Model Projects of Hostětín

20 Years of Working Towards Energy Self-Sufficiency

Co přinesly projekty v Hostětíně
20 let na cestě k energetické soběstačnosti

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Summary

The Ecological Institute Veronica actively supports organisations and people interested in the environment. Through a long-term collaborative effort with the village of Hostětín, located in the White Carpathian Mountains, the Ecological Institute Veronica has demonstrated how local projects can contribute to environmentally friendly behaviour while also supporting regional economic and social development.

The model projects in Hostětín were not planned from the outside. They were created naturally in the process of searching for balanced solutions to local issues. In the early-1990s Hostětín, a village whose future was limited by a prohibition on further construction, was developing plans for treating wastewater. The construction of a reed-bed sewage treatment plant saw the lifting of this ban. The common denominator in all of these projects was collaboration between the village and the non-profit sector and the application of primarily foreign experience. As a final result this integrated system of projects in Hostětín helps demonstrate how sustainable human settlements may look in the future.

The projects in Hostětín were designed so that they could be repeated in other places, even outside the Czech Republic. When repeating these projects elsewhere however, local conditions need to be taken into account. These projects have naturally had a positive effect on the entire village – over the last decade population decline in the village has been stopped. Hostětín demonstrates what the transformation to a low-carbon economy and local sustainable development look like in reality.

Since 1995 the following projects have been implemented as a result of collaborative efforts between the village of Hostětín, the Ecological Institute Veronica, and other regional, state, and international partners:

Hostětín has the **first reed-bed sewage treatment plant in eastern Moravia**. It is essentially an artificial wetland containing common wetland plants. Wastewater is treated primarily by the bacteria that live on the roots of these plants, which break down organic waste. They are capable of cleaning wastewater as effectively as classic wastewater treatment plants.

The municipal biomass heating plant provides heat to almost the entire village. The plant burns wood chips from the waste of local forestry operations and sawmills. Eight-five percent of homes are connected to its heat distribution system.

The **public lighting system** was renovated by installing state-of-the-art light fixtures that reduce energy consumption by at least a quarter and which have effectively eliminated light pollution.

Table 1 A table of CO_2 emission reductions

Obnovitelný zdroj energie	Přibližné úspory emisí CO_2 v tunách	Podíl
Biomasa	1 092	90 %
Slunce	113	9 %
Ostatní úsporné a šetrné technologie		
Veřejné osvětlení	2	0 %
Kořenová čistírna	12	1 %
Celkem	**1 219**	**100 %**

The Veronica Centre building was erected in 2006 and was the first public building in the Czech Republic to meet passive house standards. The building includes conference rooms and an inn. It is also a demonstration building, demonstrating various types of ecological construction principles. Thanks to the eco-inn, everyone can try out what living in a passive house is like.

Hands-on education takes place in **the orchard and natural garden**

surrounding the centre. The long-term goal is to create a demonstration orchard, which through an educational trail and fun activities, will get the public involved in preserving heirloom varieties of fruit and in restoring extensively managed organic orchards in the landscape.

Hostětín's **famous organic apple juice and organic herbal syrups** are made in the local juicing plant. More than 95% of the products made here are certified organic. Organic certification guarantees that only approved processing methods are used to make juice from high-quality apples. These apples are largely sourced from organic farmers from the White Carpathians.

Solar collectors are located on nine buildings in the village; large solar collectors are used to heat water in the juicing plant and in the Veronica Centre. Photovoltaic panels are mounted on the juicing plant for the generation of electricity. There is also a **photovoltaic power system** on the ground near the heating plant and on the roof of one house in the village.

Wooden sculptures, echoing the traditional appearance of the White Carpathians with their mosaic of fields, gardens, orchards, meadows, and deciduous forests, are to be found at look-out points, by wells, and in places connected to local legends. An educational trail named "Na okolo Hostětína" was built using modern methods for interpreting local heritage.

These projects help protect the environment, and they have also increased employment in the village. Money spent on energy, food, and services remain in the local economy and help strengthen it. The benefits to the local economy provided by the juicing plant and the heating plant were calculated using the local multiplier effect. For every Czech crown that goes into the juicing plant, 63 hellers are generated in the region. For every Czech crown that goes into the heating plant, one crown and 30 hellers are generated. The seminar centre/passive house spends 67% of all costs in the region.

The projects that have been created in Hostětín have produced an ideal environment for educating people about sustainable development. The exceptional concentration of environmental projects in the village and many years working with the public forms the base of the Veronica Centre's educational programmes. The unique infrastructure of the village means that people are not taught using models, but actual projects. Education here is truly "hands-on". Both experts and members of the general public come from the Czech Republic and abroad to Hostětín for inspiration.

If we consider all of the projects implemented in Hostětín as a whole along with their benefits for local and regional sustainable development, the following benefits can be identified:

Economic benefits	Social benefits	Environmental benefits
• Greater flows of money in the region • Efficient use of local and natural resources • Lower energy costs • A change in consumer patterns • Developing local product market	• Education • Job creation • Promotion of the region and village • Participation in civil society • DIY / voluntary work • Population growth in the village	• Biodiversity protection • Climate protection • Efficient energy use and replacing energy from fossil fuel with renewable energy • Environmental protection (including air, soil, and water)

How we work

Our work is focused on finding solutions to society's problems. In our opinion the most acute problem facing society today is climate change. With a view to the future, we endeavour to contribute to creating a sustainable society. Our main contributions come in the form of model projects, serving as inspiration and a source of information for public administration, local government, specialists, and the general public. We take part in the implementation of these projects, we monitor how they work, and we collect and share experience.

Climate change

The climate system is not entirely stable; in the geological past the climate changed too, however only very slowly. The Earth's orbit and axial tilt influenced this change, while more rapid short-term changes were caused by solar variation and volcanic activity.

However, when talking about climate change and global warming today, we are talking about a much more rapid increase in average global temperatures that has occurred over the past several hundred years. Between 1906 and 2005 this increase was about 0.80°C. This change has been confirmed by measuring atmospheric temperatures, as well as by conducting research. Current increases are beyond a doubt human-induced and are primarily caused by burning fossil fuels, deforestation, and agriculture. This has made the stable climate that humankind and human civilization have been used to for thousands of years start to change.

It is also a crucial fact to note that today the climate system is so disrupted that even if we succeed in stopping all emissions for one entire year, warming would continue. Therefore, we must act immediately. In order to have a high chance of preventing dangerous climate change, economically developed countries (including the Czech Republic), following the recommendations of the Intergovernmental Panel on Climate Change (IPCC), should lower emissions by 25-40% against 1990 figures by 2020 and by 80-95% by 2050. Other countries should also fundamentally reduce emissions against predicted development. Using Hostětín as an example, it can be seen that making such reductions is possible.

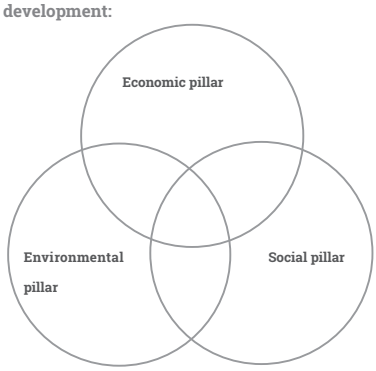
Sustainable development

The concept of sustainable development provides an answer to the question: How can society achieve development despite limited resources on Earth? This concept assumes that society can undergo economic development while improving social conditions all while not harming the environment.

Sustainable development is based on three elements: economic, social, and environmental. Relations between these elements (or pillars) are intertwined and significantly affect each other. The most important elements of the economic pillar of sustainable development are: regional money flows, efficient use of local and natural resources, and developing markets with local products. The social pillar focuses on strengthening social cohesion and stability, personal development, and lowering unemployment. Education plays an important role. The environmental pillar is focused mainly on nature conservation and the protection of the environment, natural resources, and landscape.

In the Czech Republic sustainable development is defined by Act No. 17/1992 Coll. on the environment. It is described as being: *"development which preserves for present and future generations the possibility of meeting their basic needs, and at the same time, does not reduce the diversity of nature and preserves the natural functions of ecosystems".*

Three pillars of sustainable development:



The role of municipalities

Municipalities are natural social units and are one of the key players affecting all three pillars of sustainable development. Municipalities are locally anchored and are in constant contact with their citizens and can significantly affect local happenings. They can also demonstrate sustainable projects in a small space, which can be further developed on a larger scale. Therefore, municipalities are one of the most active subjects affecting sustainability.

What leads some municipalities to sustainability? Some municipalities have begun to act out of impatience and discontent with the workings of the state and society. Other municipalities realize that the transition to sustainable development is just a matter of time and that decisions made at the international level will sooner or later be implemented at the local level. Therefore, there is no sense in waiting while decisions are being made about long-term investments that will radically affect municipalities. Municipalities can also gain an advantage by developing sectors of their economies that will profit on the implementation of projects in other municipalities once larger scale measures are taken. Other municipalities are motivated by the idea that they could become a living laboratory and later a model that other municipalities will look up to in the future.

The village of Hostětín

This village of 240 inhabitants is located in the northern part of the White Carpathian Protected Landscape Area and the White Carpathian Biosphere Reserve and is on the border of two distinct ethnological regions: Moravian Slovakia and Moravian Wallachia. The rural White Carpathian region faces several problems, including its marginal position within the Czech Republic (its marginality was only emphasized by the creation of the Czech-Slovak international border in 1993) and its unfavourable economic structure. In the 1920s employment in the industrial sector was concentrated in the arms industry and shoe industry. Both of these industries went into crisis in the 1990s. Agriculture was also drastically restructured, as it was transformed from intensive socialist agriculture to extensive agriculture involving raising livestock and fodder cultivation. In this period unemployment grew in the region.

