Master Plan

for innovative energy structures in
***Velky Krtis Region in Slovakia**,*
which could be feasible for funding in the
Structural Funds Programmes in the period 2007- 2013

Energy 4 Cohesion - Deliverable 4.4

Elaborated by Energy Centre Bratislava (ECB)

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Executive Summary

Master Plan for Slovak Target region “District of Veľký Krtíš” is the English shorter version of comprehensive regional energy conception in Slovak language, which has been developed in parallel. It gives a complete picture about energy sector in the district – typical rural and agricultural region in Slovakia; provides an analyses of energy savings and renewable energy sources (RES) potential, proposing potential projects to be supported from EU funds.

General content includes 3 main elements:

1.) Target Region Portrait,

2.) Analysis of future energy options,

3) Identification and investigation of RES and RUE Actions.

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1. Introduction

1.1 Background

Regional focus

The Master Plans presented with this report has been developed in the scope of the Energy 4 Cohesion (E4C) project, funded under the Intelligent Energy for Europe (IEE) Program. E4C strives to prepare the ground for the extended use of Structural Funds for innovative renewable energy actions in rural regions of Europe which make use of the regional renewable energy potential and increase the energy efficiency. The European social cohesion requires a balance in the economic and social conditions in all European regions. Energy can play a major role in achieving this balance. The availability of cheap and reliable energy contributes to sustainable social and economic development. Moreover, the exploitation of the own energy resources of a region means to bring additional employment knowledge and investment into the region which otherwise would be dragged into the more developed municipal regions.

In view to this regional approach the eight E4C target regions are the focus of all project related strategy and planning efforts. These regions have been selected for their suitability for extended use of renewable energies and energy efficiency actions, namely:

- Rich resources for renewable energy generation particularly biomass resource
- Clear support of the political and administrative decision makers
- Availability of an extended knowledge and data basis for the planning process.

Based on these requirements the following target regions have been selected:

1. Czech Republic: Zlin Region
2. Estonia: Saaremaa Island
3. Greece: Prefecture of Evros
4. Italy: Alta Locride
5. Latvia: Limbazi Region
6. Lithuania: Kaunas Region
7. Poland: Poviat Nowa Sol
8. Slovak Republic: Velky Krtis

Cooperative Approach

In each target regions all main stakeholders have been brought together for a successful and efficient definition of innovative energy actions in the respective region. The E4C actor cycle

includes municipalities, households, media, capital provider and financial experts. Within this actor cycle he E4C consortium partners were responsible for the coordination of the different actors, and the preparation of the regional **Master Plans**. Main focus was put to integrate suggestions and ideas existing in the region rather than exposing priorities from outside.

Action focused strategy

Comprehensive investigations were undertaken, starting from an abstract and general view on the regions, leading to concrete innovative energy set-ups, consisting of a range of RE and EE projects. A comprehensive and detailed methodology was developed within E4C, which is illustrated in chapter 1.3 of this report. It includes 3 main elements: 1.) Target Region Portrait, 2.) Analysis of future energy options, 3) Identification and investigation of concrete RE and EE actions. In this way it is ensured that concrete action potential is highlighted which is imbedded in an overall RE promotion concept for the region.

Targeted towards Structural Fund Support

The cornerstone of the E4C – strategy is to support the implementation of energy pilot actions in the selected regions feasible for public financial support, with main focus on **European Structural and Cohesion Funds (SF and CF)** during the funding period from 2007-2013. The main focus during the current programming period of SF and CF lies on the Lisbon Criteria. This reflects the ambition of the EC to reach greater sustainability, more employment and increased economic growth, targets that were set in the Lisbon Agenda. As stated above, renewable energies can contribute to these targets, moreover they increase the competitiveness of communities and regions, and foster European cohesion. However, up to date in most countries of Eastern and Southern Europe, only a small percentage of SF and CF measures have been dedicated to RE and EE projects. E4C strives to overcome the various constraints which currently hinder the broader use of Structural Funds for innovative energy actions in less developed and rural regions of Europe.

Conclusions

With the finalization of the Master Plans the core milestone of Energy 4 Cohesion has been accomplished. The large efforts undertaken by the respective partners in the regions have resulted in the selection of highly feasible and sustainable project ideas. The intense work for the Master Plans also has stimulated the interest and support of the local and regional decision makers for these results.

Since E4C is a project co-funded by European public funds, the results will be published at the E4C website. The Master Plans will also be widely disseminated in the target regions and neighboring regions, in order to gain the multiplier effect. Public funding applications and

acquisition of private investment money will start from 2008 for the realization of the innovative energy set-ups presented in the Master Plans.

1.2 Objectives

„Master Plan" as a shorten version of comprehensive document "Regional Energy Conception for the District of Veľký Krtíš" (prepared in Slovak language) is a strategy document giving a basic picture about the energy sector of target region, summarising the possibilities of higher RES utilisation as well as potentials for EE measures implementation.

Regional energy planning is a basic precondition for a better energy demand and supply management in the region resulting in several economical, environmental and social benefits for target groups in the region.

Thus **potential investors** have a chance to make a picture about:

- Amounts of biomass for energy utilisation available in the region (wooden waste and agricultural waste biomass);
- Potential locations for biomass facilities installation;
- Data about wind speed and assessment of possibilities of wind turbines construction in 2 selected reference locations in the region;
- Selection of potential locations for new small hydro power plants installation.

Thus **mayors** of municipalities have a chance to make a picture about:

- Availability of local biomass sources;
- Selected possibilities of fuel switch from natural gas/coal to biomass firing;
- Potential for energy savings in selected public buildings including possibilities of alternative energy sources utilisation (solar energy, biomass boilers, etc.).

The future energy supply and improved energy management are in line with sustainable development principles and enable dynamic development of the Veľký Krtíš region and are based on three **key objectives**:

- Reliable, available and diversified energy supply, maximal use of locally available resources;
- Effective, well planned and managed energy production and consumption;
- Reduction of current pollutants and CO_2 emissions from fuel combustion and improvement of ambient air quality.

1.3 Methodology of Master Plan Development

This Master Plan is elaborated based on a methodology, which was elaborated within Task 3.2 of the Energy 4 Cohesion project. The aim of the methodology is to facilitate the decentralised energy actions planning in 8 Target regions within the context of European Cohesion Policies. The methodology presented on next page (*Figure 1*) should ensure that:

- The results of the Target region planning can be compared;
- The coordination work for the many regions is supported with a strong tool;
- The local partners find help and guidance for assessing their potential and defining suitable renewable energy and energy efficiency actions (which will be compiled in the regional Master plans that are to be elaborated within Task 4.5 of E4C project).

As a base for the analyses of current energy supply and demand, analyses of EE & RES potentials and pre-feasibility studies prefferentialy own personal survey in the target region had been realised. Additionally, official national and regional statistic data had been collected; national technical norms and standards had been also considered.

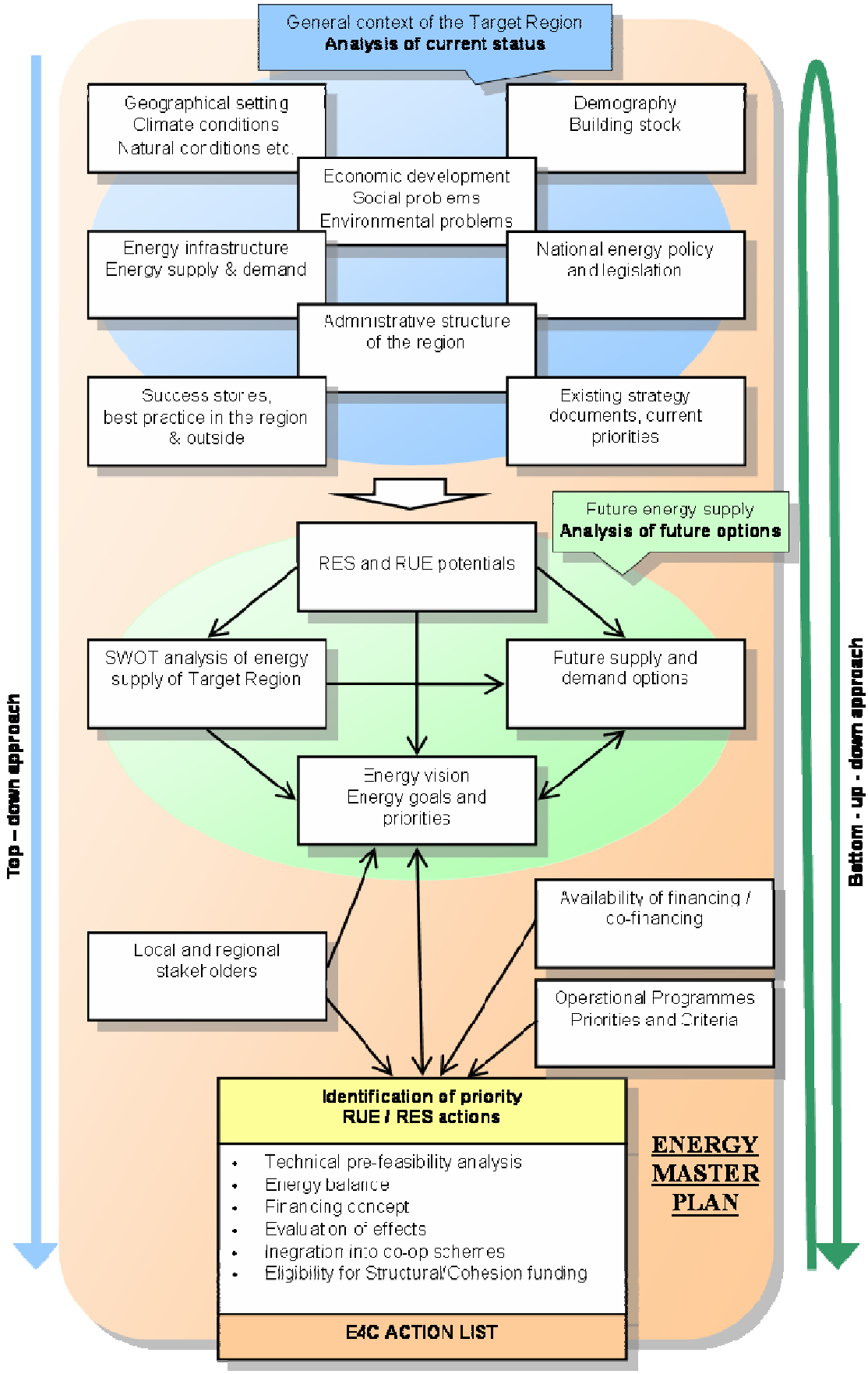

Figure 1: Methodology for elaboration of Master Plan

2. Target Region Portrait

Slovakia has faced a significant aggravation of regional disparities during the process of transformation of centrally planned economy towards free market. Different economic conditions, unequal job opportunities in the labour market, growing income differentiation and related concentration of poverty, as well as additional differences in natural and other conditions, have cause imbalanced development in different regions. The district of Veľký Krtíš is one of the most affected regions in this term.

The district's geographical location has substantially contributed to marginalization of the district (NUTS IV). It occupies the southern part of the Banská Bystrica Self-govern ing Region (NUTS III). Currently, no roads and railways of national or international relevance cross the district. Basic infrastructure is insufficient and usually suffers from a bad technical state. As a result, the District of Veľký Krtíš is considerably isolated, not only from Slovakia's major economic centres, but also within the Banská Bystrica Region.

2.1 Description of general context of the region

2.1.1 Geographical setting, natural conditions, climate, historical context

Veľký Krtíš District as an independent regional administrative territory was established in 1968 after delimitation of municipalities in the region of Lučenec and Zvolen. District territory was not changed even during a reform of territorial administration in 1996.

Tab. and figure: Basic region characteristics

District area:	848 km^2
Residential density $km^{2:}$	55
Municipality with top height above sea level:	Sucháň - 500 m above sea level
Municipalities with the lowest height above sea level:	Ipeľské Predmostie, Veľká Ves nad Ipľom - 135 m above sea level
Municipalities with the oldest written mention:	Kamenné Kosihy, Kosihovce, Nenince - year 1135

Veľký Krtíš District is situated in the southern part of the Banská Bystrica Region, thus in the southern part of middle Slovakia. It is a neighbour with the district of Lučenec, Zvolen, Krupina and Levice. Majority part of area consists of "Juhoslovenská kotlina" basin and "Krupinská planina" plain in the north. The river Ipeľ, which flows through this region, is a natural state border with Hungary.

Tab.: Target region characteristics:

Veľký Krtíš District	
Population in 2001	46 597
Population in 2002	46 550
Population in 2003	46 446
Surface area in ha within 31/12/2003	84 840 ha
Residential density 1 km^2 in 2003	55

Source: ŠÚ SR

Geomorphology of district area relates to its location. Majority part of area consists of "Juhoslovenská kotlina" basin, which is protected by "Krupinska vrchovina", "Javorie", "Strehovska pahorkatina" and "Čebovska bukovina" uplands .

District area is water passive, dry area with little amount of rainfall. The river Ipeľ, which flows through this region, is the main source of surface water. There are many mineral sources in this region, and some of them are used for relaxing purposes.

Climate of district is the same as the middle Europe climate and is influenced by area surface, by altitude, which is approximately 127 – 643 m above sea level. District area is divided into two climate spheres: south, which is warm area and north, which is mildly warm area.

Tab.: Energy of global irradiation in the Banska Bystrica region [kWh/m^2/rok]

	Horizontal	Vertical	Optimal inclination
Minimum	1038	779	1180
Average	1130	894	1298
Maximum	1179	940	1354

Source: PVGIS (c) European association 2002-2006. More information including interactively maps in Slovak language is available on the web site: http://re.jrc.cec.eu.int/pvgis/pv/imaps/imaps-sk.htm.

Specific natural climate conditions influence structure of **land fund** and its utilization in the region. Majority of agricultural land is medium fertile land (vast majority is heavy soil and medium-weight soil). Following sign indicates favourable land and climate condition, which predetermines agriculture character of the district.

Tab.: Land fund of Veľký Krtíš District 31/12/2003

Indicator	Banská Bystrica Region [ha]	District Veľký Krtíš (within the Banská Bystrica Region) [ha]
Total surface area	**945 508**	**84 840**
land:		
Agricultural land	**419 127**	**53 175**
arable soil	166 772	30 891
hop garden	0	0
vineyards	3 266	1 865
gardens	11 333	1 249
orchards	1 814	367
lawn green	235 941	18 801
Share of agricultural land in %	**44.3**	**62.7**
Non-agricultural land	**526 382**	**31 665**
Forest areas	462 477	25 864
Water areas	7 866	933
Built-up areas	32 814	3 380
Other areas	23 225	1 489
Share of forest land in %	**48.9**	**30.5**

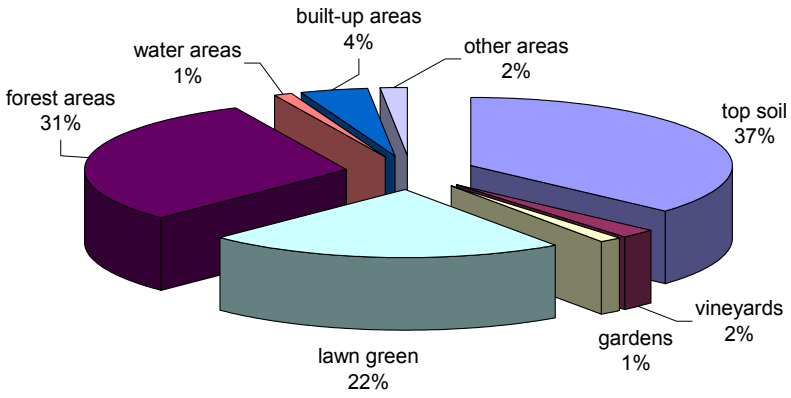

Figure: Land fund of Veľký Krtíš District

Source: Statistical Office of the Slovak republic

Land share of municipality ownership is not more than 5%.

