbo, Hallstavik and the town of Norrtälje produce warm water for heating of the different kinds of houses. The water is mainly heated by burning renewable fuels, mainly rests from loggings in the community or imports from the Baltic States. There are also about 20 000 separate houses, which are warmed up by firewood stoves. There are only few examples of solar heat and windmills in the community.		

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Sopot, Poland, **Small city economic restructuring 4** Total surface area of municipality 17,31 km^2 39 587 inhabitants The number of staff in the municipality administration - 197 **ADITIONAL DATA IN APPENDIX, Table 3**	Sopot is 100% electrified. Electrical energy is supplied to 21,202 consumers, who consumed 91,773 MWh: 19,457 households 44,444 MWh, 5 garden farms 9 MWh, 1,735 units used for non-dwelling purposes 47,311 MWh.	Individual heating. The quantity of flats shared by a number of families decreased significantly in the years 1999 – 2001. Heating systems became unified in the flats habituated by one owner. Traditional furnace heating, fuelled with coal or coke, was in use in most of these flats. In 1996, in order to reduce emission from individual heating, Sopot city began implementation of the heating modernization program. The program was based on a replacement of traditional furnaces with gas or oil-powered heaters, or with electric heating. Within the framework of this program, subsidies were granted to the residents who decided to exchange traditional heating with pro-ecological heating. In the years 1996-2001, approximately 600 subsidies were granted. The average subsidy amount was PLN 700 (150 euros). At the end of 2001, according to general estimates, approx. 5,000 individual flats were heated with gas, while approximately 1,000 flats were heated with electricity . Currently, the number of flats with individual heating sources is approximately 7,300, while approximately 1,300 flats in Sopot still have traditional furnace heating. Central heating for housing estates is supplied from estate heating units. The biggest of them is Brodwino heating unit, supplying Brodwino, Kamienny Potok, Kraszewskiego and other housing estates. The number of heating units decreased from approximately 3,000 (in 1999) to 254 (in 2001). Some of them were connected to the municipal heating system, while others were replaced with individual heating systems. The overall number of heating units is 254, which consists of 231 gas-powered heating units, 7 oil-powered heating units and 16 coal-powered heating units. The total power of existing heating units is approximately 75.8 MW, from which 70.3 MW comes from gas and oil-powered heating units). The southern part of Sopot is connected to the municipal heating	The gasification index amounts to 0.99, with 16,065 consumers in Sopot. After installation of the new medium-pressure system, limits are no longer imposed on the use of gas for heating purposes. The number of consumers using gas heating is currently 4382, and this number is increasing every year.	Energy saving policy was implemented in year 1993. Among the others, the programme included successive replacement of sodium-vapour street lamps, what has resulted in decrease of installed power and lowered operating costs of lighting devices (see Table 3 in appendix).

		system, being a part of the Gda sk heating system. A small part of this system runs through the Sopot area. 30 facilities were connected to the municipal heating system in the end of 2001. The total power of installed nodes is 11.8 MW. A special program to limit low-emission pollutions, including such pollutants as sulfur dioxide (SO_2), carbon monoxide (CO) and dust is implemented. The programme includes: - modernization of solid fuel-powered heating units by implementing environmentally friendly fuels such as oil or gas, - reduction of the number of heating units by connection of neighboring buildings to the central heating system, elimination of small heating units and modernization of large heating units, - installation of heating pumps: Orphanage, Hippodrome, - introduction of extra subsidies for replacement of coal-powered heating with ecological-powered heating in individual flats.		

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Enköping, Sweden **Small ecovillage city 1** Total surface area of municipality 1 184 km^2 38 211 inhabitants The number of staff in the municipality administration – 2 087		Nearly all buildings in the town are using district heating. The district heating system was built in 1970 – 1978. Since 1997, the production of district heating is only based on bio energy. Since 1995, 85% of the district heating has been produced by Combined Heat and Power plant (CHP), where forest residuals are mainly used as fuel, but, in addition, an increasing part is fuel from short rotation forestry.		Five years ago, a project was initiated to find a way of making Salix (willow) beneficial both for the farmers and for the energy company. The goal of the project was to establish 1000 ha of Salix in the region within ten years. With the existing plantations, it would supply the CHP with about 30% of the fuel consumption. The successful part of the project is that we can spread all produced bottom ash and the major amount of the digested sludge that is produced in the municipality.