Lowered agricultural and industrial production here meant a drop in the number of jobs in the late-1990s. Increasing unemployment forced local people to look for work elsewhere. This led to population decline in this region with a traditionally low population density. To stop people from leaving the region, people had to be offered a future. In Hostětín implementing sustainable development became the vision of the future.

Zdroj: archiv ZO ČSOP Veronica

Model projects

As there are frequently differences in theory and practice in reality, we are conducting the long-term monitoring of the results of all projects in Hostětín. In the following section, we will be focusing on each of the projects. For each project you will find information about what motivated its creation, a description of how it was implemented, and the results of the project. For each project there is also a special chapter focusing on financing. Considering the fact that most projects were pilot projects intended to test technology used therein, financing models are not transferable to other similar future projects.

Veronica Seminar Centre - Passive House

MAIN BENEFITS:

- **A building meeting passive house standards accessible to the public that demonstrates technologies and principles of green building and use of natural materials**
- Minimized heating and water heating costs
- **The eco-inn improves the educational and free-time activities available at the Veronica Centre**
- Visitors can experience firsthand what living in a passive house is like and how passive house technology works

Autor: Michal Stránský

The Veronica Centre building was erected in 2006 and was the first public building in the Czech Republic to meet passive house standards. According to the designer of the seminar centre, the cost of constructing it was only 7% more than "standard" costs based on normal prices without using passive building technology. High quality windows and heat recovery ventilation were responsible for higher costs.

Two-thirds of the costs for operating this seminar centre and passive house are spent in the region and it employs mainly locals. It also contributes to the development of tourism and helps support related businesses. The construction of the Veronica Centre facilitated the creation of a permanent education centre in Hostětín, the presence of which has positively affected visitor statistics to each local project. Creating the centre also resulted in growth in the number of seminars held here and also created the opportunity for longer educational courses and other overnight stay activities in Hostětín.

The original objective

The construction of a seminar centre was the logical culmination of the model projects executed in Hostětín. In 1998 the Veronica Foundation purchased real estate in Hostětín. The original barn located on this property was converted into the juicing plant in 2000, which was followed by the decision to erect a building that would serve as a centre for existing and planned educational programmes. Due to the remoteness of the village, constructing an inn where programme participants could stay was considered. People interested in Hostětín's projects could stay there, and it also allowed tourists and holiday-makers to stay in the village longer.

Due to the environmental profile of the organisation, the strategic objective of this project was from the very beginning to make the seminar centre an exceptional building. The building was to be constructed to meet the passive house standard of an annual heat requirement of up to 15 kWh/m^2 per year. The goal of the project was not just to build a lecture hall, kitchen, office/library, and inn, but to construct a building that would demonstrate

various construction and functional technologies for sustainable construction.

The construction of the educational centre, as well as the preceding paper work, was coordinated directly by the investor - the Ecological Institute Veronica (EIV). Project preparations took place in 2001–2005. During this time ways to finance the project were sought. An open tender for a construction company was announced at the beginning of 2006. It took seven months to complete the building and in January 2007 it was opened.

Basic design data for the Veronica Centre Hostětín building

Total building area	483 m²
Area of seminar centre	276 m²
Area for accommodation	207 m²
Enclosed volume	3 585 m³
Area of office	86 m²
Area of kitchen	58 m²
Plocha kuchyně	54 m²
Area for accommodating guests::	
From which: First floor	140 m²
Second floor	126 m²
Total heated area	**713 m²**
Accommodation capacity	25 beds (one quadruple room, three triple rooms, and six double rooms)
Office	8 work stations
Capacity of hall	50 people
Capacity of kitchen	up to 200 meals daily

Technology

The Veronica Centre passive house was erected in 2006 and was the first public building in the Czech Republic to meet passive house standards. It consists of three parts: one part containing the seminar/social room on the first floor and an office on the top floor, a second simply-shaped building intended for accommodating guests with a green roof, and a third long, one-story kitchen building. These three parts are connected by a common entrance hall.

According to Czech norms new buildings consume about 100 kWh/m² per year, whereas old buildings needs around 200–300 kWh/m² per year. Passive houses consume around seven times less energy than normal new buildings and more than ten times less than old buildings (see Graph1). If renewable energy can be used, passive buildings can become completely independent from fossil fuels. This was another of the objectives of the planned Veronica Centre.

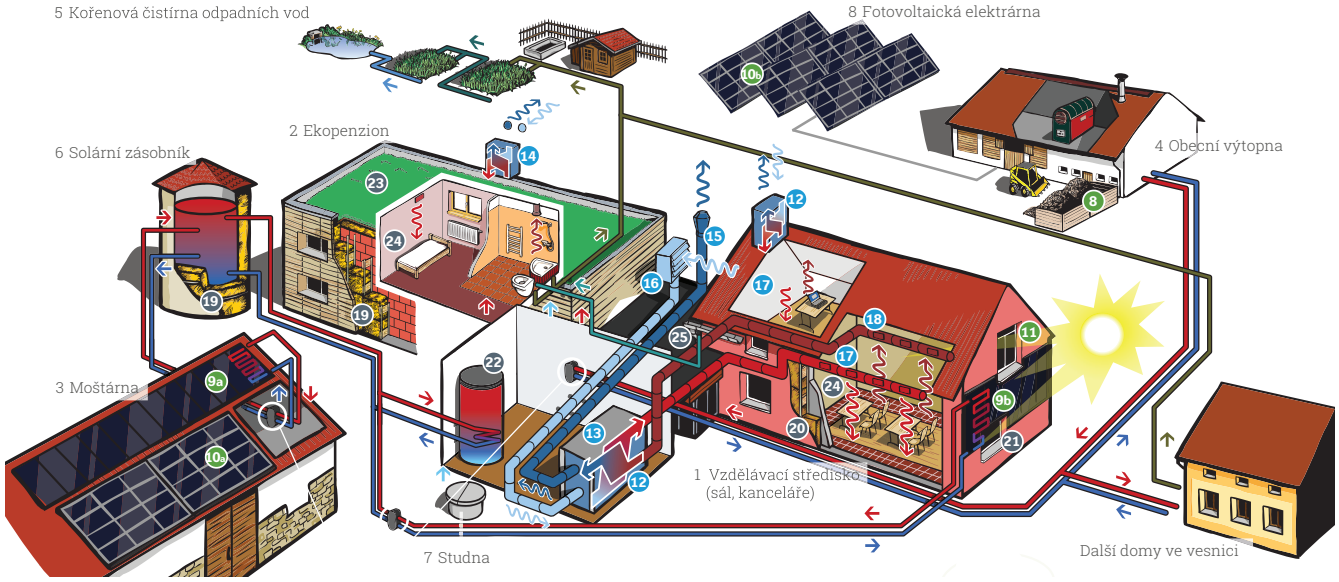
Construction methods and technology used

- insulation - mineral wool and straw up to 40 cm thick
- foundations insulated from the ground using special 20 cm thick polystyrene
- openable windows with heat transfer ≤ 0.6 W/m²K, fixed windows with heat transfer ≤ 0.8 W/m²K
- very good air tightness verified during construction with a special blower door test (air tightness of 0.7 h-1)
- mechanical ventilation with heat recovery from outgoing air
- solar water heating and supplementary heating
- supplementary heating in winter from the municipal biomass heating plant
- utilization of rain water
- green roof
- utilization of green building materials

The front of the centre is constructed from 16 cm - 20 cm thick concrete, whereas the rear is made of 17.5 cm thick bricks. External walls are insulated with at least a 30 cm layer of insulation and the roof is insulated with a 40 cm layer of insulation. The west wall and the roof of the lodgings are insulated with straw. Clay plaster was used inside, and the walls in the seminar hall have been left natural. In other parts of the building the inside walls are painted with casein paint. Old adobe bricks are used in a few smaller parts of the building. The floors are not covered in PVC; they are covered in actual natural linoleum. The windows, certified for use in passive houses, are

Schéma technologií

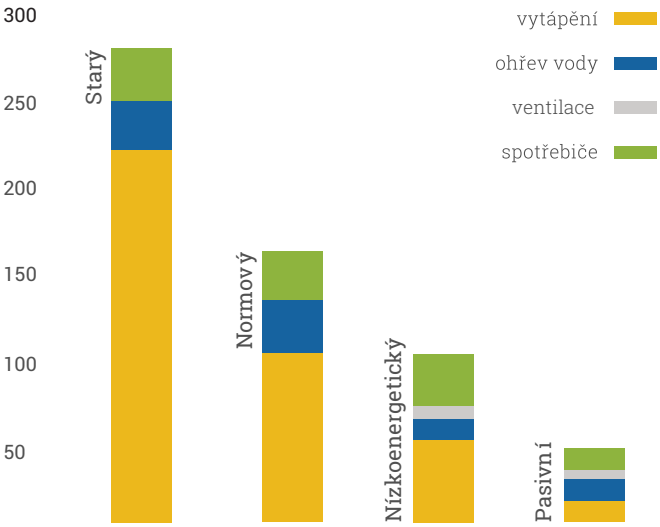
1/ Vzdělávací středisko
2/ Ekopenzion
3/ Moštárna
4/ Obecní výtopna
5/ Kořenová čistírna odpadních vod
6/ Solární zásobník
7/ Studna
8/ Biomasa, dřevní štěpka
9a/ Solární kolektor na moštárně
9b/ Solární kolektor na štítu vzdělávacího střediska
10/ Fotovoltaická elektrárna
11/ Pasivní solární zisky
12/ Větrání s rekuperací
13/ Dohřev vzduchu
14/ Větrání s rekuperací tepla v ubytovací části
15/ Odpadní vzduch
16/ Nasávání čerstvého vzduchu
17/ Větrání – přívod vzduchu do sálu
18/ Větrání – odvod odpadního vzduchu
19/ Slaměná izolace
20/ Izolace z minerální vaty
21/ Okna s trojskly
22/ Bojler
23/ Zelená střecha
24/ Hliněné omítky
25/ Svod dešťové vody pro splachování WC a úklid
26/ Výměník tepla



of exceptionally high quality.