Tab: Agricultural land used in district of Veľký Krtíš in 2006

Arable soil	29 601.94 ha
Lawn green	10 393.59 ha
- meadow	5 762.36 ha
Vineyards	1 456.39 ha
- produce fruit	963.61 ha
Orchards	275.14 ha
Back gardens	692.55 ha
Agricultural land	**42 419.62 ha**
Total crop area	29 565.75 ha

Resulting from mentioned data area of agricultural land decreased from 53 175 ha (in 2003) to 42 419.62 ha (in 2006). Area of arable soil decreased only slightly. Area of vineyards, gardens and lawn green also decreased.

Land management influenced character of the whole country. Thermophilic vegetation is situated in the northern part of the region and the main vegetation is broadleaved trees. For the southern part of the region are typical flood-plain meadows and marshland with small enclaves of flood-plain forests.

Compared to other regions of Slovakia, this region area has not so many protected places and natural creations. There are 9 national reservations, 5 natural heritage and 2 protected areas in this region. The most famous protected areas are natural reservations of “Modrokamenská lesostep”, “Čebovská lesostep” and “Kiarovský močiar”.

2.1.2 Administrative structure of the Region

There are two towns in the district: Veľký Krtíš and Modrý Kameň. Veľký Krtíš district consists of 71 municipalities. The most important place of the district is district town of Veľký Krtíš with 14 000 inhabitants. Veľký Krtíš has become the district town in 1968 after delimitation of municipalities in the region Lučenec and Zvolen.

Modrý Kameň, the town with the smallest number of inhabitants (1,414 inhabitants in 2003) in Slovakia is also situated in the region, although Vinica village with more than 1,900 inhabitants is more populous.

There is no united administration body for Veľký Krtíš district. Competence of self-administration lies on the municipalities and on the higher lever it lies on Banská Bystrica self-governing region. Specialised local state administration bodies have been created by special acts (section of road transport and road communications, land and forest management, social affairs, family and employment services, protection of the environment, education; etc.). Competence of state administration in the field of energy end environment lies on the District Office for the Environment located in Veľký Krtíš.

2.1.3 Demography and the building stock

District’s area population is a result of hundreds of years settlement in “Juhoslovenská kotlina” basin and “Krupinská vrchovina” uplands. The first written remark comes from the 12th and 13th century. Population used to live in a small villages and settlements. They worked especially on the fields or they worked as craftsmen.

District area is 848 km^2 with 55 inhabitants per 1 km^2 population density. It is middle sized compared to the other Slovak districts and it is the 3rd biggest area in the Banská Bystrica Region. With the population of 46,446 inhabitants (31/12/2003) it is quite low populous district compared to others in Slovakia. Residential density in this district is below average in Slovakia.

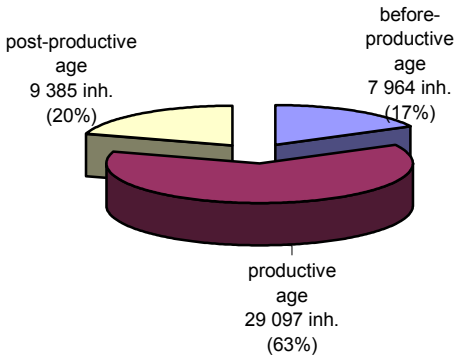

Figure: Population and it's economic activity

Source: Statistical Office of the Slovak republic

Tab: Dwellings and family houses in the Veľký Krtíš region according to last census in 2001

Houses of total	**13,244**
- of which:	
Permanently occupied houses	10,200
- of which family houses	9,688
Unoccupied houses	3,020
Dwellings of total	**18,102**
- of which:	
permanently occupied dwellings	14,763
- of which in family houses	9,924
Unoccupied dwellings	3,265
Average number of	
- inhabitants on one permanently occupied dwelling	3.16
- living area ($m^{2)}$ on one permanently occupied dwelling	58.4
- housing space on one permanently occupied dwelling	3.31
- inhabitants on one housing place	0.95
- living area ($m^{2)}$ on one inhabitant	18.5
Share of permanently occupied dwellings equipped with (in %)	
- central heating	61.3
- bathroom or shower cabinet	85.5
- summer house, weekend house, cottage	6.8
Share of permanently ocupied dwellings with 3 rooms (in %)	**71.8**

2.2 Current energy situation

2.2.1 Current energy infrastructure

In the town of Veľký Krtíš seven operating boiler rooms firing natural gas supply the majority of houses with heat and hot water at the present. The installed capacity of individual boiler rooms varies from 4.2 to 8.8 MW, with 5 to 28 years old boilers. The total annual production of heat in these seven facilities was 160,518 GJ in 2004 with total consumption of natural gas of about 6 million m^3 per year.

Other municipalities in the district have not built any central heating systems until now. The larger facilities such as primarily schools and municipal offices are heated by their own boiler rooms with outputs of 100 to 800 kW. They are based on natural gas in the villages where gas distribution network is available, while elsewhere the heat production is based on imported coal, local wood or even electricity.

Electricity is imported to the district by 400 KV power lines. At the present, there is only one small hydro-electric power plant by the water reservoir near the village of Nenince with installed capacity of 0.022 MW and annual electricity production varying depending on the river flow around 65 MWh per year.

Tab. and figure: Total primary energy supply to the region (primary energy balance)

		Units	Primary energy [TJ]	Share [%]
Solid fuels	Coke	194 t	**5.04**	**0.08**
	Lignite (brown coal)	6,219 t	**93.3**	**1.56**
	Hard coal	460 t	11.04	**0.19**
	Firewood, waste wood, wooden briquettes, pellets, others...	31,315 t	407.1	**6.83**
	Other solid fuels	n/a	n/a	**n/a**
Solid fuels total		**38,188 t**	**516.48**	**8.66**
Liquid fuels	Light heating oil	30.8 t	1.2	**0,02**
	Diesel	n/a	n/a	n/a
	Other liquid fuels	n/a	n/a	n/a
Liquid fuels total		**30.8 t**	**1.2**	**0.02**
Gaseous fuels	Natural gas	143,472,000 m^3	4,921.1	82.53
	Propane-butane	0	0	0
	Biogas	0	0	0
	Other gaseous fuels	0	0	0
Gaseous fuels total		**143,472,000 m^3**	**4,921.1**	**82.53**
Electricity	Imported electricity		523.67	8.78
	Wind		0	0
	Hydro		0.23	0
	Solar- PV		0	0
Electricity total			523.67	8.78
Other RES	Solar-thermal		0.05	0
	Geothermal		0	0
Other RES total			0.05	0
TOTAL			5,962.5	100

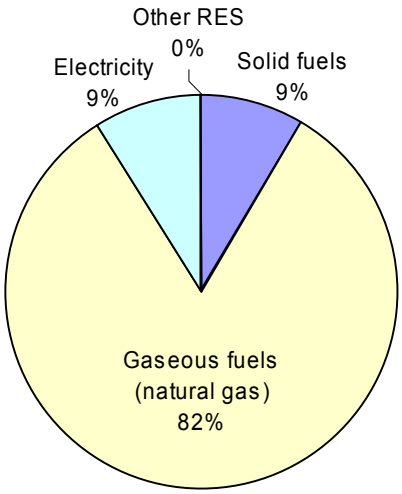

Figure: Fuel mix in the district of Veľký Krtíš.

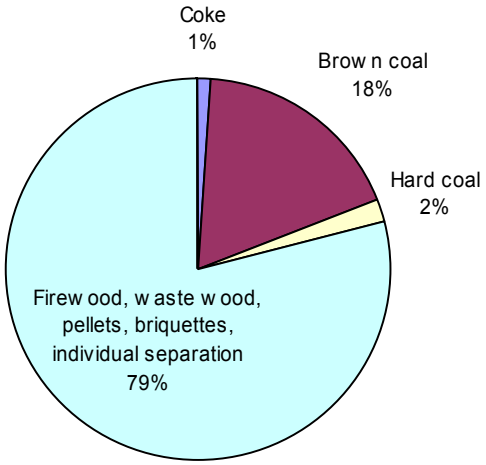

Figure: Fuel mix – solid fuels

2.2.2 Current energy supply and consumption

The district's energy balance is highly passive. Almost all primary energy resources are imported. After the termination of brown coal mining in Velky Krtis, imported natural gas became the main energy resource.

From local available renewable energy resources only firewood is used for the heating of family houses without connection to natural gas supply network. There is no boiler room in the district with greater output based on biomass (either wood chips or pellets). In the village of Hrušov, the first 1 MW straw boiler room was recently installed. It is expected that the local school, municipal office and cultural centre will be heated by this source.

Solar, wind and geothermal energy are not used for energy generation (with a few exceptions). However, it is necessary to pay attention to the exploitation of these renewable resources due to availability of thermal water resources. Currently these resources are used only for recreational purposes in two villages.

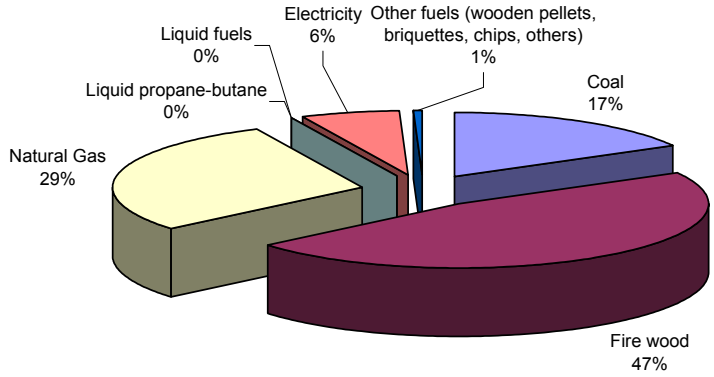

Figure: Heating sources used in households in the district of Veľký Krtíš

Source: ECB own survey

2.3 Analysis of RUE/RES potentials

2.3.1 Analysis of potentials for energy savings (RUE)

Following sectors have been considered within the energy savings potential analyses in the district of Veľký Krtíš:

- **Residential sector** – the biggest energy consumer which includes family houses as well as blocks of flats. Final energy consumption is represented by heat consumption for heating and hot water preparation. Electricity consumption is represented by powering lightning and household appliances. Potential for savings respects local climate and requirements of valid technical standards and norms;
- **Public services sector** - include final energy consumption in the public buildings such education, cultural, administration and health-care facilities operated by state, self-governance or private organisations. Buildings of commercial services sector have not been assessed due to the shortage of relevant data.
- **Industry** – where final energy demand is represented by final fuel, heat and electricity consumption for technological process and heating of the buildings.
- **Agriculture** – assessing heat and electricity consumption in agriculture and forest management.
- **District heating sector** – covers heat production and supply for blocks of flats and public buildings in town of Veľký Krtíš. On the production side there was already "Heat Energy Conception" prepared by the Slovak Energy Agency, so current energy savings potential asses the potential in heat distribution to the final customers.

The biggest potential for energy savings is in the sector of family houses. This potential is the most difficult to exploit in practise while there are many participatory bodies (households) in the process and the region is still quite economically under-developed compared to others in Slovakia. Income level of households is crucial precondition for implementation of energy savings measures. Low public awareness about available energy efficient technologies is still a big problem in rural regions such as Veľký Krtíš district.

Tab.: Total energy savings potential in the district of Veľký Krtíš

Sector	Potential for heat savings	Potential for electricity savings		Total potential
	GJ/year	GWh/year	GJ/year	GJ/year
Blocks of flats	33,267	3,335.8	12,009	45,276
Family houses	461,551	8,088.3	29,118	490,669
Public and commercial services	37,182	1,037	3,733	40,915
Industry (indicative only)	45,307	n/a	n/a	45,307
District heating (distribution only)	12,467	-	-	12,467
TOTAL	589,774	12,461.1	44,860	634,634

Potential for electricity savings in residential sector was simply divided proportionally by the number of inhabitants in family houses and in blocks of flats.

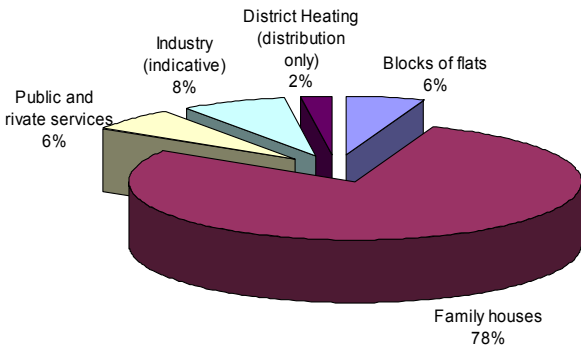

Figure: Heat savings potential (589 774 GJ/y)

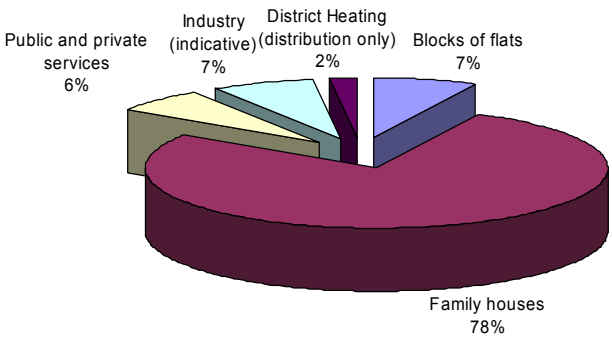

Figure: Total energy savings potential (634 634 GJ/y)

Time horizon for total potential implementation differs within each sector. While within the industry and district heating only 3 – 6 years are expected for the energy savings measures to be implemented, within the public services and blocks of flats it may be from 6 – 9 years. Exploitation of potential for energy savings in family houses sector can be much longer and the potential will not be fully realised within 12 – 15 years.

The biggest potential of energy savings (77%) is in the sector of family houses. The reason is long-term neglecting of energy efficiency issues on Slovak countryside, lower financial incomes and lower public awareness as well as absenting incentives for the implementation of energy efficiency measures.

Detailed energy savings potential analyses can be found in “Regional Energy Conception for the District of Veľký Krtíš” prepared within E4C project in Slovak language.

2.3.2 Analysis of potentials of RES

Following chapters describes analyses of technically available potential of RES. Analyses consider current state of technology development and status of its position on the market.