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Tukums, Latvia **Small eco-village city 2**		District heating system (DHS) is operated by municipality owned company "Tukuma siltums". There are three biggest district heating systems of Tukums and production capacity: - Kurzemes street DHS – 48 MW, fuel wood chips, light oil; - Kuldigas street DHS –1,8 MW, fuel wood chips; - Jauntukuma DHS – 6 MW, fuel sawdust. Construction of 10 MW boiler plant and the fuel storehouse with capacity for 10 days was completed in 2002. New boiler house operates with use of wood chips. Heating energy is produced using 60 000m^3 wood chips and 1200 t heavy oil in Kurzemes street DHS. Reconstruction of network, reconstruction of 104 individual heat substations and automatic management system have been accomplished within investment of the project "Development of the heating system of Tukums town" (1999-2002).		Tukums has no natural gas. Neither biogas nor bio fuel is produced in Tukums town at the moment.

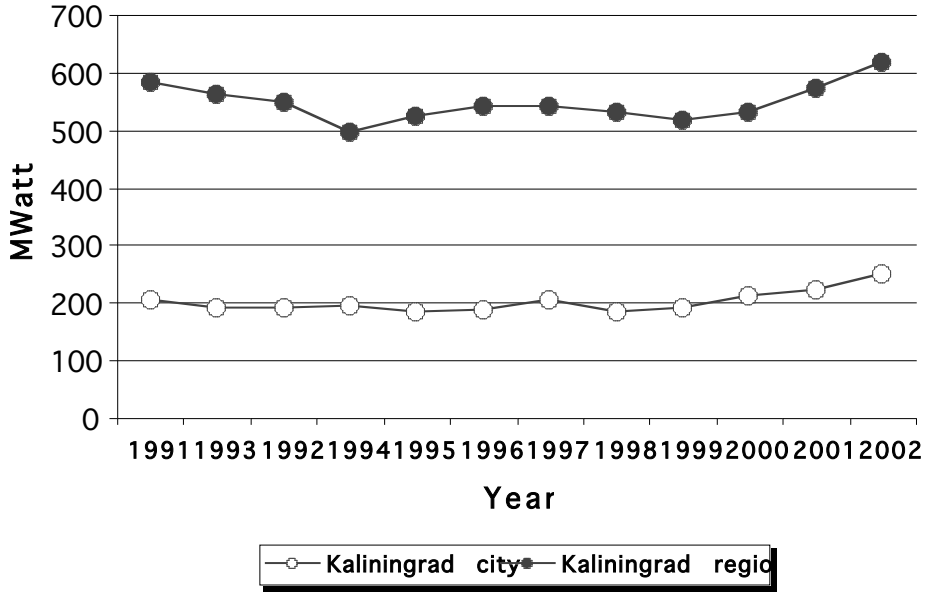
CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Kosakowo, Poland **Small eco-village city 3**	The aerial electrical supply line (115kV) is running along the municipality's border with the multi-family residential area belonging to Gdynia. Having analyzed investment possibilities, the municipality, together with the "ENERGA Gdansk Power Engineering Joint Stock Company" ("ENERGA Gdanska Kompania Energetyczna S.A."), is planning to change its location. The new established central location is not going to have negative impact on forest areas and the areas have been currently developed or planned to be developed. Most of the current energy needs are fulfilled by the aerial electrical supply line (15kV), which is planned to be modernized (as aerial-cable system) due to its frequent failures.	Kosakowo does not have any centralized energy supply source within its area. The energy needs for the purposes of residential areas, services and industry are mainly fulfilled by: a) individual heating sources such as: -gas heating 70% -coal and coke heating 20% -electrical heating 10% b) Gdynia heating system localized along the Kosakowo-Gdynia border (the system fulfills the needs of a small multi-family housing area, approximately 180 inhabitants). There are no plans located within the area of Pogorze and Suchy Dwor for reusing existing heating infrastructure belonging to Gdynia heating system.. The system previously provided heating supplies to a former state gardening company located in Kosakowo municipality.	The gas supplies are provided by Gdynia and Rumia medium pressure gas pipeline systems. The existing low pressure gas infrastructure supplies most of the municipality areas except from service and residential areas located in Pogorze. These areas are supplied by Gdynia gas pipeline system and the pipelines from the villages Debogorze-Wybudowanie and Kazimierz, which are connected to Rumia medium pressure gas network. The technical condition of low and medium pressure gas pipelines is good and the existing gas infrastructure fulfills the capacity requirements. It is planned to build underground gas storage system "Kosakowo" in the areas of Mosty and Debogorze villages. The storage areas are planned to be obtained by exploitation of the existing underground salt deposits. The national gas network will provide gas supplies to the system (planned capacity of 250 million cubic meters). The amounts of gas accumulated during summer periods will be stored in "Kosakowo" system and used during winter periods, and especially in emergency situations. 20m wide land area will be reserved during the construction period, and it will be reduced to 8m after the system have been built. It is forbidden to construct buildings and storage areas, plant trees and arrange any activities that could be dangerous for the existing gas pipeline system within the controlled areas. There is a military base and airport located within the municipality. Heating, energy and gas supplies in these areas are provided from separate supply systems. The information on military areas is not available.	