The building is heated by a hot water system connected to the municipal biomass heating plant. Passive houses usually do not need an active heating system; passive solar power, internal heat gains, and the heating of ventilated air suffice. For the seminar centre however, due to the fact that the number of people there fluctuates greatly, the idea of heating exclusively with hot air was abandoned. If there were no visitors present for a long time, the building would cool off and to heat it up again would demand a great amount of electricity, and this rapid increase in output would require excessive ventilation which would make the inside air unhealthy and unpleasantly dry.

Graph 1 Porovnání roční spotřeby energie v různých typech domů (v kWh/m²)
Zdroj: Krapmeier, Drössler, 2001



Using renewable energy

The energy used to heat the centre comes exclusively from renewable resources. The orientation of the building and the size and locations of its windows support the building's solar gain. The heat for heating the building (i.e. the heat used for hot-water central heating and for warming air in recuperation units) and for heating drinking water is supplied by two collectors and from the municipal heating plant fuelled by wood chips. The 22 m² solar collector on the front facade of the Veronica Centre (providing the building's active solar gain) was installed two years after the building was completed due to financial issues.

The 36 m² collector on the roof of the neighbouring juicing plant exceeds the operating capacity of the plant, and upon its installation hot water was planned to be used in the future education centre. Both collectors are responsible for annual savings on heat and electricity for heating water of approximately 14,500 kWh. Both collectors use an exterior steel heat storage tank insulated with straw bales which are insulated from the ground with polystyrene. The storage tank contains 9 m³ of heating water, above which is 1 m³ of nitrogen serving as expansion space. Particularly in the winter, it is necessary to supply additional heat from the central heat distribution network supplied by the biomass heating plant. As there is an office and kitchen in the building, passive heat gain from the use of electrical appliances, mainly computers, is predicted.

Local materials and furnishings

The use of renewable building materials such as wood, straw, clay plaster, and a small number of adobe bricks certainly represent an environmental advantage of the building. With the exception of the plaster, these materials were local; they were transported from distances less than 60 km away. The economic and environmental burden of transporting these materials was eliminated (see Table 2). The use of natural

materials – wood and straw – also temporarily conserves carbon, which is not returned to the atmosphere. This contributes to lessening climate change.

As far as the ecological balance of thermal insulation materials is concerned, the investor originally wanted the walls of the lodgings to be insulated with straw, but this proposal was rejected due to fire resistance requirements on the wooden cladding covering the straw insulation. Therefore only one wall and the roof were insulated with straw; the remaining walls were insulated primarily using mineral wool, and polystyrene was used on the ground and near the ground in places were mineral wool could not be used due to moisture.

Table 2 The main materials used in building the centre

Material	Local	Non-local	Renewable	Non-renewable
Local		x		x
Non-local		x		x
Renewable			x	
Non-renewable	x	x		x
Polystyrene		x		x
Straw	x		x	
Wood cladding	x		x	
Construction wood[1]		x	x	
Clay[2]		x	x	

1 / Construction lumber is obviously available locally (wood from the forest owned by the Veronica Foundation was used to build the juicing plant and warehouse). However, for public procurement it was not easy to influence where the wood came from. According to information from the main contractor, the wood came from Czech Silesia, making it from the Czech Republic.

2/ Certified clay for plastering was imported from Austria; however today certified clay plasters can be obtained in the Czech Republic, and therefore clay can now be acquired locally.

Due to a combination of requirements on the furnishings (including cost, durability, and shelf life), it was not always easy to find environmentally friendly local materials and local producers. For example, solid wood furniture using as little glue as possible and finished with an environmentally friendly substance (hardwax oil) was preferred. Some of the furniture was made from FSC certified wood from the Školní lesní podnik of Mendel University – which at the time was one of the closest certified forests. Bedding and towels in the rooms are certified Environmentally Friendly Products. The kitchen is equipped with appliances with an A energy rating.

In 2012 an ecological footprint classroom was created, which directly shows how energy savings are made in reality. It includes top kitchen appliances – some with an A+++ energy rating – and also includes a demonstration of environmental methods for cleaning, living, shopping, transport, etc.

Water

In the summer the White Carpathians are relatively dry and Hostětín and surrounding villages often have a lack of drinking water. Local people often do not have enough water in their wells. Since there is no municipal water system in Hostětín, residents are completely dependent on wells for their water. This is the reason why there is a dual water distribution systems in the building1 connected to a 6 m^3 rainwater tank. Rainwater collected in the tank is used for flushing toilets and for cleaning. How much water has been saved by this system has been monitored since February 2012. In the first year of use 36 m^3 of water were saved. Because precipitation in 2012 was below average, rainwater made up only 23% of water used for flushing toilets. It is likely that savings in future years will be higher due to modifications in the rainwater collection system.

* Dual water distribution systems are not just today's fashionable trend; during the interwar period they were common in the city of Brno. If the system is included in the design of a new building, costs are not increased by much. However, adding the system during the renovation of buildings that already have water distribution systems installed is relatively costly.

Lighting

In normal buildings the share of electricity consumed for lighting is minimal; however, in passive houses electricity consumption for lighting is a significant part of the energy balance. Therefore the building uses natural sunlight as much as possible for lighting. In spaces where windows were not possible – such as in the kitchen and in the hall way in the accommodation section – the architect utilized skylights. Artificial interior lighting for use in the evening and at night – especially in the seminar hall was designed with emphasis on maximum energy efficiency. There are light bulbs installed in the hall that are equipped with electronical ballasts that allow them to dim gradually. Once linear and compact fluorescent bulbs wear out they are replaced with more efficient LED lighting.

BENEFITS OF PASSIVE HOUSES

- **Providing greater comfort for their inhabitants**
- **Extremely low heating costs**
- **Constant inflow of fresh air**
- **Draughts are not created**
- **No temperature differences in rooms**
- **Pleasant temperatures in winter and summer**

Source: Passive House Centre

Recent experience

The building was designed to meet passive house standards with heat consumption of up to 15 kWh/m² per year. As can be seen in Graph 3 and Table 3, consumption is actually somewhat higher. This is due to how the building is actually used. Whereas the design assumed a room temperature of 20°C, it turns out that in practice people are used to a temperature of around 24°C. Guests in Hostětín expected this temperature as well. It is not an easy task to explain to visitors that it is our intention not to overheat the building. Increasing room temperature by 1°C can increase heat energy consumption by approximately 7%. However, employees are aware of the fact that people cannot unfortunately change their habits in the course of one day, and therefore the centre is usually heated to 22°C.

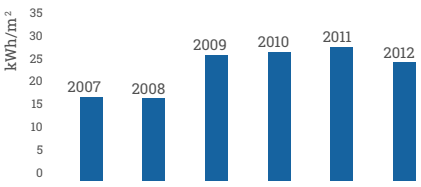
The building design also assumed internal heat gain from waste heat generated by electrical appliances and people inside the building. But the number of guests staying at the eco-inn during the winter - at the time of year when passive gains from heat radiation is most needed - is not sufficient. The inn is therefore actively heated to a temperature of 17-18°C with hot water heating in order to limit problems with quickly heating the area up to the standard temperature.

Guests of the eco-inn spend two nights on average, which is too short a time for them to

Table 3 Spotřeba tepla na vytápění v letech 2007–2012

Rok	Odebrané teplo z výtopny	Cena celkem	Spotřeba tepla na ohřev vody	Spotřeba tepla na vytápění	Měrná spotřeba tepla na vytápění
	[kWh]	[Kč]	[kWh]	[kWh]	[kWh/m².a] rok
2007	21 588	21 580	8 561	13 027	18
2008	21 338	24 690	8 450	12 888	18
2009	27 044	30 391	7 449	19 595	27
2010	28 550	31 359	8 457	20 093	28
2011	26 977	29 143	6 042	20 935	29
2012	24 032	29 231	5 587	18 445	26

Graph 3 Měrná spotřeba tepla na vytápění v letech 2007–2012



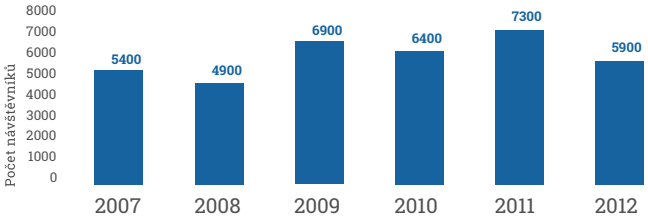
fully experience how a passive house works and what its advantages are. Despite the fact that the rooms are fully ventilated due to the heat recovery ventilator, people often feel they need to open the window "to let in fresh air". This results in unnecessary heat loss during the heating season. Other problems can be caused by the fact that in the inn two rooms share one recuperation unit that must be turned on manually.

Considering the fact that guests to the inn constantly come and go, the building is always inhabited by people who are not familiar with living in a passive house.