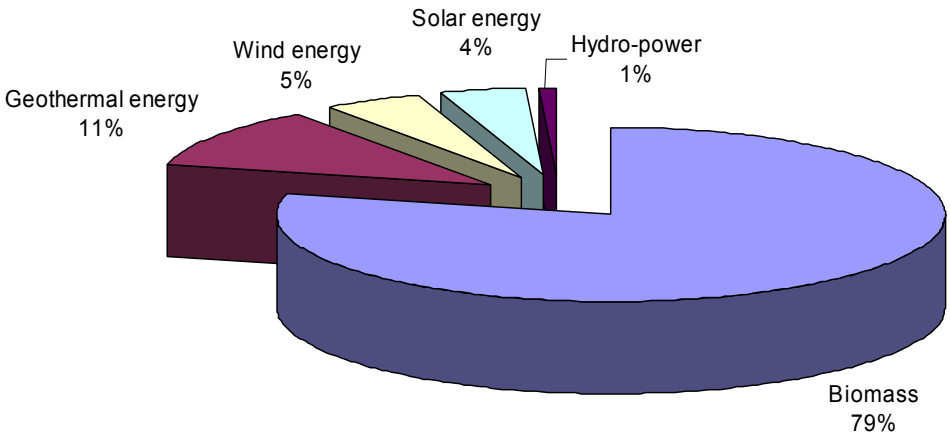

Figure: Share of each RES-kind on total technical RES potential in the district

Photovoltaic potential has not been considered within solar energy potential while it is insignificant in point of view of total primary energy sources (PES) consumption in the region.

BIOMASS

The most promising RES in the region is biomass. Biomass potential has been surveyed within three main biomass producing sectors:

a) **Forestry;**

b) **Wood-processing industry;**

c) **Agricultural biomass.**

Forestry and wood-processing industry offers different kind of biomass available for energy utilisation:

a) **Forest biomass** (residues from wood cuts in the forest), potential is restricted by the amount of annual cuts and biological and terrain site conditions in the forest;

b) **Wastes from wood-processing industry** – potential is represented by the amount of sawdust and small pieces of waste logs, which represents about 38-40% of total production;

c) **Low quality wood** – represented by cheapest, low quality (quality class "C3") fibrous wood.

Calculations of agricultural biomass available now or exploitable in the future for energy utilisation include:

a) **Straw** available as a fuel for direct firing in local boilers;

b) Number and breed of **animal stock** as a producer of residues for biogas production;

c) Area of agricultural land available for technical **corn silage** planting in order of biogas production;

d) Area of available grass land for **grass silage** production in order of biogas production.

Tab: Biomass technical potential

Biomass	Technically available energy potential [GJ]	%
Forest biomass (wastes from wood cutting and low-quality wood)	51,228	2.5
Wastes from wood processing plants	394,797	19.1
Agricultural biomass (straw for direct firing, animal excrements and crops for biogas production)	1,621,544	78.4
TOTAL	**2,067,569**	**100**

GEOTHERMAL ENERGY

Assumed renewable geothermal sources in central and north-western part of the area of Central-Slovakian neo-vulcanite reaches the amount of 82.6 MWt installed capacity; and in southern and south-eastern part of the area, where Veľký Krtíš locality including Krupinská Plain, Ipeľská Basin and adjacent part of Lučenská Basin is situated, reaches the amount of **32.6 MWt.** This figure represents perspective of new geothermal sources exploitation. Assumption of energy production is **81.5 GWh (293.4 TJ).** For comparison, DH system in town of Veľký Krtíš operates 37.11 MWt of installed capacity with annual heat production 160 TJ.

WIND ENERGY

Two wind intensity measures have been provided by national hydro-meteorological institute within the district. Windiness analyses from these 2 localities are described in detail in Slovak version “Regional Energy Conception for the District of Veľký Krtíš”.

Close to Opava village between the year 2005 and 2007 detail wind measures have been provided by private investor in order to prepare the wind park investment. Proposed wind park is located in the cadastral area of Opava and Kosihovce villages. Measures indicated total potential of **20 MWe** of installed capacity. Considering assumed exploitation during 1500-2000 hours during the year it represents annual electricity production about **35 GWh/y**.

SOLAR ENERGY

Potential for solar thermal energy utilisation for domestic hot water (DHW) preparation and pre-heating in public buildings in target region is calculated based on data survey in the region (data about heat requirements of public buildings in selected municipalities).

Calculation of potential is based on typical solar irradiation data in target region provided by Slovak Academy of Science and EU Joint Research Centre and typical energy efficiency of most common used solar-thermal collector Heliostar H300 made in Slovakia.

Tab: Solar-thermal technical potential

Sector	**Technically available solar-thermal potential [TJ]**
Family houses – domestic hot water preparation	88.7
Family houses – heating support	10.7
Public buildings – domestic hot water preparation	0.8
Public buildings – heating support	3.6
Industry, agriculture, forestry	97.9
DH system in town of Veľký Krtíš	2.1
TOTAL	**203.8**

HYDRO-POWER

Total technically exploitable hydropower potential of river flows in district of Veľký Krtíš is 7.07 GWh (**25.45 TJ**), of which 1.74 GWh (**6.25 TJ**) represents **ecologically exploitable hydropower potential** in 2020.

Tab.: Proposed new hydro-power plants till 2020 on Ipeľ River within the Veľký Krtíš district.

Name	River	km	Facility	Qa $m^3.s^{-1}$	Max.gradient m	Capacity $m^3.s^{-1}$	Capacity MWh	Production GWh	Note
Balog nad Ipľom	Ipeľ	75.50	dam	13.31	3.10	14.00	0.340	1.430	VZ-V, E
Veľká Ves nad Ipľom	Ipeľ	70.50	dam	13.31	2.58	9.50	0.189	0.307	VZ-V, E
Total							**0.569**	**1.737**	

Notes:
rkm - river km
VZ - V - dam already exists
E - ecologic

Source: MH SR / VUPEX

2.3.3 Identification of available RES/RUE options in the region

Tab.: Matrix for evaluation of RES options

Type of RES action / sector	House-holds	Public sector	Commercial services	Industry	Public en. supply, waste mgmt., waste water treatment	Agriculture and forestry
Solar thermal	****	*****	****	**	**	**
	-	**++++** (OP ZP / ROP / EF)	**+++** (OP KaHR / EF)	**++** (OP KaHR / EF)	**+++** (OP KaHR / OP ZP)	**+** (OP KaHR)
Solar PV	*	*	**	*		
	-	**+** (OP ZP)	**++** (OP KaHR)	**++** (OP KaHR)		
Hydro	-	-		*	*	-
	-	-	**+** (OP KaHR)	**++** (OP KaHR)	**+** (OP ZP)	-
Wind	-	-	-	**		
	-	-	-	-		
Geothermal and ambient heat	*	*		*		*
	-	**++** (OP ZP / EF)	**+++** (OP KaHR)	**+++** (OP KaHR)	**++** (OP ZP / EF)	**+** (OP KaHR)
Biomass -wood	****	***	***	***	****	****
	-	**+++++** (OP ZP / EF / ROP)	**++++** (OP KaHR)	**++++** (OP KaHR)		**+** (OP KaHR / NPRV)
Biomass – agricultural waste	**	***	***	**	****	*****
	-	**+++++** (OP ZP / EF)	**++++** (OP KaHR)	**++++** (OP KaHR)		**++** (OP KaHR / NPRV)

Type of RES action / sector	House-holds	Public sector	Commercial services	Industry	Public en. supply, waste mgmt., waste water treatment	Agriculture and forestry
Biomass – energy crops	*	*	*	*	*	****
	-	-	-	-	-	++ (NPRV)
Biogas –landfill gas	-	*	-			
	-	-	++ (OP KaHR)	+ (OP KaHR)	+ (OP KaHR)	
Biogas – sewage gas	-	*	-		*	
	-	++ (OP ZP)			++ (OP ZP)	
Biogas from organic material	-	*				*****
	-	+ (OP ZP)	++ (OP KaHR)	++ (OP KaHR)		++ (NPRV / OP KaHR)

Tab.: Matrix for evaluation of RUE options

Type of RUE action / sector	House-holds	Public sector	Commercial services	Industry	Public energy supply, waste mgmt., waste water treatment etc.	Agriculture and forestry
Thermal insulation of buildings	****	****	***	***	**	**
	-					
Regulation of heating	****	****	***	**	**	**
	-		**+++** (OP KaHR)	**+++** (OP KaHR)		
Utilization of waste heat				**	**	*
	-			**++++** (OP KaHR)		
Decrease of energy losses in networks		**	**	***	**	
	-		**+++** (OP KaHR)	**+++++** (OP KaHR)	**+++** (OP KaHR)	
Savings in public lighting systems		***	*	**	*	
	-		**+++** (OP KaHR)	**+++** (OP KaHR)		

Legend:

- *zero stars () = lowest relevance and potential; five stars (*****) = highest relevance and potential; no star (-) = not applicable;*
- *zero pluses () = lowest relevance; five pluses (**+++++**) = highest relevance, (-) = not applicable;*
- **OP KaHR** = Operational programme competitiveness and economy grow (competence of Ministry of Economy); **OP ŽP** = Operational programme environment (competence of Ministry of Environment); **ROP** = Regional operational programme (competence of Ministry of the Regional Development); **EF** = Environmental Fund; **NPRV** = National Countryside Development Programme (competence of Ministry of Agriculture).

SWOT analysis

SWOT analysis of energy demand side of the target region (what are the Strong and Weak points, where are Opportunities and Threats) with focus on reduction of energy demand by **energy saving measures**.	
STRENGHTS ➢ Clear property ownership background in the most of blocks of flats – associations of the owners are investing into blocks heat insulation projects; ➢ Private DH operator has already invested into DH system refurbishment (regulation adjustment, heat pipelines); ➢ Broad offer of energy efficient technologies and appliances on the market; ➢ Availability of technologies and capacities for buildings reconstruction, insulation, etc. for efficiency increase; ➢ Sufficient level of knowledge and practical experience of local suppliers of technology and construction companies;	**WEAKNESSES** ➢ Lower incomes of households compared to national average; ➢ Shortage of equity financial sources for the investments; ➢ Weak economical development, lower GDP per capita compared to Banská Bystrica self-governing region as well as compared to national average; ➢ High share of inhabitants living in old family houses with high energy demand; ➢ Low public awareness about energy efficient technologies; ➢ Poor technical state of heat, ventilation and air condition systems in public buildings, neglected energy efficiency measures from past; ➢ Low ability to cope with gas and electricity prices increase in families with low income (share of energy expenditures is high); ➢ Losses in the final demand for energy are high; ➢ Promotion of RUE and RES is low; ➢ Most of designers and architects still continue to prefer/offer traditional systems of HVAC on natural gas and avoid designing solar thermal and/or other renewable applications (biomass boilers).
OPPORTUNITIES ➢ Intent to switch from 4-piping to 2-piping heat	**THREATS** ➢ Threat of disconnections from DH system in

distribution system and to construct new compact heat exchanging units in selected blocks in town of Veľký Krtíš (in order to reduce heat losses); intent to replace some boilers by CHP units; ➢ Heat economy development conception already prepared by the Slovak Energy Agency; ➢ Assignment of competences in facility management from state administration to self-government bodies, NGOs, associations and private companies;	town of Veľký Krtíš, what may cause instability of the system and decrease of energy production and distribution efficiency; ➢ Future increase of natural gas prices; ➢ Lack of finance for projects developing energy efficiency and renewables infrastructure; ➢ Lack of local capacities for development of projects; ➢ Lack of attention and funds for awareness increase, promotion and dissemination of the energy plan results.

SWOT analysis of energy supply in the target region (what are the Strong and Weak points, where are Opportunities and Threats) with focus on **utilisation of RES**

STRENGHTS	**WEAKNESSES**
➢ Availability of huge amounts of agricultural biomass, large size of unused grasslands; ➢ The number and average size of agricultural companies in the region is partially high; ➢ Favourable climate for agricultural production; ➢ Presence of 5 wood-processing plants (none of them is processing wooden waste itself at the moment); ➢ Relatively high developed natural gas supply network, reliability of supply is high; ➢ Renewables are used mainly in the form of biomass (fire wood) in family houses;	➢ Underdeveloped road infrastructure; ➢ Not very favourable wind conditions; ➢ Lower incomes of households compared to national average; ➢ Shortage of equity financial sources for the investments; ➢ Weak economical development, lower GDP per capita compared to Banská Bystrica self-governing region as well as compared to national average; ➢ Still considerable share of solid fuels (fire wood, coal) and electricity use in households, increasing mainly due to gas prices increase; ➢ Potential for electricity production form renewables is low (only CHP based on biomass or biogas – expensive);
OPPORTUNITIES	**THREATS**
➢ Operating DH system in town of Veľký Krtíš (possible fuel switch to wooden biomass as well as biogas firing);	➢ Insufficient personal capacity for high quality projects preparation; ➢ High administrative requirements of EU project

➢ Long-term agricultural tradition in the region; ➢ Eligibility for EU funds as well as national Environmental Fund direct investment support; ➢ High potential for biomass in the future; ➢ Potential for solar-thermal technologies installation in the future; ➢ New support to solar-thermal and biomass firing boilers installations in households after adoption of national programme „Programme for higher biomass and solar energy utilisation in households“; ➢ Implementation of energy audit recommendations ; ➢ Favourable way of setting the level of RES-E fixed purchase prices (feed-in tariffs), but without long-term guarantee;	proposal preparation, bureaucracy, still unclear conditions for EU support application; ➢ Missing long-term guarantee of fixed RES-E purchase price (feed-in tariff); ➢ Cheaper solid biomass for direct firing instead of high efficient technologies usage (e.g. gasification boilers); ➢ Higher solid particles emissions in case of low-efficiency boilers usage; ➢ Competitiveness between furniture industry and energy sector in purchase of wooden waste (e.g. sawdust) from wood processing; ➢ Dependency on natural gas and other fossil fuels imports, electricity imports; ➢ Increase of energy prices in the world market.

3. Energy Vision

3.1 Energy Vision milestones

Renewable energy and energy efficiency 15 years outlook (till 2022) can be seen in tables below.

Tab.: Technical biomass energy potential till 2022

Biomass	Technically available energy potential [GJ]	%
Forest biomass (wastes from wood cutting and low-quality wood)	51,228	2.5
Wastes from wood processing plants	394,797	19.1
Agricultural biomass (straw for direct firing, animal excrements and crops for biogas production)	1,621,544	78.4
TOTAL	**2,067,569**	**100**

Tab.: Technical solar thermal energy potential till 2022

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Family houses – domestic hot water preparation	88.7
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Public buildings – domestic hot water preparation	0.8
Public buildings – heating support	3.6
DH system in town of Veľký Krtíš	2.1
TOTAL	**203.8**

Total technically exploitable hydropower potential of river flows in district of Veľký Krtíš is 7.07 GWh (**25.45 TJ**), of which 1.74 GWh (**6.25 TJ**) represents **ecologically exploitable hydropower potential** in 2020.

Total technically exploitable geothermal potential is **32.6 MWt.** Assumption of energy production is **81.5 GWh (293.4 TJ).**

Total technically exploitable wind potential within 15 years represents **20 MWe** of installed capacity. Considering assumed exploitation during 1500-2000 hours during the year it represents annual electricity production about **35 GWh/y (126 TJ)**.

Within the 15 years outlook about **635 TJ of energy can be saved** by exploiting potential for energy savings in the region.

Total primary energy consumption (except transport) in the region was **5,963 TJ in 2005** of which:

- 10.7 % could be saved by the implementation of energy savings measures within next 15 years;
- 34.8 % could be covered by biomass in technical point of view;
- 4.9 % could be covered by geothermal energy in technical point of view;
- 3.4 % could be covered by solar-thermal energy in technical point of view;
- 2.1 % could be covered by wind energy in technical point of view;
- 0.4% could be covered by hydro-power in technical point of view and 0.1% in technical and ecological point of view;

3.2 Objectives and priorities

The future energy supply and improved energy management are in line with sustainable development principles and enable dynamic development of the Veľký Krtíš region and are based on three key **objectives**:

- **Reliable, available and diversified energy supply, maximal use of locally available resources;**
- **Effective, well planned and managed energy production and consumption;**
- **Reduction of current pollutants and CO_2 emissions from fuel combustion and improvement of ambient air quality.**

None energy vision can be realised without concrete projects implementation in the region. Implementation of the concrete projects will be depending on overall situation on RES market, economical development in Slovakia and application of support programmes for energy efficiency and RES utilisation including EU structural and cohesion funds. Commercial, public and third sector should be included in this process. Proposed practises necessary for the implementation of mentioned priorities are described in the table below.