CITY	ENERGY SUPPLY	HEATING SUPPLY	GAS SUPPLY	ENERGY SAVING & RENEWABLE ENERGY
Hågaby, Sweden **Small eco-village city 4**		The heat supply consists of 80% district heating and local solar collectors producing 20% of the heat to the whole area including 100 households the central common building, the sports centre and the school.		When Hågaby village was rebuilt in 1996-1999, the present 78 rental apartments consumed 30% less energy (electricity and heat). The 22 tenants owned apartments were built as passive, energy conserving houses from the beginning. Between 2004 – 2006, an energy saving program is realized in this part including measures in the ventilation system, the regulation of air inlet vaults, internal air distribution in the houses, the warm water circulation system and the building of energy saving porches in most houses. The solar collectors provide renewable energy but also the district heating. In total, the renewable energy sources comprise direct solar heating, passive solar heating, wood fuel, district heating sources such as wood chips, garbage and peat (the latter can be questioned as a renewable resource). New heat storage techniques based on salt storage are planned as well as experimental development of new solar collector techniques, solar cells and passive solar heat constructions.

APPENDIX

Kaliningrad, Russia

Figure. Watt consumption in Kaliningrad region and Kaliningrad city during 1991-2002 years.



Lodz, Poland

Table 1. Łód Power Plant's heat production output in hot water and technological steam.

Year	Net production output (for supply network) – hot water in [TJ]	Net production output (for supply network) – technological steam [TJ]
1998	18367	4625
1999	17119	4028
2000	15519	3404
2001	16597	3271
2002	15362	2935
2003	15176	2865
2004*	6602	889

*data – 1st quarter-year. Source: data made available by the Łód Power Plant.

Table 2. Consumers and households' electric power consumption

Specification	1995	2000	2001
Consumers (as on 31.XII)	324659	324369	326565
Demand			
- in W GWh	578,3	584,7	
- in kWh per 1 dweller	700,4	737,1	746,5
per 1 consumer*	1781,2	2109,5	2266,1

*for calculation purposes an average number of consumers was assumed
Source: „Łód 's Statistics for 2002", Statistics Bureau for Łód , 2002.

Sopot, Poland

Table 3. The number of installed sodium-vapour street lamps in the years 1999-2000 in Sopot.

Year	Number of street lamps	Installed power (kW)
1999	3,120	551,01
2000	3,159	514,58
2001	3,182	479,75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