Photo: ZO ČSOP Veronica

Excellent food is available: organic food, Fair Trade products, and local food are all used generously and there are no processed foods to be found. Guests can choose from vegetarian and meat-based meals. The kitchen will cook only for groups of ten or more, as cooking for less people would be loss-making. The services provided by the educational centre also bring earnings, including hall rental, equipment rental, etc. The seminar hall is rented out for seminars, workshops, conferences, and training meetings held by other organisations, as well as for recreational activities and family events (e.g. birthday parties, weddings, etc.) An agreement has been made with the village that allows for citizens of Hostětín as well as civic organisations based in Hostětín to use the hall free of charge. Civic associations and local families usually order refreshments from the kitchen staff. The number of registered visitors to the Veronica Centre in 2007-2012 is depicted here:

Graf 4 Počet návštěvníků Centra Veronica v letech 2007–2011



Gable roof

Following regulations contained in the regional master plan the seminar part of the building has a gable roof and an office with roof windows is located in the attic space. Roof windows are problematic construction elements that are best avoided in passive houses. In the summer the windows are sources of great solar gain and they overheat the office. The windows must be consistently shaded and at night the building should be cooled off by opening the windows and allowing a draught to form. The designer planned for this type of cooling system, however it is used only infrequently. As at night there is no one in the office there is a risk of wind and rain damage. Employees also needed to learn how to combine the use of controlled heat recovery ventilation with additional heating from the classic heating system so that the air does not dry out in the winter. In contrast to the eco-inn the passive office does not have any internal thermal gain at night (from people and computers), nor does it have regular sources of moisture, such as showers and cooking. Air exchange levels can be checked by examining the CO_2 monitor (which measures CO_2, temperature, and humidity).

Even though the heat required for the Veronica Centre is somewhat higher than that required for passive houses, its heating requirements are much lower than is the norm in the Czech Republic. Therefore, the

main goal of the Veronica Centre, which is to familiarize the public with what passive houses are and how they work, can be achieved. Energy consumption figures and explanations are available to the public.

Inspiration

There are several thousand passive houses in Europe. They can be found in the greatest numbers in Germany, Austria, Switzerland, and Sweden.

According to estimates there are 400 to 500 passive houses in the Czech Republic, but no official statistics exist. The Passive House Centre maintains a very good, but non-compulsory, database. In 2006 the Veronica Centre was the first public building erected in the Czech Republic to meet the passive standard. In 2013 we can find administrative buildings meeting the standard (belonging to the Environmental Partnership in Brno and the Intoza company in Ostrava), a hotel (in Nechory u Prušánek), a block of flats (in Dubňany), and a nursery school (in Slivenec); currently a retirement home is being built in Modřice. Public interest in passive buildings is growing; this was helped along by subsidies offered by the Czech state as part of the Green Savings programme. More subsidies should become available as part of the proposed New Green Savings programme. The building is a source of inspiration particularly in light of the new Energy Performance of Buildings Directive approved by the EU in 2010.*

* The EPBD requires that by 31 December 2020 all new buildings have almost zero energy consumption. The directive further requires that new buildings in Member States used and owned by government bodies constructed after 31 December 2018 must have almost zero energy consumption. Buildings with almost zero energy consumption are buildings that are highly energy efficient with zero or very little energy consumption. Any necessary energy should come largely from renewable resources. Source: EPBD

Financování

As the building investor was a non-profit organisation, the finances came from different sources: subsidies and donations. In the initial phases money from the Austrian government to support the work of architect G. W. Reinberg and his colleagues was important, as were funds from the Dutch government fund MATRA, which supported all project work and provided co-financing. We acquired capital from EU structural funds, including from the Joint Regional Operational Programme (financed by the ERDF – European Regional Development Programme) in the Zlín Region mentioned for building infrastructure for developing regional human resources as well as from the State Environmental Fund. In addition money and material donations were made by sponsors – especially Českomoravský cement (1.65 million Kč) and Philips ČR. Managing project finances proved to be an extraordinarily difficult process of screening and searching for possible ways to utilize structural funds for such an innovative project, moreover in the non-profit sector. Changes in the JROP regulations meant that the project could not be financed in stages; therefore we obtained a commercial loan from the bank Česká spořitelna for pre-financing. According to the designer, the cost of constructing the building was only 7% higher than the "standard" cost

Table 4 Sources of funding for building the Veronica Centre

Sources of funding	Amount in million Kč	Percentage of total costs
JORP	13,2	56 %
State Environmental Fund	5,38	23 %
Ministry of Regional Development CZ	1,65	7 %
Gifts and grants	3,26	14 %
Total	23,49	100 %

based on normal prices without using passive building technology. The price per square metre was 32,000.00 Kč. Local construction workers and tradesmen were employed by the general contractor to work on the building.

Financing

The Veronica Centre's inn is self-financing, therefore it is not a losing operation. The main goal of the Veronica Centre Hostětín is to educate people about sustainable development, a goal which cannot be completely commercially independent in today's world. Therefore, the educational activities of the Veronica Centre are largely dependent upon grants and subsidies. Economic activity, based on providing dining, lodging, and other services, supplements educational activities and partially finances them.

Payback period of passive house technology

The simple payback period of the investment in building the passive house, excluding maintenance costs (including replacing the heat recovery ventilation unit after its service life of approximately ten years), but including annual growth in prices from the biomass heating plant of 6.5%, was 16 years. After 16 years, the annual heating savings are estimated to be 175,000.00 Kč.

In light of expected (but difficult to predict) growth in energy prices1 it can be assumed that investments in increasing energy efficiency will continue to be advantageous. Thanks to savings made by using straw as insulation, a thick layer of homemade straw insulation is significantly cheaper than an equally thick layer of conventional insulation.

According to Jan Bárta from the Passive House Centre on average passive houses cost 0% to 15% more than "normal" buildings to build. Fifteen percent is the upper limit, so that the higher costs can be covered by energy savings. In practice it has been demonstrated that in the Czech Republic the payback period for these investments ranges from 10 to 13 years. Unpredictable growing energy prices have an influence on the payback period. Energy costs, however, certainly will rise as will the savings of those living in passive houses. Passive houses, however, are not only about investment returns; they are also about maintaining low living costs over the long term. Passive houses are essentially energy independent and are therefore a good retirement investment opportunity.

* V roce 2012 se ceny energií na základě údajů Českého statistického úřadu meziročně zvýšily o 4,3 %.

Juicing plant

THE MAIN BENEFITS OF THE JUICING PLANT

- **Support and promotion of organic agriculture**
- Processing locally produced fruit
- **Preserving landscape character and landscape diversity**
- Support for the local economy and job creation

Zdroj: archiv ZO ČSOP Veronica

Despite the fact that the juicing plant was established by a non-profit organisation, it has gradually become an economically self-sufficient operation. However, without initial grants and other material and non-material input it would have been impossible to have established it. The juicing plant helps contribute to conserving the biodiversity of apple varieties from the White Carpathians. These varieties will be preserved for future generations. The juicing plant guarantees good purchase prices and motivates owners of orchards consisting of varieties of fruit growing on tall-trunked trees. The two permanent and six seasonal jobs the plant has produced are also important. The juicing plant has created employment opportunities for hard-to-employee people.

The original objective

The initial intention to preserve the extensive fruit orchards of the White Carpathians was expanded to include a long-term programme of research and mapping the local fruit gene pool, planting genetically diverse orchards, and supporting the processing of locally produced fruit. The construction of the juicing plant was thus one of the many steps involved in the broadly conceived fruit growing programme in the White Carpathians.

Non-governmental organisations involved in the project founded the Traditions of the White Carpathians (TWK) civic association in 1998 as a coordinating organisation. The aim of this association is to motivate local inhabitants to care for natural resources, the landscape, and the biological diversity of the White Carpathians. The Ecological Institute Veronica and later the Veronica Foundation created a vision of motivating local orchard owners to maintain and further develop their orchards by offering them the opportunity to process, market, and otherwise make use of traditional fruit varieties.

TWK took the decision to build a juicing plant in Hostětín on property that the Veronica Foundation owned. This property included an old farmhouse and orchard, purchased in 1998. In 1999 work was commenced on renovating

the barn into the main production area for the future juicing plant. Construction work was done by a group of local tradesmen and during the summer holiday volunteers and participants in summer multi-day courses and in an international workshop organized by the INEX Association for Voluntary Activities helped out.

The Apple Festival, which is held every year in late-September and is an important promotional event for the projects in Hostětín, still depends on the help of volunteers. ých projektů.

Juicing plant technology

Apples are transported to the plant in large containers on trucks, or they are brought by small-scale growers in sacks. Based on whether the fruit is organic or not, it is sorted into hoppers. The apples are washed from the hoppers and transported to a crusher by a screw conveyor, where they are crushed into apple pulp. The apple pulp is carried along a perforated conveyor belt to a belt press. The pressed juice then drips through the belt to a tank from which it automatically drains – either it is filled directly into bottles or it is stored in stainless steel tanks.

The press can process three tonnes of apples per hour. The juice yield percentage can be up to 70%. As opposed to mass-production practices where the pressed apple juice is condensed into a concentrate which is later filled into bottles for the consumer with the addition of drinking water to bring the juice back to its original density, in Hostětín apple juice is filled into bottles without any thinning or concentration. Juice that is not filled directly into bottles during the pressing process are stored for later filling in stainless steel tanks ranging in volume from 10 m^3–13 m^3. Before being filled into the tank the juice is pasteurized in a recuperating heat exchanger; it is heated up to 85°C and then is subsequently cooled down by pumping cold juice in (which is heated up in the process to 25–30°C). Heat recuperation saves up to 80% energy. The juice is pumped from this tank as needed during the course of the year. Before being filled into bottles the juice is pasteurized once again.

To get the juicing plant started up, the equipment was acquired from a family-run juicing plant from a German producer of juice and fruit wine. All of the machines in the bottling line were quite old, at almost 30 years old, and it was necessary to make repairs before bringing it into operation.

In 2007 a new warehouse equipped with stainless steel tanks and a recuperating pasteurizer was built, and a new automatic belt press for fruit was added and started operation. The remaining used equipment was completely replaced before autumn 2011.