PRIORITY	Proposed measures	Implementing bodies	Financing sources
Efficient use of energy in both new and existing buildings (incl. sustainable land use planning	Thermal insulation of the buildings	Associations of flat owners Municipalities (public buildings) Industry and services	State Fund or Housing Development (soft loans for heat insulation, grants for systematic breakdowns removal) Commercial loans Own sources EU Structural Funds (private and public sector)

PRIORITY	Proposed measures	Implementing bodies	Financing sources
Efficient production of heat and electricity	CHP implementation Heat pipelines insulation Efficient technologies implementation	Private sector Public sector (municipalities – heat supply in buildings)	Own sources Commercial loans EU Structural Funds – OP Competitiveness and Economy Grow under the Ministry of Economy
Increased use of renewable and local waste energy	**Pilot projects** of biomass and biogas utilisation in municipalities and agricultural sector **proposed within E4C project**	Municipalities Private sector – agricultural companies	Bank loans External capital EU Structural Funds – OP Competitiveness and Economy Grow under the Ministry of Economy
Education and awareness, promotion of local actions	Seminars and work-shops	Regional Development Agency of Banská Bystrica Self-governing region NGO Friends of Earth CEPA Energy Centre Bratislava	National Energy Efficiency Fund (to be established) Interreg III A projects EC – Intelligent Energy for Europe Programme
Funds raising for modernisation of		Private sector	EU Structural Funds – OP Competitiveness

PRIORITY	Proposed measures	Implementing bodies	Financing sources
energy supply infrastructure and efficient use of energy		Public sector	and Economy Grow under the Ministry of Economy
Efficient energy management and cooperation of regional administration, municipalities and private sector	E4C Regional Energy Conception and its up-date	Banská Bystrica Self-Governing Region	Budget of the Banská Bystrica Self-Governing Region

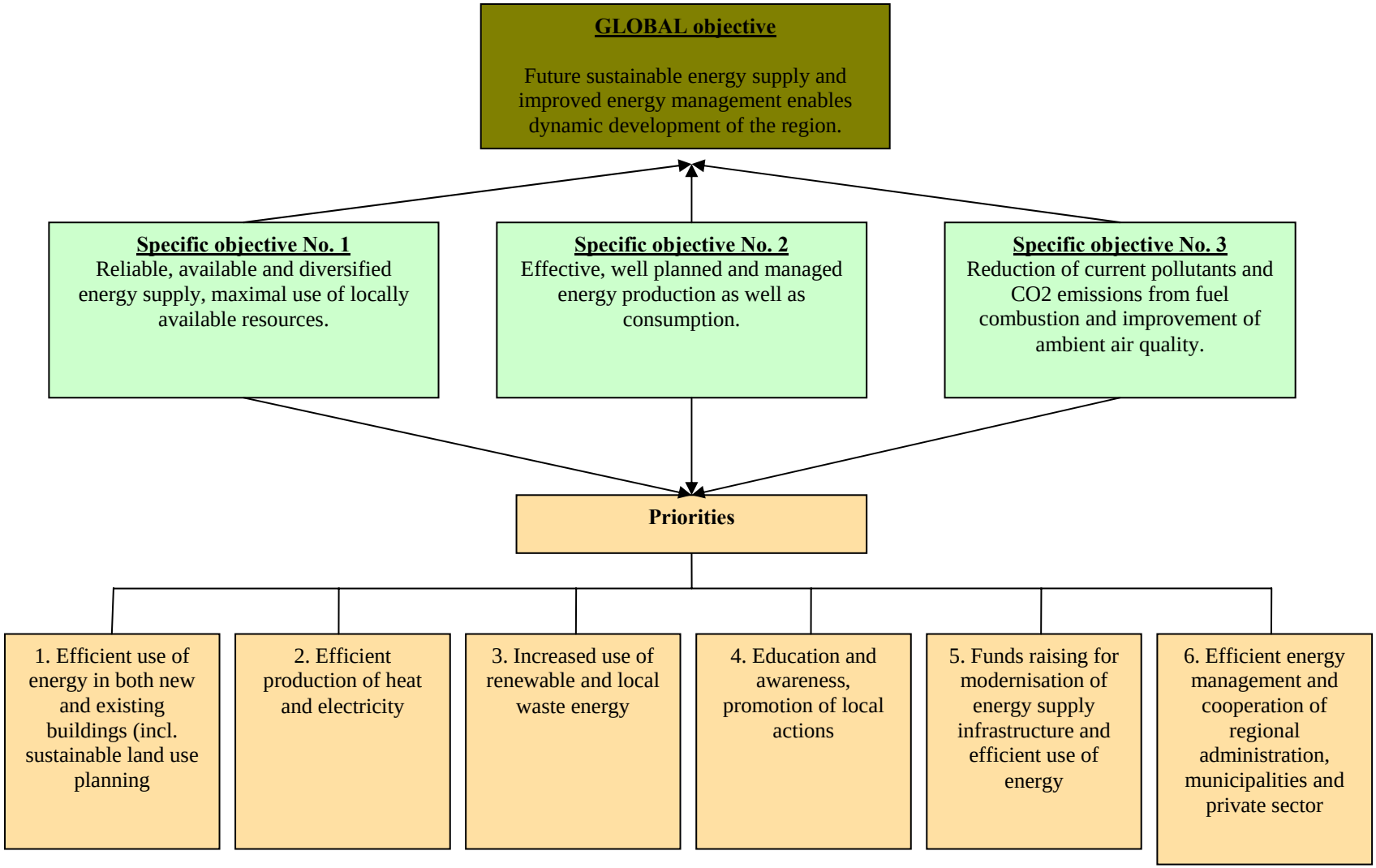


Figure: Structure of the Energy vision of Veľký Krtíš Region

3.3 Presentation of feasible Energy Action Bundles suitable for Structural Funds

3 biomass and biogas focused potential projects and 1 energy saving potential project have been selected as pilot representative action to be implemented in order to meet the priorities set by the vision:

- DH fuel switch from natural gas to biomass and biogas plant installation in Veľký Krtíš town;
- Energy savings measures in block of flats in town of Veľký Krtíš;
- Biomass DH and biogas plant construction in Dolná Strehová municipality;
- Biomass DH and biogas plant construction in Malý Krtíš municipality.

3.3.1 Fuel switch and biogas plant in town of Veľký Krtíš

Project Proposal – town of Veľký Krtíš
Proposal includes biomass firing boilers construction within the local DH system in town and biogas plant construction for heat supply of public buildings, households and private sector.
Current state
The biggest part of heat in town (160,000 GJ/a) is being produced in 6 heat cycles of DH system firing natural gas. Installed capacity of DH system is 37.11 MWt. DH is operated by private company Steffe KVK ltd.
Technological solution
Construction of 2 new DH heat cycles including boilers for wooden chips firing and intra-connection of existing heat cycles with biogas plant. DH 1 - 5 MW wooden-chips boiler; DH 2 - 4 MW wooden-chips boiler; Biogas plant 1,000 kW_{el}, 1,060 kW_{tep}. *Technical parameters of the boiler room:* *Technical parameters of the biogas station:*

Installed capacity: 5 MWt + 4 MWt Number of boilers: 2 Annual heat production: 91,000 GJ Fuel consumption: 11,000 t of wooden chips	Installed capacity: 1,000 kWe; 1,060 kWt Number of CHP units: 2 Annual heat production: 24,000 GJ Annual power production: 7,592,000 kWh Inputs consumption: 20,000 t of corn silage
Investors	
Town of Veľký Krtíš or Stefe KVK – wooden chips boiler room construction; Agricultural company Agrovíno Čebovce – biogas station construction.	
Benefiting groups	
Town – reduced costs on heating; **Residents** – reduced costs on heating, higher employment (3 expected jobs in boiler room plus 3 new jobs in biogas station operation – guard and service, 3 preserved jobs in agricultural company due to ensured steady market for corn silage production **Agricultural company** – ensuring market for technical crops planting, incomes from electricity sales, higher economic yield from the land; Expected fossil fuels savings and pollutants and GHG emissions reductions: - **natural gas savings** 3,725,300 m^3 **(**115,760 GJ), what represents savings of 6,314 t of CO_2 emissions and 5.8 t NOx emissions.	
Logistics	
Wooden chips will be supplied from local sawmill (PRP Veľký Krtíš ltd.) produced from waste wood and low quality wood from local forests. Biogas will be produced from corn silage planted by local agricultural company (Agrovíno Čebovce ltd.) on the area of about 600 ha. Substrate from biogas station will be used as fertiliser.	
Financing	
Town of Veľký Krtíš will apply for grant from EU structural Funds (95% of eligible costs on installation of boilers, the rest (5%) will be covered by own sources or bank loan. **Agricultural company Agrovíno Čebovce** will apply for grant from EU Structural Funds (50% of eligible costs on biogas plant construction, the rest will be the bank loan)	

Expected investment costs
Boiler rooms + heat cycles intra-connection): 85 mil. Sk; Biogas station: 146 mil. Sk.
Expected implementation time
Year 2008

3.3.2 Energy savings in block of flats in town of Veľký Krtíš

Project Proposal – town of Veľký Krtíš
Proposal includes energy saving measures implementation within typical block of flats in Veľký Krtíš town. While it is supplied from local district heating system, this project proposal supports the implementation of objectives set by energy vision on demand side.
Current state
Block of flats type T06B on "Lučenecká street" number 69-71 in Veľký Krtíš with 8 floors and 4 entrances. Flat house was constructed in 1978. It is supplied by heat and domestic hot water from local district heating system through heat exchanging unit.
Technological solution
Project consists of: - Thermal insulation of the building envelope; - Thermal insulation of the roof; - Replacement of the windows.
Investors
Association of flat owners.
Benefiting groups
Flat owners – inhabitants of Veľký Krtíš – reduction of heat consumption and thus costs on heating.
Financing
- Own financial sources (common reconstruction fund, in which financial resources of the flat owners are being accumulated); - Bank loan; - Investment subsidy from State Building Development Fund.
Expected investment costs
4 395 550 SK (130 thousands of Euro)
Expected implementation time
Year 2008

3.3.3 Biomass DH and biogas plant in Dolná Strehová

Project Proposal – Dolná Strehová Municipality	
Proposal includes biomass district heating system construction and biogas plant construction for heat supply of public buildings, households and private sector.	
Current state	
Total energy consumption in Dolná Strehová municipality is expected to be about 28 000 GJ in 2010, of which 82% is being consumed by the households, 18% by private and public sector. Natural gas covers 42% of energy production, 45% electricity, 3 % coal and 40% fire wood.	
Technological solution	
DH system construction in the village including heat pipelines and biogas plant construction.	
Technical parameters of the boiler room:	*Technical parameters of the biogas station:*
Installed capacity: 3,100 kWt	Installed capacity: 500 kWe; 600 kWt
Number of boilers: 2	Number of CHP units: 1
Annual heat production: 14,000 GJ	Annual heat production: 14,000 GJ
Fuel consumption: 1,700 t of wooden chips	Annual power production: 3,572,000 kWh
	Inputs consumption: 9,000 t of corn silage
Investors	
Municipality of Dolná Strehová – DH system construction including pipelines and wooden chips boiler room; Agricultural company Agrodružstvo Senné, Závada – biogas station construction.	
Benefiting groups	
Municipality – reduced costs on heating; **Residents** – reduced costs on heating, higher employment (3 expected jobs in boiler room plus 3 new jobs in biogas station operation – guard and service, 3 preserved jobs in agricultural company due to ensured steady market for corn silage production **Agricultural company** – ensuring market for technical crops planting, incomes from electricity sales, higher economic yield from the land;	

Expected fossil fuels savings and pollutants and GHG emissions reductions:

- **natural gas savings** cca 380,952.4 m^3 (11,760 GJ), what represents savings of 646 t CO_2 emissions and 0.594 ton NOx emissions;
- **firewood savings** cca 1,166.7 ton (11,200 GJ), what represents 17.5 t solid particles savings and 18,7 t CO emission savings;
- **electricity savings** about 1.17 GWh (4,200 GJ);
- **coal savings** about 70 t (840 GJ).

Logistics

Wooden chips will be supplied from local sawmill (Bioenergy Závada ltd.) produced from waste wood and low quality wood from local forests. Biogas will be produced from corn silage planted by local agricultural company (Agrodružstvo Senné ltd.) on the area of about 260 ha. Substrate from biogas station will be used as fertiliser.

Financing

Municipality of Dolná Stehová will apply for grant from EU structural Funds (95% of eligible costs on installation of DH system, the rest (5%) will be covered by own sources or bank loan.

Agricultural company Agrodružstvo Senné in Závada will apply for grant from EU Structural Funds (50% of eligible costs on biogas plant construction, the rest will be the bank loan)

Expected investment costs

DH system (boiler room + heat pipelines): 102 mil. Sk (including chipping machine and heat pipelines in the village);

Biogas station: 64 mil. Sk.

Expected implementation time

Year 2008

3.3.4 Biomass DH and biogas plant in Malý Krtíš

Project Proposal – Malý Krtíš Municipality	
Proposal includes biomass district heating system construction and biogas plant construction for heat supply of public buildings, households and private sector as well as local industrial park.	
Current state	
Municipality has functional natural gas supply network, the biggest share on energy consumption have households. Local small industrial park is being constructed on local land. At the moment one 1 ha production hall is operating within the industrial park. The outlook is further 2 or 3 halls. Total heat consumption is expected to be about 32,000 GJ in 2010 (of which 10,000 GJ municipality and 22,000 GJ industrial park).	
Technological solution	
Boiler room construction in the village and biogas plant construction.	
Technical parameters of the boiler room:	*Technical parameters of the biogas station:*
Installed capacity: 2,5 MWt	Installed capacity: 500 kWe; 600 kWt
Number of boilers: 1	Number of CHP units: 1
Annual heat production: 19,000 GJ	Annual heat production: 13,000 GJ
Fuel consumption: 2,300 t of wooden chips	Annual power production: 3,900,000 kWh
	Inputs consumption: 10,000 t of corn silage
Investors	
Municipality of Malý Krtíš – boiler room and heat pipelines construction; Agricultural company Babka ltd. – biogas station construction.	
Benefiting groups	
Municipality – reduced costs on heating; **Residents** – reduced costs on heating, higher employment (3 expected jobs in boiler room plus 3 new jobs in biogas station operation – guard and service, 3 preserved jobs in agricultural company due to ensured steady market for corn silage production **Agricultural company** – ensuring market for technical crops planting, incomes from electricity sales, higher economic yield from the land;	

Expected fossil fuels savings and pollutants and GHG emissions reductions: - **natural gas savings** 10,760 GJ), what represents savings of 549 t CO_2 emissions and 0.5 ton NOx emissions;
Logistics
Wooden chips wil be supplied from local sawmill (PRP ltd.) produced from waste wood and low quality wood from local forests. Biogas will be produced from corn silage planted by local agricultural company (Babka ltd.) on the area of about 300 ha. Substrate from biogas station will be used as fertiliser.
Financing
Municipality of Malý Krtíš will apply for grant from EU structural Funds (95% of eligible costs on installation of DH system, the rest (5%) will be covered by own sources or bank loan. **Agricultural company Babka** will apply for grant from EU Structural Funds (50% of eligible costs on biogas plant construction, the rest will be the bank loan)
Expected investment costs
DH system (boiler room + heat pipelines): 66 mil. Sk; Biogas station: 69 mil. Sk.
Expected implementation time
Year 2008 (industrial park 2010)

4. Action Bundles

Pilot actions presented above are further closely described here.