The new high-tech bottling line can fill juice into various sizes of bottles (including 0.75 l, 0.5 l, and 0.2 l). Over the past ten years the juicing plant has invested a total of 6.3 million Kč in new technology. Investments in new technology shares two things in common: increasing product quality and saving energy.*

* The total value of the acquired property is higher due to subsidies (In 2007 the organisation received a 1.3m Kč subsidy from the Ministry of Agriculture of the Czech Republic.)

THE EFFICIENT USE OF NATURAL RESOURCES

- **Local apples**
- Heat from the central biomass heating plant
- **Water heating with solar collectors**
- A new recuperating pasteurization unit saving 80% of heat
- **Some of the wastewater from cleaning the apples containing high levels of sugar is used to water agricultural land (which prevents the reed-bed sewage treatment plant from being overloaded)**
- The juicing plant warehouse is insulated with straw bales. (Additional heating is not necessary in winter. In the summer air conditioning is used for cooling).
- **Electricity from photovoltaic panels installed on the juicing plant's roof**

The juicing plant's product line

In September 2000 the first season of juicing plant operation was commenced. Since then the juicing plant has expanded its product line and since 2007 packaging has been standardized. Whereas in 2000 44% of juice was organic, since 2007 the percentage of organic juice has regularly exceeded 85%. Four of the plant's products bear the Traditions of the White Carpathians® label, which guarantees their regional origin and quality.1 Another mark of quality is that Hostětín apple juice received the first Czech Organic Food Product of the Year award in 2002. Other awards for apple juice containing sea buckthorn and elderberry syrup followed.

* Currently 35 products and services from the White Carpathians bear this regional label.

The product line includes:

Fruit juices (single-fruit and mixed, organic and non-organic, e.g. Hostětín organic apple juice, Hostětín organic apple and red beet juice, and Hostětín organic apple and sea buckthorn juice)

Syrups (four varieties of organic syrups)

Distilled beverages (In 2008 calvados from Hostětín was introduced on the market, which is distilled at the nearby Rudolf Jelínek distillery in Vizovice)

Recent experience

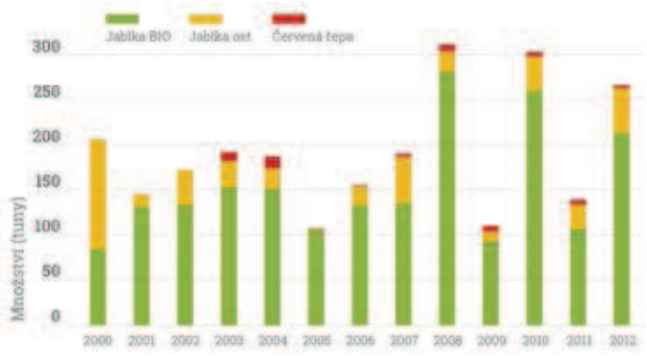
The economics of running the plant

The Hostětín juicing plants meets the criteria to be a social enterprise,1 as it focuses on both environmental and social goals. Specifically, these goals include preserving the landscape character of the White Carpathians, supporting organic agriculture, creating local jobs, and changing consumption patterns. The ownership and management structure of the juicing plant also meet social responsibility criteria. The project is also a source of sustainable income for the TWC civic association.

Emphasis on regional origin is clearly reflected in the statistics of those supplying apples to the juicing plant. An analysis of costs for purchasing apples in 2004-2012 demonstrated that more than 86% of costs going towards the purchase of apples were spent within 40 km of Hostětín. It is also true that a large share of suppliers grow their apples within the boundaries of the White Carpathian Protected Landscape Area (54% of expenditures was spent on apples from here). In total, 21% of the juicing plants costs were spent on purchasing apples.

* Social enterprises are organisations that conduct commercial activities in order to fulfil social goals.

Graf 5 Moštárna v Hostětíně – zpracované suroviny v letech 2000–2012



Thanks to significant financial, material, and non-material support in the early phases of the project, the juicing plant is now profitable.

Table 5 A summary of financial results in 2004-2012 (in thousands of Kč)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Total costs	2 487	2 102	1 847	3 364	3 981	3 492	4 961	4 916	5 283	
Total revenue	2 585	2 262	2 201	3 830	4 078	4 245	5 472	5 308	4 961	
Profit	98	160	354	466	97	753	511	393	-322	2 510
Profit margin	5 %	10 %	21 %	13 %	2 %	18 %	9 %	7 %	-6 %	

Financial results in 2004 and 2005 were affected by property transfers and the creation of a reserve fund for planned repairs to the press. Due to the fact that in the end equipment was not repaired, but a new press was purchased in 2006, this reserve fund lowered costs. The lower profits indicated in 2005 were most likely affected by apple crop failure. Losses in 2012 were caused by a decrease in retail revenue and high depreciation, the results of investments from the preceding year. In summary, the project is profitable and its profit margin is within the norm for the business sector.

Waste

The largest problem facing the operation of the juicing plant is managing the waste it creates. After the collapse of the returnable bottle market, the juicing plant with its newly purchased filling line was forced to abandon the use of returnable bottles. Since 2012 the entire product line has been filled in non-returnable glass bottles. Although most studies indicate that these types of containers have the highest negative environmental impact of all, they have a more closed life cycle1 than, for example, PET bottles. Therefore, it is not entirely clear if using non-refundable glass bottles is more environmentally friendly than if plastic bottles were used. Unfortunately, there are not many ways to package the product in returnable, closeable bottles. How to deal with this situation and how to come up with a solution that meets the technological demands of the market is being worked on; however, a progressive solution would demand a large amount of capital and is thus beyond the financial ability of the juicing plant.

Another negative impact of operating the juicing plant is the production of organic wastewater. In its first year of operation, it was discovered that the organic wastewater produced by the Hostětín juicing plant (BOD5 to 5,000 mg/l of wastewater) exceeded the capacity of the reed-bed wastewater treatment plant, and therefore some of the wastewater is collected in tanks and sprayed on nearby orchards and fields as fertilizer.

* When glass is recycled it is in no way degraded, in contrast to recycling plastic. Glass can be recycled infinitely.

Financing

In light of the fact that the TWC civic association started up the juicing plant, finances were obtained from multiple sources. The involvement of foreign specialists from the Hëllef fir d´-Natur foundation from Luxembourg (especially Raymond Aendekerk) helped obtain a most significant grant for building the juicing plant from the Ministry of the Environment of Luxembourg as well as a loan from the Alterfinanz bank in Luxembourg. TWC was able to obtain other grants, subsidies, and advantageous loans thanks to collaborative efforts with other non-profit organisations. Funds for activities for preparing and implementing the project were obtained mainly from grants awarded by Czech and foreign foundations. Sponsorships, donations, and help from volunteers in renovating and operating the juicing plant in 1999-2001 also played an important role.

All significant grants, donations, loans, and sponsorships are summarized in Table 8. For a more detailed view of how the juicing plant is financed see Table I.

Table 6 |||| A summary of the most significant forms of support for the juicing plant project in Hostětín (in CZK)

Recipient	Loans, sponsorships	Grants, donations	Investments
ZO ČSOP Veronica	0	4 074	0
The village of Hostětín	0	200	0
The Traditions of the White Carpathians Civic Association	1 980	60	0
Tradice Bílých Karpat s. r. o (since 2011 Moštárna s.r.o.)	2 750	1 302	2 200
Total	**4 730**	**5 636**	**2 200**

Table 7 The most significant sources of support for the juicing plant in Hostětín

Type of financing	Subjekt	Beneficiary	Purpose	Time period	Amount (thousands of CZK)	Value in 2007 (thousands of CZK)
grant	The Ministry of the Environment of Luxembourg	ZO ČSOP Veronica (through the Fondation Hëller fir d´Natur foundation)	Construction and technological design plan, construction of the juicing plant, warehouse, machines (investments) + activity of the association, experts	1999	3 600	4 120
grant	Civil Society Development Foundation	ZO ČSOP Veronica	Training and project organisation	1999	250	310
donation	Českomoravský cement a. s.	ZO ČSOP Veronica	Construction materials (25 t of cement)	1999	60	70
grant	Ministry of Regional Development of the Czech Republic, Rural Development Programme	The village of Hostětín	Co-financing the start-up of test operations (purchase of juice-storage tanks and handling equipment)	2000	200	240
loan	Alterfinanz bank	Traditions of the White Carpathians Civic Association (from the Luxembourgish Banque et caisse d'épargne de l'État via Hëller fir d´natur foundation and the Veronica Foundation)	Commencing operation of the juicing plant	2000	1 230	1 450
loan	ZO ČSOP Veronica	The Traditions of the White Carpathians Civic Association	Commencing operation of the juicing plant	2000	600	710
loan	PRO-BIO Association of Organic Farmers	Civic Association The Traditions of the White Carpathians	bridge loan for commencing construction loan for purchasing organic apples	2000–2001	150	170
grant	Ministry of the Environment of the Czech Republic	ZO ČSOP Veronica	Education and project implementation	2001	164	175
grant	Environmental Partnership	The Traditions of the White Carpathians Civic Association	Support for organic fruit growing in the White Carpathians + promotional material and printing labels	2001	40	45
donation	Slovácké strojírny	The Traditions of the White Carpathians Civic Association	Two 10 m^3 tanks (estimated value of donation)	2001	20	20
loan	The Traditions of the White Carpathians Civic Association	Tradice Bílých Karpat, s. r. o.	Investment of operating capital	2003	550	610
grant	Ministry of Agriculture of the Czech Republic	Tradice Bílých Karpat, s. r. o.	Organic agriculture consultation	2006	12	12
grant	Ministry of Agriculture of the Czech Republic	Tradice Bílých Karpat, s. r. o.	Modernization of production equipment (press, tanks)	2007	1 290	1 390
loan	Veronica Foundation	Tradice Bílých Karpat, s. r. o.	Financing the purchase of the press	2007	2 200	2 200
investment	Veronica Foundation	Tradice Bílých Karpat, s. r. o.	Financing investment in new technology for Tradice bilých karpat s.r.o.	2007	700	700
investments	Veronica Foundation	Tradice Bílých Karpat s. r. o.	Construction of the pressing shop (appreciation of real estate - increasing the endowment of the Foundation)	2007	700	700