Fuel switch and biogas plant in town of Veľký Krtíš

4.1 Step 1: Technical pre-feasibility - Fuel switch and biogas plant in town of Veľký Krtíš

4.1.1 Detailed technical project description

4.1.1.1 Energy production

Main characteristics

Project idea consists of two steps:

a) Fuel switch within current DH system in town of Veľký Krtíš in selected boiler rooms from natural gas to biomass firing;

b) Biogas production and energy utilisation in biogas plant, with heat supply to the DH system.

Tab.: Current situation in heat supply

Current installed capacity of the DH system:	37.11 MWt
Number of heat cycles within DH system:	6
Installed capacity of natural gas boiler room PK-1	4.16 MWt
Installed capacity of natural gas boiler room PK-2	4.19 MWt
Installed capacity of natural gas boiler room PK-4	7.62 MWt
Installed capacity of natural gas boiler room PK-5	7.08 MWt
Installed capacity of natural gas boiler room PK-6	5.26 MWt
Installed capacity of natural gas boiler room PK-7	8.8 MWt
Annual heat production (2004)	160 000 GJ

Tab.: Advisable state – biogas plant

Installed capacity of proposed biogas plant	1.00 MWe
	1.06 MWt
Annual Electricity Generation in Biogas Plant	7,592,000 kWh
Annual Heat Generation in Biogas Plant	24,000 GJ (6.67 GWh) (15% share on heat demand of DH system)
Total consumption of corn-silage	20,000 tones

Tab.: Advisable state – DH system

Installed capacity of wooden chips firing boiler rooms (boiler rooms PK 5 and PK 7)	5 MWt + 4 MWt
Annual fuel consumption (Wooden chips, max. humidity 50%)	12 400 tones
Annual heat production from biomass	91,000 GJ (25.28 GWh) (57% share on heat demand of DH system)

Sale of electricity

Electricity produced in cogeneration units of biogas plant will be supplied to the electricity distribution grid operated by SSE, a.s. – central Slovakia distribution company.

Wooden chips will be supplied from local sawmill (PRP Veľký Krtíš ltd.) produced from waste wood and low quality wood from local forests. Biogas will be produced from corn silage planted by local agricultural company (Agrovíno Čebovce ltd.) on the area of about 600 ha. Substrate from biogas station will be used as fertiliser.

PPA or LOI has not been prepared yet. Electricity will be sold to the grid in line with regulation policy of Regulatory Office for the Network industries (RONI). According to the last Decree of RONI number 2/2006, fixed purchase price of the electricity produced from biogas from fermenting technology is 4,200 SK/MWh for 2007. For the 2008 next Decree of RONI is expected. Feed-in fixed prices are being recalculated by RONI each year considering annual core inflation rate. Long-term guarantee of feed-in tariffs is expected within the new law on RES support, which should be prepared (according to the governmental “Strategy for Higher RES Utilisation”).

In case that the heat price to be supplied from biogas plant to DH system would not lead toward higher final heat prices for final consumers and heat medium is same DH operator is obliged to purchase heat according to the Act on Heat Energy. Expected heat price could be 200 SK/GJ as an acceptable compromise between legislative requirements, economy of the biogas plant operation and costs of heat production within DH system.

4.1.1.2 Technical project components

Technically project will consist from civil construction objects and operational objects, both for biomass boiler and biogas plant.

Operational objects within biogas plant to be installed:

- CHP units and equipment;
- Fermenting technology;
- Biogas storage, regulation unit, biogas pipelines;
- Pump station, substrate preparation storage;
- Pipelines for water, heat and substrate;
- Electronic wirings;
- Control system;
- Heat connection to the DH system;
- Transformer;
- Frameworks;

Civil construction objects within biogas plant:

- Storage tanks and digesters;
- Pipeline bridges;
- Engine room;
- Site for transformer;
- Input substrates storage;
- Transmission lines;
- Terrain and road adjustments;
- Lightning and fencing;
- Water source and water distribution.

Location and concrete construction solution depends on concrete technology supplier, which should be selected in a tender.

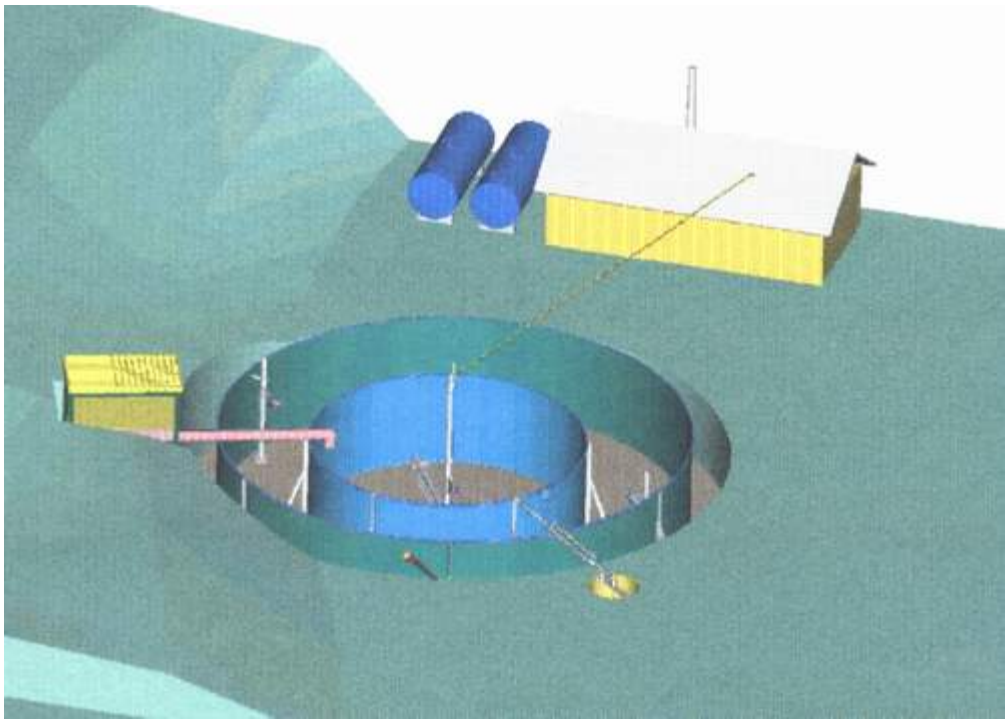


Figure: One of possible solutions for biogas plant construction

Operational objects within biomass boilers to be installed:

- Boiler rooms and engine rooms;
- Transport of fuel to the boiler;
- Transmission system;
- Controlling system;
- Machine room for heat supply to the DH pipeline network;
- Steel frameworks.

Civil construction objects within biogas plant:

- Biomass boiler rooms;
- Operational daily fuel storages;
- Long-term fuel storage;
- Chimneys;
- Outer heat distribution

4.1.2 Suitability of production technology

Concrete technology will be selected after preparation of TOR and announcing of public tender procedure.

One of possible technology providers could be K&H Kinetic company, which is only one which already built corn-silage based biogas plant in Slovakia.

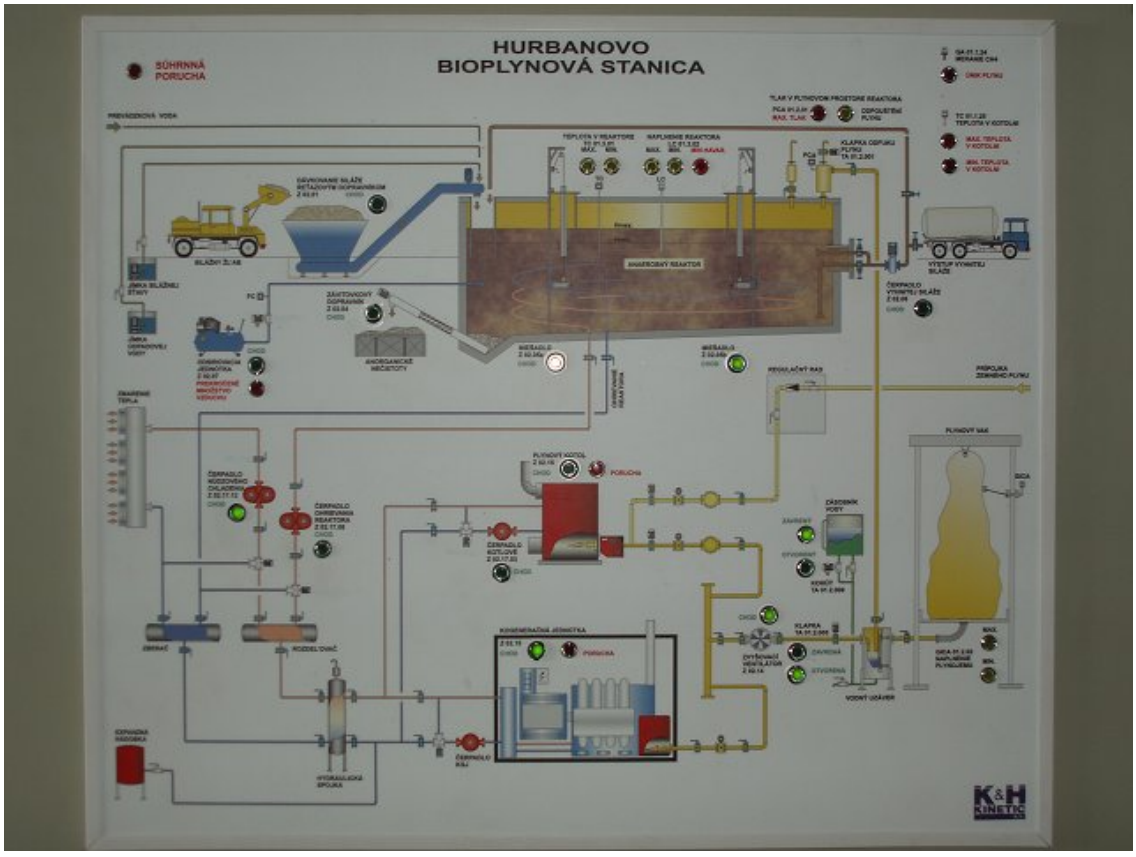


Figure: K&H Kinetic technology scheme in operating biogas plant in Hurbanovo

Figure: CHP unit in biogas plant Hurbanovo

Availability and suitability of site

One of possible locations for biogas plant is free agricultural area across from cross road between Železničná and Lučenská street in the direction of PRP sawmill. Location is on edge of town. Land needed is about 200 × 200 m.

Biomass boilers should be connected to one common heat cycle from current natural gas boiler rooms PK5 and PK7. One of two proposed biomass boilers could be installed in current heat exchanging station "Železničná". Another one could be installed instead of current natural gas boiler in current boiler room.

- **Access to raw materials**

Raw materials required are 11 000 tomes of wooden chips for biomass boilers and about 20 000 tones of corn-silage. Corn will be planted by local agricultural company Agrovino Čebovce s.r.o. or another of several agricultural companies within 10 km from preliminary selected site close to town of Veľký Krtíš. Wooden waste and chips will be supplied by local saw mill PRP, s.r.o. Stability of supply depends on the price which can investors to the biomass boilers as well as to the biogas plant offer to keep the economy of the project. Further negotiations between biomass suppliers and potential purchasers are necessary.

- **Access to transportation**

Fuel (wooden chips) could be transported from proposed central storage in sawmill by lorry. To the operational fuel storage it could be transported by frontal loading machine. This storage should have sufficient capacity for 2-months.

Substrates for biogas plant will be collected by agricultural machines owned by agricultural company and transported to the silos, where it will be pressed and then ready-made silage will be stored for whole year.

- **Access to a qualified labour pool**

Operation of both biomass boilers and biogas plant will be autonomous.

Operation stuff will consists of permanent attendant service stuff in the area of biogas station, manager of the plant responsible for failure-free feeding and operation of the plant. For attendant (guard) service three people will be contracted with work shift 8 hours per day. Guard staffs don't have to be qualified for the operation; their responsibility will be to keep record about operation and call a manager in case of any troubles. A minimum salary set by law in Slovakia would be sufficient for guard stuff.

For the operation of each biomass boiler room and heat distribution 2 workers including attendance and operation are required.

Qualification requirements for operation of boilers as well as CHP units are set by several national technical standards (e.g. STN 070703, STN 070710, STN EN 12170 for boilers and STN 38 6405 for gas facilities and others).
District of Veľký Krtíš suffers from low employment possibilities compared to the national average. Training of stuff required for operation will be provided by technology suppliers (costs on training should be included in the investment costs).
Operation and service of CHP units within biogas plant will be provided externally by technology supplier based on the contract. Two experts – one machine engineer and one electrical engineer - will be available in order to intervene in case of any break-down and periodically for the maintenance.

- **Access to production inputs**

Biomass boiler room will be located within current heat exchanger building, which is already connected to water and electricity supply and sewerage. Another biomass boiler should be located in current PK4 boiler room which is also already connected to the necessary infrastructure.
Electricity production from biogas plant should be supplied to the grid through newly built transformer. Route length is about 100 m. Route of heat pipeline to be built from CHP units to the DH system is about 900 m. Required water for fermenting technology should be supplied from newly built well and pumping station.

- **Emissions potential**

Expected fossil fuels savings and pollutants and GHG emissions reductions:
- natural gas savings 3,725,300 m^3 **(**115,760 GJ), what represents savings of 6,314 t of CO_2 emissions and 5.8 t NOx emissions.

- **Environmental impact**

The main factors with considerable impact on the environment are:

- noise;
- polluting emissions;
- waste water.

Operation of the facilities should be in line with requirements set by Ordinance No. 40/2002 of the National Council about health protection from noise and vibrations. Noise study has to be prepared in the next step after feasibility study preparation.

Emission limits for such energy sources are set by national legislation by the Ministry of Environment. In the next round of project technical documentation preparation it is necessary to prepare emission-technology expert assessment and disperse study.

Waste water will be out flowed by pipe to exterminatory pit and then to a sewerage.

- **Regulatory requirements**

Building permit is necessary for the construction. Technical documentation for building permit has to be prepared. Work safety and environmental requirements are regulated by several governmental ordinances and regulations (some of them mentioned above).

4.2 Step 2: Energy balance - Fuel switch and biogas plant in town of Veľký Krtíš

Current state within existing DH system:
Installed capacity: 37.11 MWt
Number of heat cycles within DH system: 6
Annual heat production (2004): 160 000 GJ

Technical parameters of proposed boiler room:
Installed capacity: 5 MWt + 4 MWt
Number of boilers: 2
Annual heat production: 91,000 GJ (~57% share on total DH system production)
Fuel consumption: 11,000 t of wooden chips

Technical parameters of proposed biogas station:
Installed capacity: 1,000 kWe; 1,060 kWt
Number of CHP units: 2
Annual heat production: 24,000 GJ (~26% share on total DH system production)
Annual power production: 7,592,000 kWh
Inputs consumption: 20,000 t of corn silage

In case of successful fuel switch to biomass in current DH system and biogas plant construction renewable energy sources would have about 73% share on heat production within DH system of Veľký Krtíš town. The rest will be supplied by natural gas.

At the moment about 3 300 flats within blocks of flats is connected to the DH system, where about 5.5 mil m^3 is being consumed. Of total number 4 479 of flats the share of district heating supply is about 70%.

4.3 Step 3: Financial analysis - Fuel switch and biogas plant in town of Veľký Krtíš

4.3.1 Investment Cost

Tab.: Estimation of project costs

Costs of the location:	n/a
Equipment and material costs:	Boiler rooms + heat cycles intra-connection): 85 mil. Sk; Biogas station: 146 mil. Sk.
Taxation:	19% VAT, 19% income tax
Engineering and managing the project completion: - technical-economy study - feasibility study preparation costs - documentation for territorial decree - project for building permit - realisation project documentation - survey on site and negotiations with local stakeholders (4 person-months) - construction supervision - authorial supervision	 40,000-60,000 SK 90,000–140,000 SK 100,000-120,000 SK 700,000-900,000 SK 900,000–1,200,000 SK 120,000 SK 200,000-300,000 SK 150,000–220,000 SK
Other costs:	Travel and personal costs for project preparation expenses: 450 000 SK Preparation of the application for EU funds: 250 000 SK
Other capital costs:	n/a
Grants of different sources:	-

Note: Exchange rate as of June 4th 2007: 1 Euro = 33.861

4.3.2 Project Preparation Expenses

It is expected that from the pre-feasibility stage till the construction about 1 year intensive work will be needed. For clarification of the necessary inputs for the cash-flow analyses and business plan preparation following steps have to be implemented:

- Further negotiations with biomass supplier - agricultural company about possible contract on biomass supply, fertiliser purchase - quality and quantity requirements;
- Further negotiations with heat purchaser – district heating company about possible contract on heat purchase - quality and quantity requirements;
- Further negotiations with the municipality – authorisation process (building permit, cadastre office statement, etc.);

Activities above requires additional travel and personal costs – about 450 000 SK per year.
Additionally for the preparation of the application for EU Structural Funds about 200 000 SK is required.

4.3.3 Financial Engineering

Total investment
6 923 895 Euro

Private Funding		Public Funding	
2 309 119 Euro		4 614 776 Euro	
Equity	Commercial loan	Structural Fund	Other grants
692 736 Euro	1 616 383 Euro	4 614 776 Euro	0 Euro

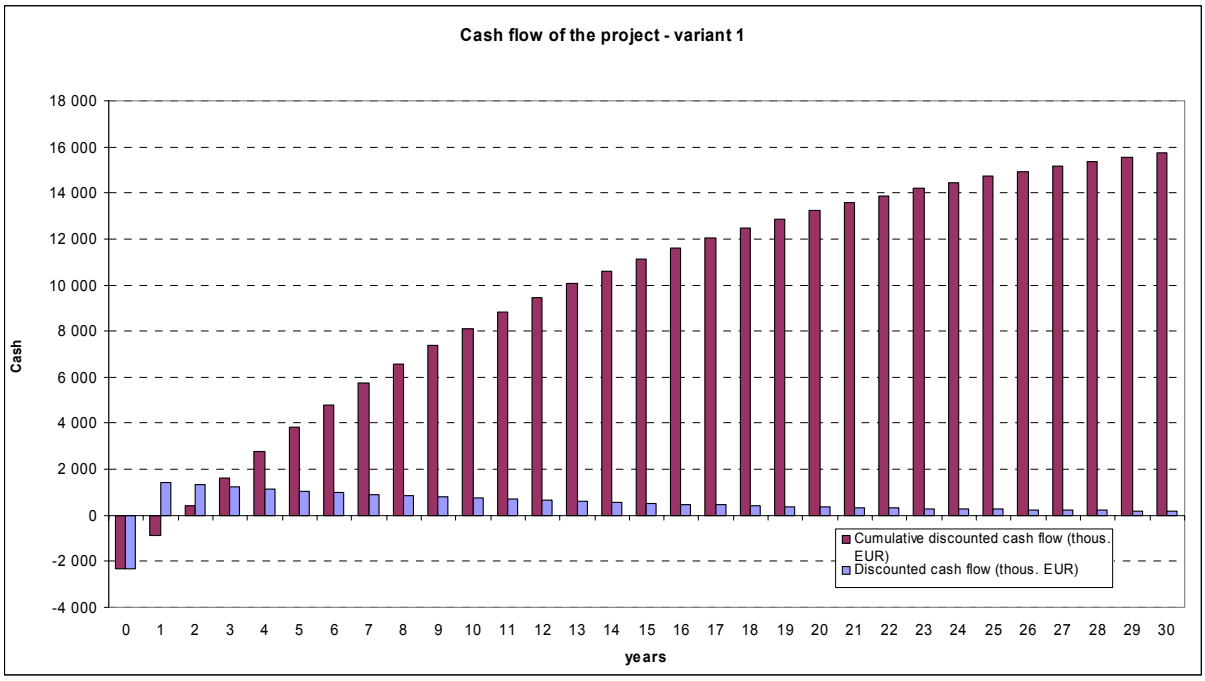
Project life time	20 Years

4.3.4 Economic Analysis

Investment costs (thous. EUR)	6 924	thous. EUR
Investment subsidy from SF / CF (thous. EUR)	4 615	thous.

Economic lifetime	20	years
Discount rate	9%	
Combined rate of increase of prices	1,5%	

Net Present Value (NPV)	13 235	thous. EUR
Internal Rate of Return (IRR)	68,0%	
Profitability indicator (PI)	191%	
Simple payback	1,5	years
Real (discounted) payback	1,7	years



4.4 Step 4: Positive effects in view to overall energy vision - Fuel switch and biogas plant in town of Veľký Krtíš

District heating system of Veľký Krtíš town is one of the biggest energy facilities in Veľký Krtíš district – target region of the E4C project - with annual production of 160 000 GJ (currently from natural gas). Proposed solution with partial fuel switch to wooden chips firing and heat from biogas plant utilisation almost 72% will be covered by renewable energy source (biomass). In case of project successful implementation share of RES on district's total primary energy sources consumption will increase by 2%.

Implementation of project will have a positive effect on each of 3 main specific objectives set by the Vision:

- Specific objective No. 1 - Reliable, available and diversified energy supply, maximal use of locally available resources;
- Specific objective No. 2 - Effective, well planned and managed energy production as well as consumption;
- Specific objective No. 3 - Reduction of current pollutants and CO2 emissions from fuel combustion and improvement of ambient air quality.

4.5 Step 5: Cooperation scheme - Fuel switch and biogas plant in town of Veľký Krtíš

Several activities and expert analyses have to be done by expert organisations in order to prepare the project in phase to be prepared for construction.

Project holders:

- Town (biomass boiler installation within current DH system);
- Agricultural company “Agrovino” (bioga plant construction);

Project beneficiaries:

- Residents of town (cheaper heat from current DH system);
- Agricultural company (profit from energy sales, ensuring market for technical crops planting, higher economic yield from the land;

Also several **external organisations** have to be contacted before or during project implementation:

- Stefe KVK s.r.o. – private company operating DH system in town of Veľký Krtíš, which has to purchase heat from boiler rooms and biogas plant;
- SSE, a.s. – private electricity distribution company, which has to purchase electricity from biogas plant;
- Public authorities and offices (e.g. Municipal Authority in order to approve the locality for biogas plant; Cadastral Office of Veľký Krtíš in order to identify land owners, etc.).

Feasibility study of the project, technical documentation both for biomass boiler rooms and biogas plants and projects for building permit have to be processed by external expert organisations, which should arise from a public tender. Preparation of the application with all required documentation for EU Structural Funds can be processed both by municipality and agricultural company, or assigned to external expert organisations (e.g. Energy Centre Bratislava).

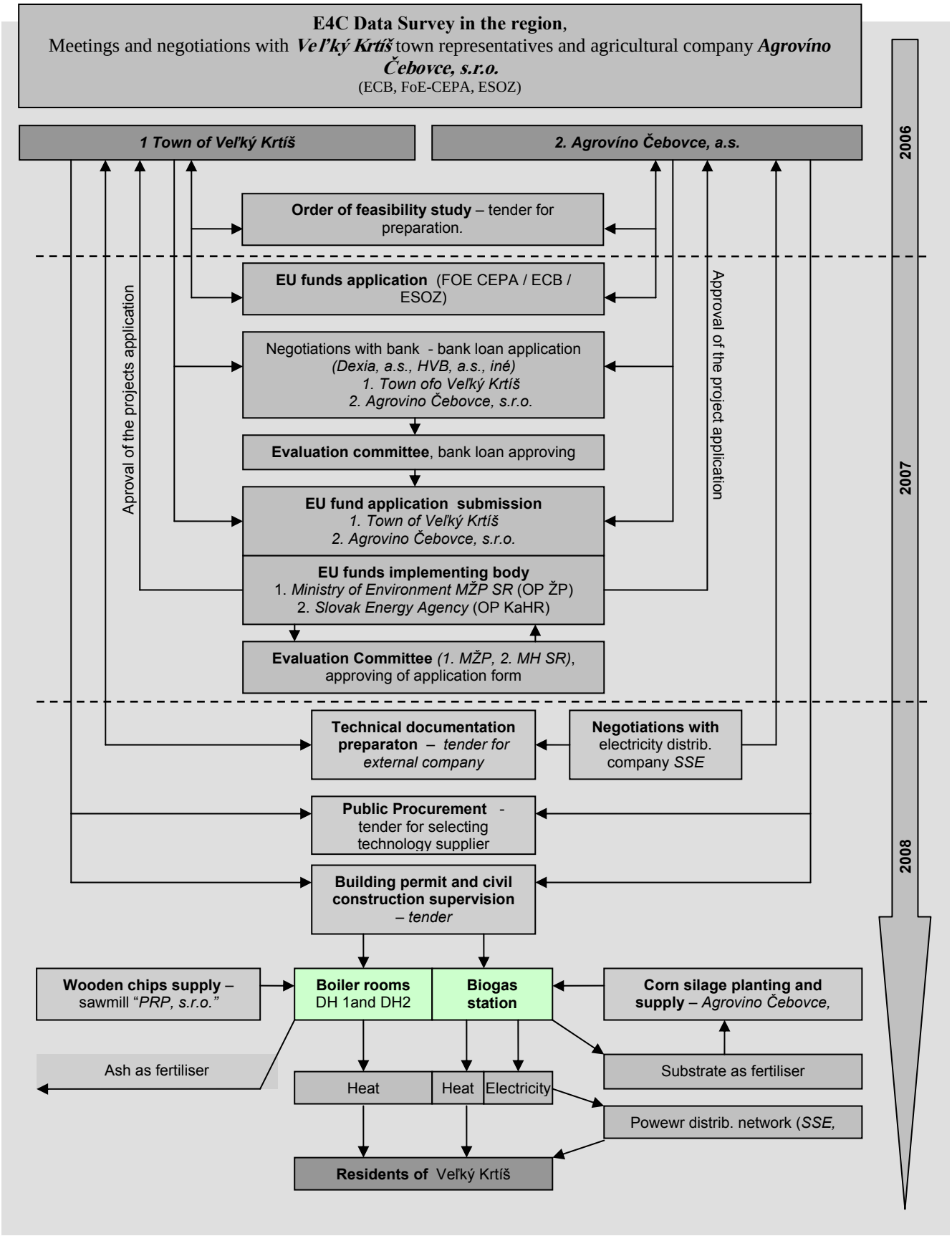


Figure: Possible co-operation scheme for biomass boiler rooms and biogas plant construction in Veľký Krtíš.

Legend:

MZP SR = Ministry of the Environment; MH SR = Ministry of the Economy; FoE CEPA = N.G.O. Friends of Earth-CEPA; ECB = Energy Centre Bratislava, OP ZP = Operational Programme Environment, OP KaHR = Operational Programme Competitiveness and Economy Grow; SSE = Central Slovakia distribution company.

4.6 Step 6: Strategy for financing Energy Actions by Structural Funds

Project holders have now a valuable pre-feasibility study indicating main benefits and circumstances of project idea and have to make a decision if they will choose proposed co-operation scheme and will be applying for EU support. On the other hand, final versions of the Operational Programmes as well as state support schemes and calls for proposals with exact specification of the eligibility have not been published yet (20th of June 2007). Energy Centre Bratislava as well as Friends of Earth-CEPA are ready to support project holders in process of application preparation, while these organisations have experiences with similar projects preparation in previous programming period.

Energy Savings in block of flats in Veľký Krtíš town

4.7 Step 1: Technical pre-feasibility – Energy Savings in block of flats in Veľký Krtíš town

Project consists of three energy saving technical measures:

- Heat insulation of the building envelope;
- Heat insulation of the roof;
- Windows replacement.

The block of flats is a typical building representing residential sector of Slovakia, where town of Veľký Krtíš is no exception to the rule. Such kinds of buildings represent the core of heat consumption within local DH system, in which renewable heat from biogas plant could be supplied (see previous pilot action).

Figure: Example of block of flats type "T 06 B" after heat insulation of gable walls.

Figure: Example of block of flats type "T 06 B" – previous state.

Block of flats on Lučenecká street was build in 1978 and doesn't meet actual requirements regarding energy efficiency specified in actual norms and standards.

Panel Construction System T06B is solved as a transversal carrying system with the carrying walls module of 3.6 m. Construction height of the floor is 2.8 m. This technology was used to build 4 to 8 floor buildings in rows or 13 floor tower buildings with basement, or with technical floor on the ground.

Construction elements are:

- Carrying walls are made of reinforced concrete 14.15 cm thick;
- Ceiling panels are of reinforced concrete 15 cm thick;
- The peripheral coating is made of silicates most frequently 30 cm thick. It is implemented in various material alternatives, such as slag-concrete and porous concrete, etc. The surface layer of panels is 3 cm thick cement mortar with silicon surface sanding;
- Partition walls are made of reinforced concrete, assembled, 8 cm thick;
- Roof construction was solved as a flat roof with 3% slope with internal drainage for rain water. The thermal insulation layer is of 5 cm thick polystyrene with smelted water insulating layers;
- Buildings have basement with cellars and installation of gas, water, heating and sewage;
- Buildings are centrally heated from the central source of heat. The heating system consists of double piping with forced circulation. The heating bodies - radiators, are made of metal sheets. In few cases the heating has single pipe system with a forced circulation. The annual energy consumption of the building is approximately 11.3 MWh/flat (40.3 GJ/flat).

Concrete block on Lučenecká street number 69-71 was selected due to fact that thermal insulation was not constructed yet and the building suffers from panels degradation (see photo below). Such system breakdown enables the owners to be eligible to the investment support from State Housing Development Fund.

Figure: Block of flats type T 06 B. on Lučenecká street – degradation of gable panel insulation

4.7.1 Detailed technical project description

4.7.1.1 Energy savings

Calculation of heat and technical parameters was based on data from technical literature. Duration of heating season and climate conditions were set on the base of national technical standards STN 73 0540 – 3. Average temperature of outdoor air during heating season was set to +2.7°C, calculation temperature of outdoor air was set according to STN 73 0540-3 to 13°C; in the level of 200 m above sea and considering elevation temperature gradient for II. temperature domain. Average indoor temperature used in calculation was +19°C. The number of heating degree-days is 3 374. Detailed heat and technical parameters are in table below. Whole building was considered as one zone. Calculation is comparing changes of heat and technical parameters in case of heat insulation of the roof, facade, gable walls and replacement of windows. Climate conditions, operation of the building and inner solar heat gains are unchanged and therefore not considered in calculation of annual energy savings. Calculation considers lower uncontrolled infiltration thanks to better tightness of new windows.