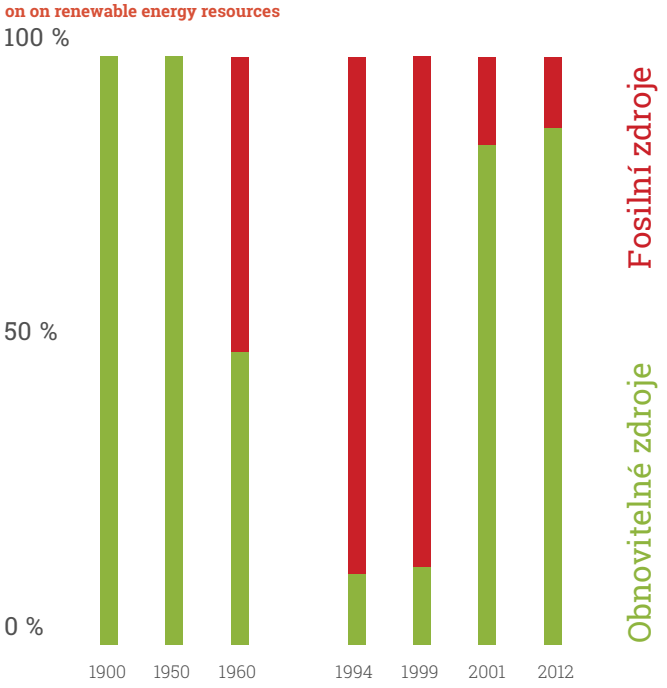
Renewable energy resources

Whereas until the mid-twentieth century wood was the main source of heating energy in Hostětín and other rural villages in the White Carpathians, starting in the 1950s wood-generated heat was gradually replaced by heat from fossil fuels. Households were most commonly heated with coal and later with electricity. This unfavourable trend peaked in the mid-1990s. After more than fifteen years of striving for energy self-sufficiency Hostětín has gained a wealth of experience in utilising renewable energy.

Municipalities generally have enough resources at their disposal to cover their own needs. Through the use of modern technology, materials, and knowledge this is very possible. Besides providing moral and environmental benefits such as reducing air pollution and CO_2 emissions, energy self-sufficiency results in direct economic gain. Money spent on heat and electricity remains within the region, while electricity produced within the region can be sold outside of the region. The reliability and security of heat and energy supplies in the future is thus ensured. Self-sufficiency also offers solutions to social issues as it creates local jobs and supports farmers who grow energy crops.

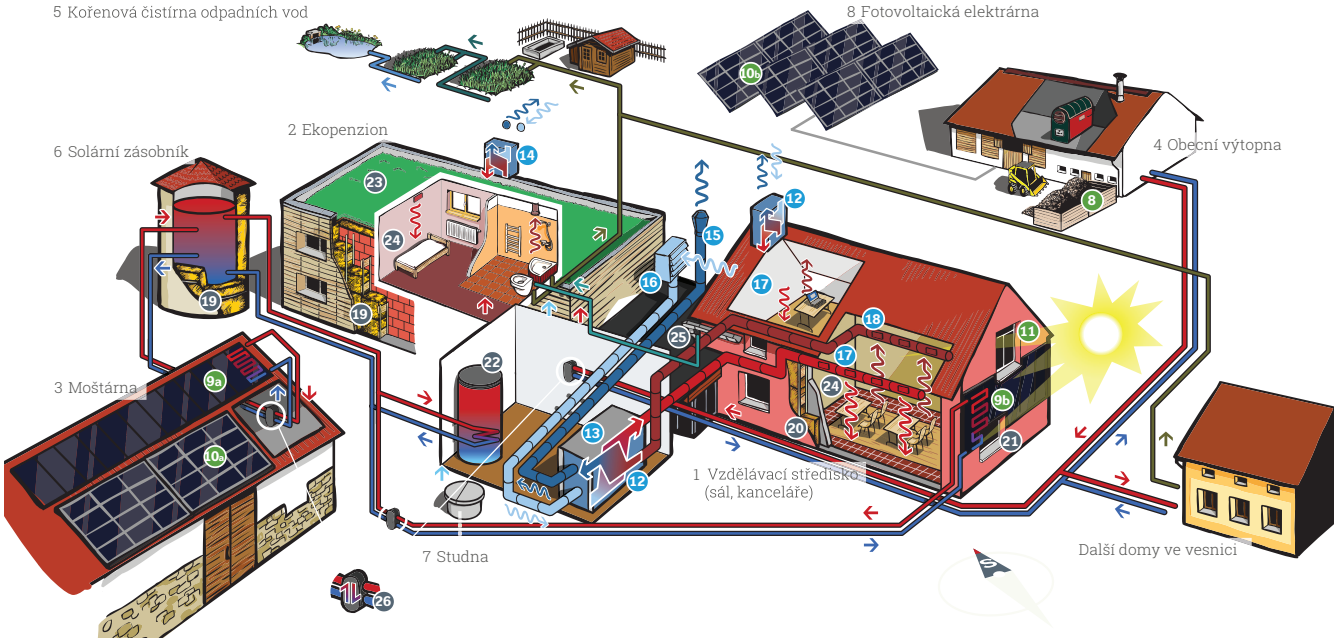
The systematic implementation of environmental projects is guiding Hostětín towards becoming a one-hundred percent fossil fuel free village. The greatest achievements have been made so far in heating and water heating. Until the mid-twentieth century the main source of heating energy was wood. Since the 1950s wood was gradually replaced by fossil fuels. Households were most commonly heated with coal and later with electricity. This unfavourable trend peaked in the mid-1990s. Starting in 1997 a new renewable energy source, solar energy for heating water, started to be used in several households. Since 2000 when the municipal heating plant was built, renewables have grown to cover most heat consumption and since 2008 solar power has been used to generate electricity. Residents of Hostětín thus prevent 1,200 t of CO_2 being emitted into the atmosphere annually.

Graph 6 Ratio of renewable to non-renewable energy sources from publication on renewable energy resources



Outline of renewable energy in Hostětín

Schéma zdůrazňuje především napojení domů na teplo z obecní výtopny na biomasu a využívání energie slunce pro ohřev vody a výrobu elektřiny. Všechny technologie jsou detailně popsány v následujících kapitolách.



Zdroje energie:

8 Biomasa, dřevní štěpka | 9a Solární kolektor | 9b Fasádní solární kolektor | 10a,b Fotovoltaická elektrárna | 11 Pasivní solární zisky

Větrání:

12 Větrání s rekuperací: 2 jednotky ve sklepě, 1 v patře, 6 v ubytovně | 13 Dohřev vzduchu | 14 Větrání s rekuperací | 15 Odpadní vzduch / 16 Nasávání čerstvého vzduchu | 17 Větrání – přívod vzduchu do sálu | 18 Větrání – odvod odpadního vzduchu

Ostatní:

19 Slaměná izolace| 20 Izolace z minerální vaty | 21 Okna s trojskly | 22 Bojler | 23Zelená střecha | 24 Hliněné omítky | 25 Svod dešťové vody pro splachování WC a úklid | 26 Tepelný výměník

Autor: Michal Stránský

Municipal biomass heating plant

MAIN BENEFITS

- **Climate protection**
- Improving air quality in the village
- **Price and accessibility of energy not dependent on world prices**
- Regional energy security
- **Money spent on heat remains in the village**

Zdroj: archiv ZO ČSOP Veronica

The municipal biomass heating plant has been providing heat to almost the entire village since 2000. The air in the village is much cleaner than it was in the past. People no longer have to go the cellar to get coal, and they collectively prevent 1,100 t of CO_2 from being emitted and thus contribute to climate protection. The heat generated by local biomass also increases the village's independence on external sources of energy.

The Hostětín heating plant positively influences the flow of money in the region. Thanks to the fact the heat is generated locally and that it is generated using local fuel, a large amount of the money spent on heating stays in the region, which would otherwise be spent elsewhere. Another important fact is that the village, being the operator of the heating plant, has kept the price of heat affordable and has created jobs for local inhabitants. More than 85% of all households are involved in the project; users are mainly satisfied with the heating.

In light of the fact that in the future more buildings will be insulated and thus less heat will be needed, the village must focus on connecting buildings adjacent to the existing heat distribution system and must look for new opportunities for using the heating plant all year long.

The original objective

Since Hostětín is located off the path of a planned gas pipeline, it was clear that the village would have to ensure a source of heating differently than most neighbouring villages. Several studies were conducted and several seminars were held before the District Office in Uherské Hradište proposed the construction of a municipal heating plant utilizing waste wood as fuel. Using this non-fossil fuel meant the replacement of 585 MWh of electricity, 250 t of brown coal, and 20 t of black coal annually. Savings on fuel costs in comparison to heating each building separately reached 14%.