Tab.: Technical and heat parameters of original constructions.

Construction	Area [m^2]	Temperature gradient (θi -θe), [K]	U [$W/m^2.K$]	Q [W]
Gable walls	458.30	16.3	1.696	12 670
Other walls (facade)	889.00	16.3	1.674	24 257
Roof	337.89	16.3	0.790	4 351
Staircase glazing	76.16	16.3	7.000	8 690
Windows and doors	514.86	16.3	2.900	24 337
Ceiling of entrance floor	337.89	16.3	1.295	7 132
TOTAL	2 614.10			81 438

After heat insulation of roof, façade and gable walls including windows replacement at the level of actual technical standards´ requirement (STN 73 0540/2002) heat losses by heat transition (Q'_T) will be reduced (see next table). Glazing of staircase remains unchanged with insulated walls.

Tab.: Technical and heat parameters of constructions after heat insulation.

Construction	Area [m^2]	Temperature gradient (θi -θe), [K]	U [$W/m^2.K$]	Q'_T [W]
Gable walls	458.30	16.3	0.460	3 436
Other walls (facade)	889.00	16.3	0.460	6 666
Roof	337.89	16.3	0.200	1 102
Staircase glazing	76.16	16.3	7.000	8 690
Windows and doors	514.86	16.3	2.100	17 624
Ceiling of entrance floor	337.89	16.3	1.295	7 132
TOTAL	2 614.10			44 649

In order to reach such change of heat transition coefficient installation of contact façade heat insulation system is necessary. Mineral fibre insulation will be 60 mm thick. Insulation material should have heat conduction coefficient in dry state max. 0.045 W/m.K, density min. 85 kg/m^3 and compressibility max. 1.5%. For the roof about 30-40 mm would be enough, while the heat conduction of insulation could be max. 0,05 W/m.K, density min. 150 kg/m^3 and pressure solidity min. 40 kPa by 10% deformation. Windows should be double-glazed with inner air and wooden or plastic frame (three-chamber system).

The difference in **heat losses by heat transmission through walls** is 36.8 kW or 45% less than original state. Considering the duration of heating season and the number of heating degree-days with constant heat supply **annual heat savings are 658 GJ/year**.

Reduction of heat flow by ventilation through **windows** is 12.98 kW. During the heating season **heat savings** will be **232 GJ/year**.

Total heat savings will be 890 GJ/year.

Total heat requirement considering average heating season (207 days per year) and average outdoor temperature +2.7°C and indoor temperature +19°C **is 1 907 GJ/year**. Reduced by inner energy gains (electrical appliances, people, etc.) and solar gains theoretical **total heat consumption** for heating **is 1 400.8 GJ/year**.

By the implementation of proposed energy savings measures **total theoretic heat consumption will be reduced by 890 GJ/year** (63.6%). Such high percentage can be expected only in case of ideal conditions for civil construction works and further facility management in line with standard requirements.

Recorded consumption during the last years can be seen in next table. This heat consumption for heating consider real climate proportions of the last years, real inner and outdoor heat gains, real facility management and real quality of constructions. Considering same percentage of heat savings compared to reference state (63.3%) and considering calculation of real average of consumption during last years; the **real** figure of **energy savings will be 778 GJ/year.**

Tab.: Measured heat consumption during last years

Year	2000	2001	2002	2003	**Average**
Real heat consumption [GJ/year]	1 271.0	1 210.0	1 204.0	1 208.0	**1 223.3**
Number of degree-days [D°]	3 086	3 477	3 357	3 607	**3 381.8**
Specific heat consumption [GJ/D°]	0.412	0.348	0.359	0.335	**0.363**

Conservative figures used in the calculation of potential for energy savings ensure the real accessibility of calculated energy savings in real life.

4.7.1.2 Technical project components

The main component used is a mineral wool. Products from the mineral-basalic wool are good for the thermal, acoustic and non-flammable isolation of building frames, technological and energetic equipments. Products have shape of board, strip, mat and round blocks in the bulk weight from 30 to 200 kg/m^3. Products are certificated and controlled in the sense EU certification and if it is needed also in the sense of national and foreign standards. Products are hygienically and health innocuous, they have permanent shape and have an unlimited vitality. Products can be easily cut and shaped according to the needs. All products are hydrophobic and diffusive.

For the windows replacement any type of window in compliance with European harmonised standard for windows STN EN 14351-1 can be used.

4.7.2 Availability and suitability of site

- **Access to markets**

Heating insulation and windows replacement is a common measure at present in Slovakia. There are plenty of technology suppliers on the market.

- **Emissions potential and environmental impact**

Energy savings of 778 GJ/year represents about **43 tones of CO_2 savings** within concrete block of flats (emission factor for natural gas 0.0549041 tonnes CO_2/GJ).

- **Acceptance within community receptiveness**

The residents of Veľký Krtíš living in block of flats are very opened to energy savings measures, while it is a tool how to reduce the payments for heating. Many other blocks have already started insulation and windows replacement.

4.8 Step 2: Energy balance - Energy Savings in block of flats in Veľký Krtíš town

Year	Real heat consumption [GJ/year]
2000	1 271.0
2001	1 210.0
2002	1 204.0
2003	1 208.0
Average	**1 223.3**
After project implementation	**445.3**

4.9 Step 3: Financial analysis - Energy Savings in block of flats in Veľký Krtíš town

4.9.1 Investment Cost

Meassure:	SKK	EUR
Insulation of outdoor walls	1 053 650	31 117
Insulation of the roof	202 740	5 987
Replacement of windows	3 089 160	91 231
Technical documentation	50 000	1 477
TOTAL	**4 395 550**	**129 812**
Investmnet support (ŠFRB) on insulation of outdoor walls	*526 825*	*15 558*
Own sources	*1 000 000*	*29 533*
Bank loan	*2 868 725*	*84 721*

Exchange rate: 33.861 SK = 1 EUR (June 2007)

4.9.2 Project Preparation Expenses

Technical documentation for the project is needed. Costs on preparation are estimated about 50 000 SK (1 477 Eur). For the preparation of the application for national State Housing Development Fund as well as for the bank loan about 20 000 SK is expected to be spent (590 Eur).

4.9.3 Financial Engineering

Total investment
129 812 Euro

Private Funding		Public Funding	
114 253 Euro		15 558 Euro	
Equity	Commercial loan	Fund	Other grants
29 533 Euro	84 721 Euro	15 558 Euro	0 Euro

Project life time	25 Years

4.9.4 Economic Analysis

Investment costs (thous. EUR)	130
Investment subsidy from State Housing Development Fund (thous. EUR)	16
Economic lifetime	25
Discount rate	6%
Combined rate of increase of prices	1,5%

The block of flats is connected to local district heating system operated by Stefe KVK company. Heat prices are being regulated by Regulatory office for Network Industries in line with national legislation. At the moment (2007) the residents of block of flats are paying heat price as follows:

- fixed part of price 207.179 SK/GJ (incl. VAT)
- variable part of price 492.303 SK/GJ (incl. VAT)

Total heat price for final consumer is 699.482 SK/GJ (20.7 EUR/GJ) for 2007 in Veľký Krtíš. Considering annual heat consumption of 1,223.3 GJ it represents 855,676 SK (25,270 Eur) payment for heat, of which 16,071.5 Eur can be saved.

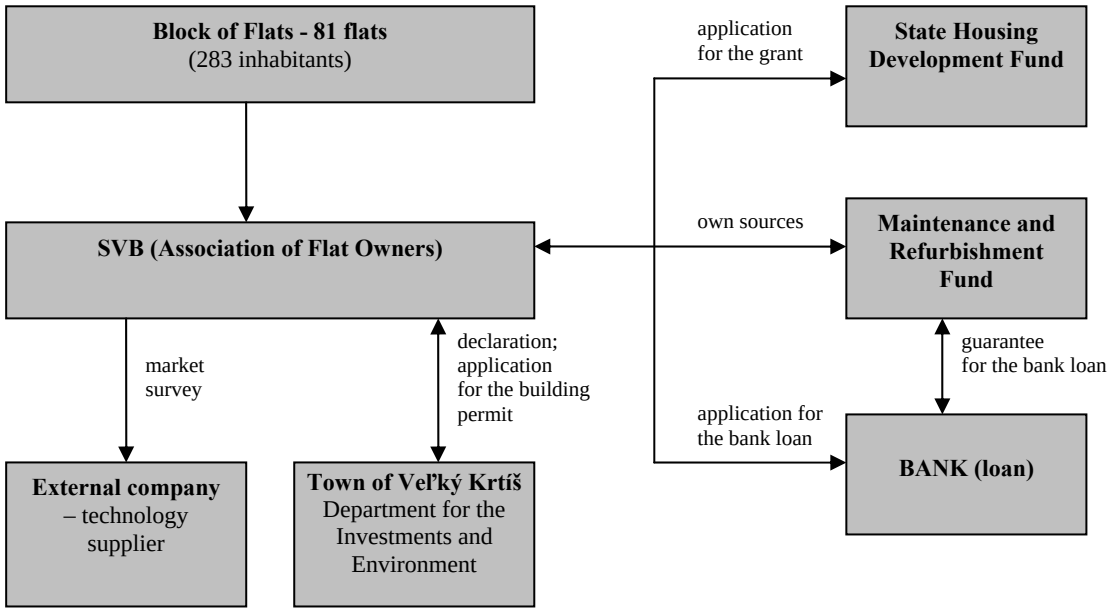
Net Present Value (NPV)	141
Internal Rate of Return (IRR)	16,1%
Profitability indicator (PI)	108%
Simple payback	6,7
Real (discounted) payback	8,1

4.10 Step 4: Positive effects in view to overall energy vision - Energy Savings in block of flats in Veľký Krtíš town

Total energy saving potential within Veľký Krtíš district has been set at 634,634 GJ/year, of which the main part is represented by family houses. For the blocks of flats total technical potential for saving is 45,276 GJ/year. Energy savings calculated for the concrete block of flat type T06B at the level of 778 GJ/year are realistic and feasible also in other similar blocks.

Costs saving at the level of 16,071.5 Eur represents significant amount of financial resources, which will not be paid to heat distributor and after then to monopoly natural gas supplier from Russia but will be used by the residents for individual consumption, what will support local economy.

4.11 Step 5: Cooperation scheme - Energy Savings in block of flats in Veľký Krtíš town



Step 6: Strategy for financing Energy Actions by Funds - Energy Savings in block of flats in Veľký Krtíš town

Inhabitants of the block of flats associated in SVB association are willing to invest into the energy saving measures in order to decrease heat consumption and thus payments for heat. Fact that there are some structural malfunctions in the building makes them eligible for the investment support from State Housing Development Fund. The main part will be financed from the bank loan. Slovak banks have a wide offer in this field. Required bank loan guarantee will be covered by own financial sources – payments which are being paid monthly to the common account managed by the same bank. Bank will thus acquire control over the account in which monthly payments to Maintenance and Refurbishment Fund, payments for energy, water supply and sewerage, waste management, etc. are being remitted. There are no dodgers in the block, so any problems with bank loan application are not expected. The rest of the financial sources needed will be covered by own sources.

Biomass DH and biogas plant in Dolná Strehová

4.12 Step 1: Technical pre-feasibility - Biomass DH and biogas plant in Dolná Strehová

4.12.1 Detailed technical project description

Energy production

Total energy consumption in Dolná Strehová municipality is 28,000 GJ in 2010 outlook. Consumption of the households represents 22,960 GJ; consumption of public and private sector is 5,040 GJ. Natural gas covers 42% of energy consumption, 45% is electricity, 3% coal and 40% fire wood.

New biomass boiler room with heat pipelines and new biogas plant should cover 100% of energy consumption in 2010.

Technical project components

Project consists of 2 main phases:

a) Construction of boiler room with 2 wood chip firing boilers and heat distribution network inside the village;

b) Construction of biogas plant next to the village.

Technical parameters of the boiler room:	*Technical parameters of the biogas station:*
Installed capacity: 3,100 kWt	Installed capacity: 500 kWe; 600 kWt
Number of boilers: 2	Number of CHP units: 1
Annual heat production: 14,000 GJ	Annual heat production: 14,000 GJ
Fuel consumption: 1,700 t of wooden chips	Annual power production: 3,572,000 kWh
	Inputs consumption: 9,000 t of corn silage

Technically project will consist from civil construction objects and operational objects, both for biomass boiler room and biogas plant.

Operational objects within **biogas plant** to be installed:

- CHP units and equipment;
- Fermenting technology;
- Biogas storage, regulation unit, biogas pipelines;
- Pump station, substrate preparation storage;
- Pipelines for water, heat and substrate;
- Electronic wirings;
- Control system;
- Heat connection to the DH system;
- Transformer;
- Frameworks;

Civil construction objects within **biogas plant**:

- Storage tanks and digesters;
- Pipeline bridges;
- Engine room;
- Site for transformer;
- Input substrates storage;
- Transmission lines;
- Terrain and road adjustments;
- Lightning and fencing;
- Water source and water distribution.

Operational objects within **boiler room** to be installed:

- 2 wooden-chips firing boilers;
- Heating water storage tank;
- Heat exchanger;
- Pipelines and water pump;
- Electronic wirings;
- Control system;
- Heat pipelines;
- Transport of fuel to the boiler;
- Transmission system;
- Steel frameworks.

Civil construction objects within **boiler room**:

- Pipeline bridges;
- Boiler room;
- Terrain and road adjustments;
- Lightning and fencing;
- Water source and water distribution;
- Operational daily fuel storages;
- Long-term fuel storage;
- Chimneys;
- Outer heat distribution

Location and specific construction solution depends on concrete technology supplier, which should be selected in a tender.

Suitability of production technology

Concrete technology will be selected after preparation of TOR and announcing of public tender procedure.

- **Raw materials**

Raw materials required are 1,700 tomes of wooden chips annually for biomass boilers and about 9,000 tones of corn-silage. Corn will be planted by local agricultural company Agrodružstvo Senné s.r.o. or another of several agricultural companies within 10 km from preliminary selected site close to Dolná Strehová. Wooden chips will be supplied by local saw mill Bioenergia Závada, s.r.o. Stability of supply depends on the price which can investors to the biomass boilers as well as to the biogas plant offer to keep the economy of the project. Further negotiations between biomass suppliers and potential purchasers are necessary.

- **Access to transportation**

Fuel (wooden chips) could be transported from proposed central storage in sawmill by lorry. To the operational fuel storage it could be transported by frontal loading machine. This storage should have sufficient capacity for 2-months.

Substrates for biogas plant will be collected by agricultural machines owned by agricultural company and transported to the silos, where it will be pressed and then ready-made silage will be stored for whole year.

- **Access to a qualified labour pool**

Operation of both biomass boiler and biogas plant will be autonomous. Operation stuff will consists of permanent attendant service stuff in the area of biogas station, manager of the plant responsible for failure-free feeding and operation of the plant. For attendant (guard) service three people will be contracted with work shift 8 hours per day. Guard staffs don't have to be qualified for the operation; their responsibility will be to keep record about operation and call a manager in case of any troubles. A minimum salary set by law in Slovakia would be sufficient for guard stuff.

For the operation of biomass boiler room and heat distribution 2 workers including attendance and operation are required. Qualification requirements for operation of boilers as well as CHP units are set by several national technical standards (e.g. STN 070703, STN 070710, STN EN 12170 for boilers and STN 38 6405 for gas facilities and others).

District of Veľký Krtíš suffers from low employment possibilities compared to the national average. Training of stuff required for operation will be provided by technology suppliers (costs on training should be included in the investment costs).

Operation and service of CHP units within biogas plant will be provided externally by technology supplier based on the contract. Two experts – one machine engineer and one electrical engineer - will be available in order to intervene in case of any break-down and periodically for the maintenance.

- **Emissions potential**

Expected fossil fuels savings and pollutants and GHG emissions reductions:

- **natural gas savings** 380,952.4 m^3 **(**11,760 GJ), what represents savings of 646 t of CO_2 emissions and 0.594 t NOx emissions.
- **Fire wood savings** 1,166.7 tones (11,200 GJ), what represents 17.5 t of solid particle savings and 18.7 t CO_2 emissions savings;
- **Electricity savings** about 1.17 GWh (4,200 GJ);
- **Coal savings** about 70 t (840 GJ).

- **Analyze environmental impact**

The main factors with considerable impact on the environment are:

- noise;
- polluting emissions;
- waste water.

Operation of the facilities should be in line with requirements set by Ordinance No. 40/2002 of the National Council about health protection from noise and vibrations. Noise study has to be prepared in the next step after feasibility study preparation.
Emission limits for such energy sources are set by national legislation by the Ministry of Environment. In the next round of project technical documentation preparation it is necessary to prepare emission-technology expert assessment and disperse study.

Waste water will be out flowed by pipe to exterminatory pit and then to a sewerage.

- **Regulatory requirements**

Building permit is necessary for the construction. Technical documentation for building permit has to be prepared. Work safety and environmental requirements are regulated by several governmental ordinances and regulations (some of them mentioned above).

4.13 Step 2: Energy balance - Biomass DH and biogas plant in Dolná Strehová

Current state of energy demand:

- 25,000 GJ;

Energy demand outlook in 2010:

- 28,000 GJ; of which: 22,960 GJ natural gas; 3.5 GWh electricity; 11,200 GJ fire wood.

Future state of energy supply:

- Annual heat supply from boiler room: 14,000 GJ;
- Annual heat supply from biogas plant: 14,000 GJ;
- Total heat supply: 28,000 GJ;
- Electricity supply from biogas plant: 3,572,000 kWh;

Share of renewable energy sources on heat consumption in 2010: 100%.
Share of renewable energy sources on electricity consumption in 2010: 100%*

**Electricity will be purchased from biogas plant and distributed to final customers by electricity distribution company (SSE, a.s.).*

4.14 Step 3: Financial analysis - Biomass DH and biogas plant in Dolná Strehová

Tab.: Estimation of project costs

Costs of the location:	n/a
Equipment and material costs:	Boiler rooms + heat network): 102 mil. Sk; Biogas station: 64 mil. Sk.
Taxation:	19% VAT, 19% income tax
Engineering and managing the project completion: - technical-economy study - feasibility study preparation costs - documentation for territorial decree - project for building permit - realisation project documentation - survey on site and negotiations with local stakeholders (4 person-months) - construction supervision - authorial supervision	 40,000-60,000 SK 90,000–140,000 SK 100,000-120,000 SK 700,000-900,000 SK 900,000–1,200,000 SK 120,000 SK 200,000-300,000 SK 150,000–220,000 SK
Other costs:	Travel and personal costs for project preparation expenses: 450 000 SK Preparation of the application for EU funds: 250 000 SK
Other capital costs:	n/a
Grants of different sources:	-

Note: Exchange rate as of June 4th 2007: 1 Euro = 33.861

4.14.1 Project Preparation Expenses

It is expected that from the pre-feasibility stage till the construction about 1 year intensive work will be needed. For clarification of the necessary inputs for the cash-flow analyses and business plan preparation following steps have to be implemented:

- Further negotiations with biomass supplier - agricultural company about possible contract on biomass supply, fertiliser purchase - quality and quantity requirements;
- Further negotiations with the municipality about funding of new company operating future DH system;
- Further negotiations with the municipality – authorisation process (building permit, cadastre office statement, etc.);

Activities above require additional travel and personal costs – about 450,000 SK per year.
Additionally for the preparation of the application for EU Structural Funds about 200,000 SK is required.

4.14.2 Financial Engineering

Total investment
169,450,000 SK 3,012,315 EUR

Private Funding		Public Funding	
1,197,543 EUR		3,806,739 EUR	
Equity	Commercial loan	Structural Fund	Other grants
359,263 EUR	838,280 EUR	3,806,739 EUR	0 EUR

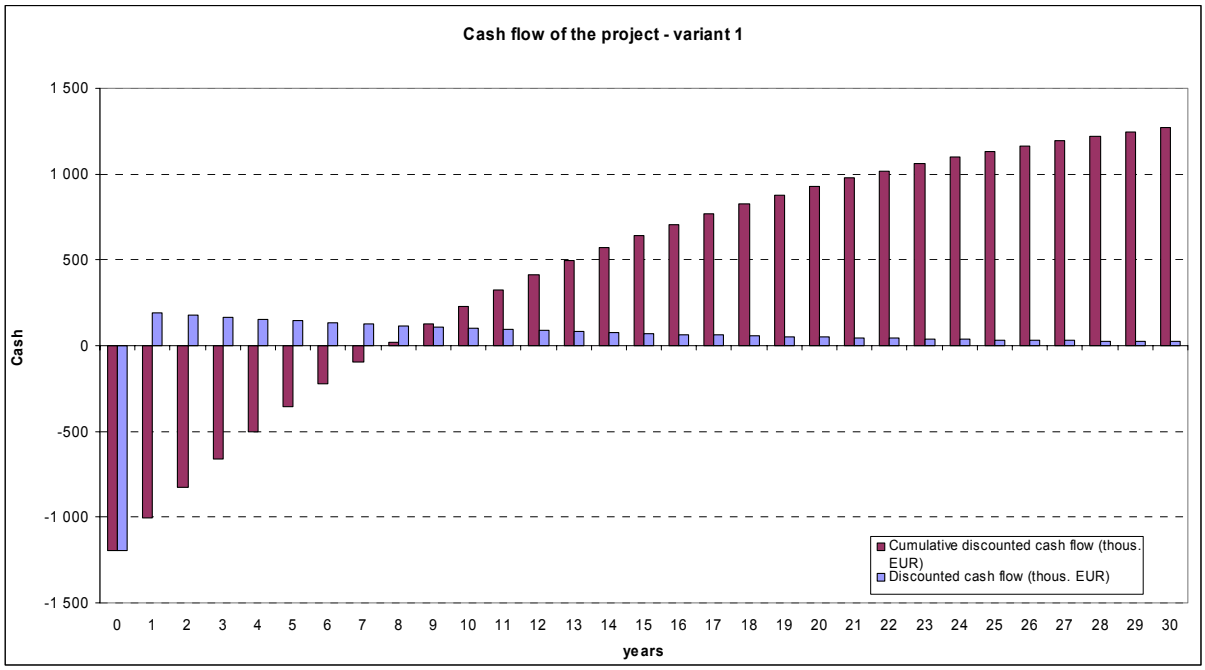
Note: Exchange rate as of June 4th 2007: 1 Euro = 33.861

Project life time	20 Years

4.14.3 Economic Analysis

Investment costs (thous. EUR)	5,004.0	thous. EUR
Investment subsidy from SF / CF (thous. EUR)	3,807.0	thous.
Economic lifetime	20	years
Discount rate	9%	
Combined rate of increase of prices	1.5%	

Net Present Value (NPV)	**930**	thous. EUR
Internal Rate of Return (IRR)	**18.2%**	
Profitability indicator (PI)	**19%**	
Simple payback	**5.8**	years
Real (discounted) payback	**7.8**	years



4.15 Step 4: Positive effects in view to overall energy vision - Biomass DH and biogas plant in Dolná Strehová

Although individual fire wood firing is one of the ways of biomass energy utilisation, it is not the most efficient and environmental friendly solution. Construction of local DH system and biogas plant will make the whole village independent from the fossil fuels imports.

Implementation of project will have a positive effect on each of 3 main specific objectives set by the Vision:

- Specific objective No. 1 - Reliable, available and diversified energy supply, maximal use of locally available resources;
- Specific objective No. 2 - Effective, well planned and managed energy production as well as consumption;
- Specific objective No. 3 - Reduction of current pollutants and CO_2 emissions from fuel combustion and improvement of ambient air quality.

4.16 Step 5: Cooperation scheme - Biomass DH and biogas plant in Dolná Strehová

Several activities and expert analyses have to be done by expert organisations in order to prepare the project in phase to be prepared for construction.

Project holders:

- Municipality (biomass boiler and DH system installation, founding of DH operating company);
- Agricultural company “Agrodružstvo Senné” (biogas plant construction);

Project beneficiaries:

- Residents of municipality (cheaper heat from DH system compared to individual heating);
- Agricultural company (profit from energy sales, ensuring market for technical crops planting, higher economic yield from the land;

Also several **external organisations** have to be contacted before or during project implementation:

- SSE, a.s. – private electricity distribution company, which has to purchase electricity from biogas plant;
- Public authorities and offices (e.g. Municipal Authority in order to approve the locality for biogas plant; Cadastral Office of Veľký Krtíš in order to identify land owners, etc.).

Feasibility study of the project, technical documentation both for biomass boiler rooms and biogas plants and projects for building permit have to be processed by external expert organisations, which should arise from a public tender. Preparation of the application with all required documentation for EU Structural Funds can be processed both by municipality and agricultural company, or assigned to external expert organisations (e.g. Energy Centre Bratislava).

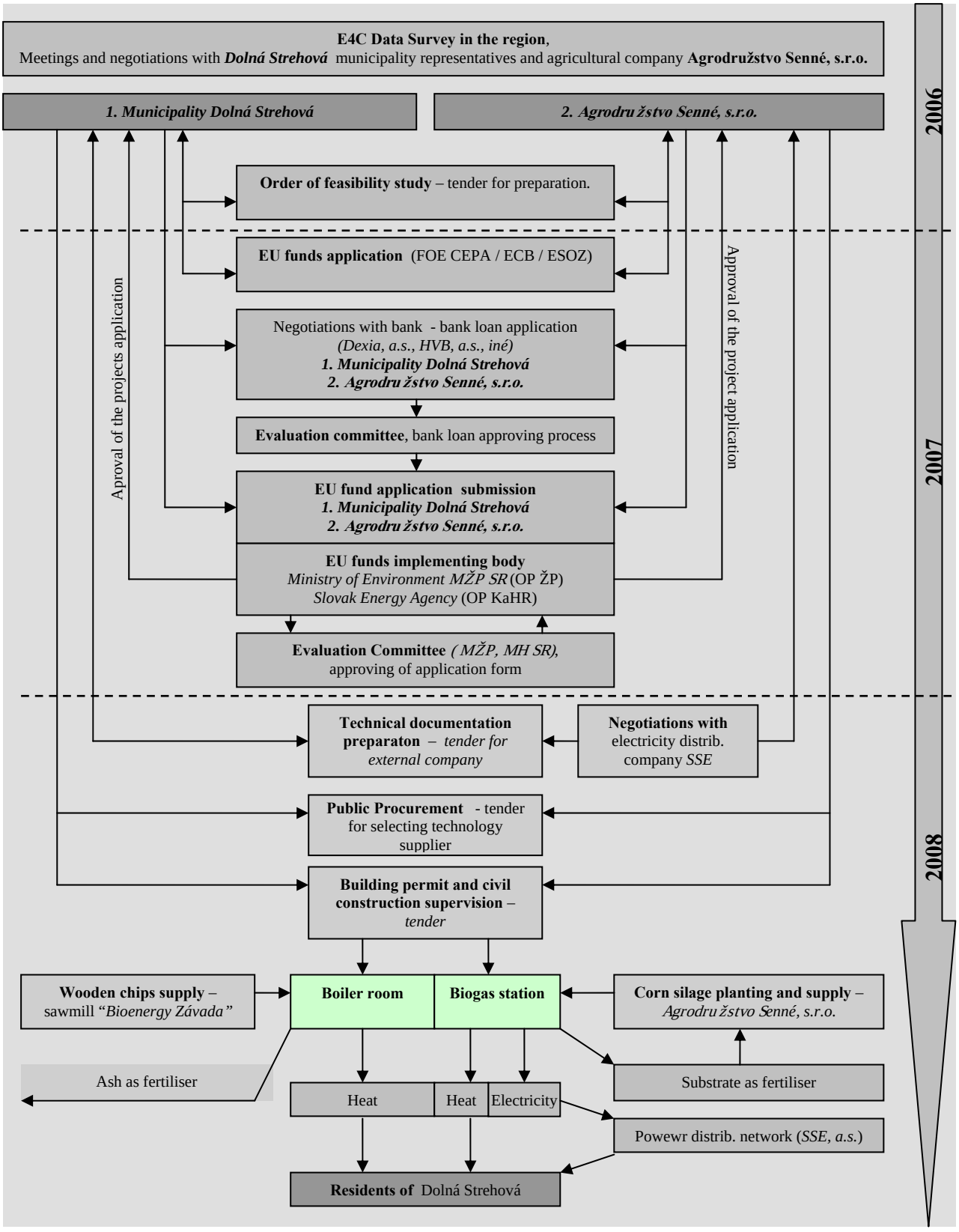


Figure: Possible co-operation scheme for biomass DH system and biogas plant construction in Dolná Strehová municipality.

Legend:
MZP SR = Ministry of the Environment; MH SR = Ministry of the Economy; FoE CEPA = N.G.O. Friends of Earth-CEPA; ECB = Energy Centre Bratislava, OP ZP = Operational Programme Environment, OP KaHR = Operational Programme Competitiveness and Economy Grow; SSE = Central Slovakia distribution company.

4.17 Step 6: Strategy for financing Energy Actions by Structural Funds

Project holders have now a valuable pre-feasibility study indicating main benefits and circumstances of project idea and have to make a decision if they will choose proposed co-operation scheme and will be applying for EU support. On the other hand, final versions of the Operational Programmes as well as state support schemes and calls for proposals with exact specification of the eligibility have not been published yet (20th of June 2007). Energy Centre Bratislava as well as Friends of Earth-CEPA is ready to support project holders in process of application preparation, while these organisations have experiences with similar projects preparation in previous programming period.

5. Conclusion and Outlook

Regional Energy Conception for the District of Veľký Krtíš (Slovak version published in August 2007) has been already amended by several local stakeholders. It was also sent to the Banská Bystrica Self-governing region - where the district of Veľký Krtíš comes under. Self-governing region will be also implementing organisation for some parts of EU funds, where coherence with regional conception will be advantage for the applicants. Preparation of regional energy concepts will be very probably obligatory in future in line with up-coming national legislation.

Regional energy planning as on district level is not a common practise in Slovakia. Regional stakeholders now have a tool for decision making in the field of RES utilisation and energy savings measures incl. investments planning.

Annex 1: Energy 4 Cohesion Poster

Annex 2: Energy 4 Cohesion Project Presentation