The first step in implementing the project was a survey gauging the interest of Hostětín's inhabitants in connecting their households to the biomass heating plant; roughly 50% were in favour of the idea. Awareness of, and interest in, the project grew gradually. In March 1998

Veronica held a seminar for the inhabitants of Hostětín, in the course of which they went on a field trip to Kautzen, Lower Austria, where a municipal biomass heating plant was already in operation. At this time the village was able to obtain funding for the planned project with the assistance of the Environmental Partnership and the Ecological Institute Veronica. While the heating plant was actually being constructed, the above-mentioned organisations were involved in project management as were the District Office in Uherské Hradište and the Dutch BTG business group.

Technology

The heating plant began operation in the autumn of 2000. The village of Hostětín is its owner and operator. The 732 kW hot water heater is fuelled by combusting waste wood (mainly wood chips and saw dust from waste wood from nearby sawmills and forests), which is stored in a 900 m^3 warehouse. The heating plant supplies heat throughout a 2.8 km long hot water network to which 70 users are connected of the total 86 buildings in Hostětín (meaning that 83% of buildings in the village receive heat from the plant). The rate of capacity to length of the distribution network is relatively low at only 0.261 MW per 1 km of hot water distribution.

After ten years in operation the municipal heating plant was significantly modernized in 2010-11; the boiler room technology was completely renovated including both machinery and the control system. These technological modifications were made in order to save operating costs and to implement a new management system for the entire system facilitating the ability to set combustion parameters exactly. The renovation also resulted in lower electricity consumption and helped limit heat loss. The utilization of renewable energy for operating the municipal heating plant, which is supplied by photovoltaic panels, has been saving on operating costs since coming into operation in 2010. The electricity consumption of the heating plant after renovation in 2010-11 fell by half and currently annual electricity consumption is less than 20 MWh (72 GJ). Therefore about 1.6% of the total energy produce needs to be input in the form of electricity (16 kWhel/MWht).

Recent experience

Decentralized heat and energy generation has many advantages. The village has become less dependent on the national distribution network as well as on foreign sources of non-renewable energy. Now it can fully decide about projects and control money flows and the influence of projects on the surrounding area. The fact that the village itself generates heat from biomass is a good guarantee of energy security, a frequently debated topic these days.

Development of the regional biomass market

When the Hostětín heating plant was being built the situation of the biomass market was different than it is today: the demand for waste wood was lower, as was its price. The price of biomass has increased over the last decade with growing demand and inflation; it is also indirectly related to the growth in price of other fuels, primarily oil and coal. The purchase price for fuel for Hostětín rose by almost 80% in seven years. Support for co-firing biomass with other fuels in large power and heating plants in the Czech Republic played a role in the growing price of biomass.

Wood chip suppliers have gradually changed. Long-term agreements for supplying fuel could not be closed due to the fact that demand has exceeded supply. Until 2003 Hostětín obtained its fuel within 25 km from the village; in 2004 this distance doubled, as the village's main supplier closed down. Since then supplies have once again stabilized: in 2012 a vast majority of fuel came from within 15 km, which significantly decreased transportation fuel costs

Satisfaction and inspiration

According to research conducted by Petr Holub1 in 2007 the inhabitants of Hostětín are generally satisfied with the heating plant; they see the heating provided by it as being efficient,

easy-to-use, and environmental. Residents who have connected to the heating plant have gained a central heating system that on their part does not require any servicing, fuel preparation, cleaning out ashes, etc. Inhabitants have also praised the greatly improved air quality in the village, since the usage of coal heating has stopped.

It was assumed that the heating plant would serve as a model project that would inspire the construction of other biomass heating plants in the region. The opportunity to see how such a heating plant works could have influenced the implementation of other projects; this influence however is very difficult to determine. Today, nearby Hostětín there are biomass heating plants in Štítná na Vláří, Slavičín, and Brumov-Bylnice.

* Petr Holub conducted his research as part of his Master's thesis Obnovitelné zdroje energie, decentralizace společnosti a komunitní život [Rewenable Energy Resources, Society Decentralisation, and Community Life], which he defended at Masaryk University.

Climate and air protection

The Hostětín heating plant was intended to reduce Czech and Dutch1 CO_2 emissions. In contrast to combusting natural gas or other fossil fuels, utilizing biomass for generating energy practically eliminates greenhouse gas emissions (see Table 13). The heating plant supplies approximately 3,500 GJ of heat during the heating season and prevents the emission of approximately 1,100 tons of CO_2 annually.

In addition to completely replacing the use of fossil fuels in the operation of the heating plant, residents of Hostětín are also considering other ways to sustainably exploit energy resources. Over the past 12 years 20 homeowners have invested in insulating their homes (primarily by replacing windows and insulating building exteriors).

In comparison with solid fossil fuels, wood chips are a high-quality, clean source of energy. Once the heating plant went into operation, the total emissions of pollutants decreased to 6% of their original amounts when each house in Hostětín had its own heating system (see Table X).

In Petr Holub's research, many inhabitants confirmed a subjective improvement of air quality in the village..

* As part of the Joint Implementation programme, see the chapter on financing

Table 8 A comparison of the emission of pollutants in Hostětín before the heating plant was constructed (1999) and during operation (2012)

	1999	2012
SO_2	5,10 t	0,04 t
C_xH_y	2,76 t	0,00 t
CO	11,89 t	0,66 t
Particulate matter	4,82 t	0,09 t
NO_x	1,19 t	0,43 t
CO_2	1451,85 t	1451,85 t

Economics

The average price of heat supplied from biomass heating plants in 2011 was 525 Kč/GJ including VAT. The price of heat in Hostětín (340 Kč/GJ in 2011, and 397 Kč/GJ in 2012) is two-thirds the national average. Operating the municipal heating plant in Hostětín is thus a beneficial public service, where the price of heat provides equilibrium between economic and social goals in terms of long-term sustainability.1

The village of Hostětín is in charge of operating the municipal heating plant, which includes purchasing and transporting fuel, planning operations, coordinating workers, and accounting. Local inhabitants are employed in the boiler room (for fuelling, basic maintenance, and simple repairs). Salary costs make up approximately 6% of total costs, and these proportional salary costs are positively reflected in an acceptable price of heat for the consumer. Boiler room operators are on call 24 hours a day; regular daily inspections take about half an hour.

In 2005 a system by which two elements make up the final price was introduced in Hostětín. Fixed operational costs make up a set price that all users in the same consumption category must pay. The second part of the price reflects actual heat consumption. For example in 2012

the set price for permanent residences was 7,632 Kč and 3,220 Kč for other buildings, and the variable part of the price was calculated based on a price of almost 250 Kč per GJ. This mechanism has to a certain extent stabilized consumption as households no longer need to provide additional heating to their houses from other sources. In spite of this, it is assumed that many households combine heat from the heating plant with heat from their own wood from the surrounding forest. It is estimated that up to 20% of households do this, especially at the start and end of the heating season. Outside of the heating season Hostětín locals use other sources for heating water for household consumption, mainly electricity and solar energy.to se odhaduje, že mnoho domácností kombinuje teplo z výtopny s teplem z vlastního dřeva z okolních lesů. Tuto možnost využívají odhadem až z 20 %, zejména v období na začátku a konci topné sezony. Mimo topnou sezonu používají Hostětínští jiné zdroje tepla k ohřevu vody pro domácnost – především elektřinu a solární energii.

* The Energy Regulatory Office, Evaluation of heating energy prices to January 1, 2012

Table 9 Income statement of he municipal heating plant in 2010-2012

Costs		2012		2011	
Material consumption (wood chips)		729	61 %	753	73 %
Electricity		69	6 %	121	12 %
Repairs		16	1 %		0 %
Other services		39	3 %	3	5 %
Wages		74	6 %	49	8 %
Taxes and fees		2	0 %	86	0 %
Depreciation		260	22 %	1	0 %
Insurance		11	1 %	16	2 %
Costs – total		**1 200**	**100 %**	**1 030**	**100 %**
Heat sales		1 178		1 032	
Other revenue		21		63	
Interest		1			
Income – total		**1 200**		**1 095**	
Net income	**Kč**	**0**		**65**	
Amount of heat sold	GJ	3 381		3 342	
Average price of heat (including VAT)	Kč/GJ	397		340	

Financing

The fundraising process was very complicated and several partners helped us with it. The Ministry of the Environment assisted in arranging contacts between the village and the Dutch TEI - Twente Energy Institute and one of its member groups, BTG - Biomass Technology Group. BTG wrote a grant proposal for the Dutch governmental agency Senter and in December 1998 the project was approved by the Dutch government.1 The total value of the grant was approximately 11.4 million crowns and covered all of the equipment for combusting wood chips and for financing a promotional campaign about the project. Czech sources also contributed to the project: the heat distribution system was supported by an approximately 3.2 million Kč subsidy from

the Czech Energy Association (CEA). Residents paid 30,000 Kč per connected house; in total 67 houses were connected contributing nearly two million Kč towards the total costs. A large share of necessary funds (about 19.8 million Kč) were acquired from the State Environmental Fund (SEF).

The total cost of the project was around 36 million Kč.2 The village was able to build the heating plant without burdening its budget with a loan.

Covering a high percentage of costs with grants is not unusual for projects like this. In 2007 grants generally covered 30-85% of total investment costs for building biomass heating plants, and it was possible to obtain advantageous loans to cover up to 40% of costs. Implementing most similar projects without grant funding would most likely not have been possible. It should be noted that other municipal heating projects, such as the introduction of natural gas heating, cannot get by without subsidies.možná.

* The heating plant was built thanks to a Dutch-Czech partnership through the Joint Implementation (JI) mechanism established by the Kyoto Protocol in 1997. The aim of this mechanism is to reduce global emissions of CO2, as they contribute significantly to global warming, through collaboration between countries where reducing emissions is costlier and the countries of Central and Eastern Europe undergoing economic transformation. JI assumes foreign investment in transforming countries in exchange for emission credits as a form of investment yield. The heat generating plant in Hostětín however was included in the pilot phase of JI, a category which is also referred to as "activities implemented jointly" (AIJ). These activities are voluntary in nature and involve no emission trading in the form of credits. The vision for the heating plant is thus included in the framework of an international agreement to which tens of countries have signed with the goal of achieving global sustainable development.

** The cost of the project was higher due to the Dutch grant, which included the boiler, its installation and annual maintenance, and funds for an awareness campaign.

Table 10 Financing the heating plant

Financial resources	Investment	Amount in million Kč	Share in %
The Dutch government (through the SENTER agency)	Boiler room technology	11,4	31 %
SEP	Additional financing for investments (heat exchangers, the boiler room building, etc.)	19,8	54 %
CEA	Heat distribution network	3,2	9 %
Connected residents	Connections	2,0	5 %
Total		**36,4**	**100 %**

Solar energy

UTILIZING SOLAR POWER

- **Solar thermal collectors heat up drinking and heating water.**
- Photovoltaic panels convert solar radiation into electricity.
- **Solar architecture uses solar radiation to heat the interior of buildings, for example by using large windows.**

Zdroj: archiv ZO ČSOP Veronica

In the Czech Republic one hundred times more solar energy falls on the Earth's surface than the total consumption of primary sources of energy consumption in the country.

Solar thermal systems

Nine households in Hostětín use solar systems for preheating water; when the weather is favourable, they can be used for full water heating. Homeowners installed them themselves between 1997 and 2001. Systems from that time period contain a 6 m^2 aluminium absorber plate and a 700 l tank for storing hot water, 150 l of which is taken up by a pressure tank containing heated drinking water. One interesting aspect of these systems is that they employ a modular system.1 Their future users were always involved in installing them. In the past, most households in Hostětín heated water in electric boilers. Solar hot water heating with a self-installed system saves 2 MWh of electricity annually. Besides these self-installed plate systems, evacuated tube collectors can be seen in the village, for example on the roof of the local shop.

* People got individual parts of the system, which they assembled and installed themselves.

Large-scale solar collector on the juicing plant and heat storage

A 36 m^2 collector was installed in 2001 in collaboration with AEE, an Austrian organisation supporting the utilization of renewable energy, and with financial assistance from EBL, an organisation from Luxembourg. The collector is in a wooden frame and replaces the original roof tiles. Located behind the juicing plant is a tank containing 9 m^3 of heating water and insulated with 1 m thick straw-bale insulation. Both the juicing plant and the next-door Veronica Centre are supplied heat from the tank. The collector on the juicing plant saves roughly 8.5 MWh in heating and electricity annually.

Solar facade collector on the Veronica Centre building

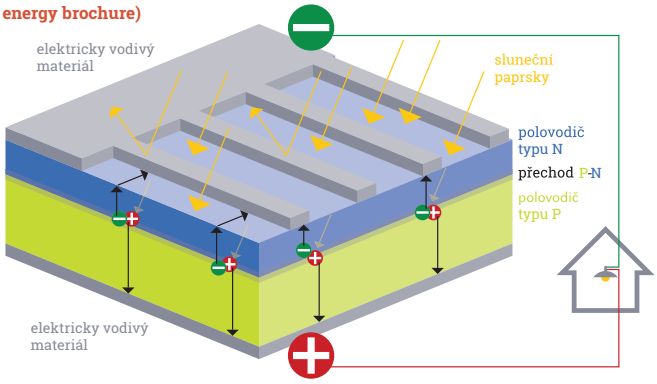
Since 2008 there has been a facade collector on the facade of the seminar centre equipped with

a 22 m² selective absorber. If the water in the tank is hot enough, it can be used to heat the seminar centre and inn. In colder periods of the year it is used for preheating the bottom of the drinking water boiler. The collector increases annual savings of external heat supply for the building complex on the Veronica Foundation's land by about 6 MWh.

Photovoltaic panels for generating electricity

Photovoltaic panels use the photoelectric effect to directly transform solar radiation into electricity. Between 900 kWh and 1200 kWh of solar radiation per square metre falls on the Czech Republic annually. In the Czech Republic a system with a capacity of 1 kW is capable of providing 800 to 1000 kWh of electricity annually. (The average annual household consumption per capita is 1200 kWh). The size of a 1 kW photovoltaic panel system depends on the efficiency of the solar cells used (10 - 40%) and ranges from 6 m² to 9 m². Currently, there are three photovoltaic electricity systems in Hostětín, installed between 2008 and 2011.

Scheme: The principle of how a photovoltaic panel works (from the renewable energy brochure)



Photovoltaic system on the roof of the juicing plant

In 2008 a photovoltaic system was installed on the roof of the juicing plant consisting of 40 220 W polycrystalline panels covering 64 m². The total capacity of the system is 8.8 kW and is connected to the grid by two inverters. The angle of the panels corresponds with the angle and orientation of the roof (38° angle; S30°E). The predicted annual capacity of this system was be more than 8,000 kWh, corresponding to savings of 9 tons of CO_2 emissions.

The amount of electricity generated in total annually is comparable with the amount of energy consumed by the juicing plant. The immediate amount of consumed and generated electricity differs; during the juicing season (September-November) the juicing plant consumes more electric energy than the solar system on its roof generates, and therefore it must draw electricity from the power grid. In contrast, during the summer the amount of electricity generated exceeds the needs of the juicing plant, and the excess electricity is provided to the grid. In 2012 22.4% of the total electricity generated by the photovoltaic system was consumed directly by juicing plant operations. Electricity generated by the photovoltaic system also covered 29.6% of the juicing plant's consumption. Average annual electricity generation in 2009-2012 slightly topped 9,000 kWh and exceeded expectations by nearly 10%.

Photovoltaic system behind the municipal heating plant

In 2010 a photovoltaic system consisting of 230 polycrystalline panels covering 360 m² each with a maximum output of 220 W was brought into operation on municipal property behind the heating plant. The total capacity of the system is 50.6 kW and it is equipped with six inverters. To utilize local conditions, the panels are at a 25° angle and are orient-

ed S10°W. The entire system should generate 49 MWh of electricity annually, which is the equivalent of reducing CO_2 by 57 tons annually. The annual yield of the system is predicted to be 962 kWh per 1 kilowatt of installed panels.

During the heating season some of the electricity generated is used directly in the municipal biomass heating plant. Excess electricity and the entire amount of electricity produced outside of the heating season, which makes up for about 85% of produced electricity, is supplied to the power grid. In 2012 the system generated and sold a total of 56 MWh, which is more than two times as much as the municipal heating plant consumes.

Recent experience

The main benefit that using solar energy provides is its minimal environmental impact. The system of collectors requires a small amount of electricity to drive circulator pumps and the control system; the amount of gained heat is about one hundred times as much as the energy consumed.

Self-installed solar systems influenced changing patterns in energy source utilization. At the time, it was one of the first programmes aimed at supporting the use of solar energy in the Czech Republic. The installed collectors have been beneficial for education. Local inhabitants and visitors have gained confidence in this new technology, which has proven itself in daily usage.

Photovoltaic systems are a clean way of producing electricity. Per each kilowatt of installed power, emissions of carbon dioxide are reduced by one ton, helping mitigate climate change. The energy required to manufacture silicone panels has fallen to the level where the energy invested in making photovoltaic panels and other components of the solar systems is gained back within two to four years of operation. For at least another twenty years the system yields net energy profits. Silicone can be gained from recycled photovoltaic panels; other parts of photovoltaic systems are easily recycled once their service life has ended, including panel supports.

Operating such systems has no negative environmental impact. One of the few potential disadvantages of the photovoltaic power stations is that they can take up agricultural land. The service life of solar power systems is 20 to 25 years and therefore according to legal regulations the agricultural land solar power stations are built on is "lost" only temporarily. Once the service life of the panels has come to an end, the station can be removed and the land can be used for agricultural purposes once again. This problem however is not a concern in Hostětín; two of the three installations are on rooftops, whereas the power station by the heating plant is on non-agricultural land.

Both of the above-described technologies have been installed on the roof of the juicing plant: solar collectors and photovoltaic panels. Their yield differs from season to season. In the summer, when direct solar radiation is at its height, the specific active solar gain of photovoltaic panels (0.51 kWh/m^2 per day) is roughly half of that of solar collectors (1.11 kWh/m^2 per day). In contrast during the winter, when it is often cloudier and the hot water collector does not generate enough heat to fully heat water, the average daily active solar gain of photovoltaic panels (0.05 kWh/m^2 per day) is the equivalent of 87% the value for hot water collectors (0.07 kWh/m^2 per day). Solar thermal collectors clearly beat photovoltaic systems when it comes to year-round totals, as collectors provide 254 kWh/m^2, whereas photovoltaic systems provide only 132 kWh/m^2.

Table 11, 12 |||| Renewable energy use in the juicing plant

Year	Consumption in MWh					Production in MWh	Comparison	
	Electricity			Heat		Electricity		
	Supply from the electrical grid	Internal consumption	Total consumption	Heating oil	Heat from the municipal heating plant	Photovoltaic electricity	Share of internal consumption of electricity	Share of electricity produced and consumed
	A	B	C=A+B	D	E	F	B/C	F/C
2008	11,52	0,00	11,52	72,40	20,42	0,00	0 %	0 %
2009	7,93	0,92	8,85	53,97	24,78	8,76	10 %	99 %
2010	9,67	2,37	12,03	85,06	26,66	8,09	20 %	67 %
2011	6,50	2,01	8,51	38,92	22,03	9,65	24 %	114 %
2012	7,45	2,13	9,59	19,38	22,46	9,52	22 %	99 %
Total	**43,06**	**7,43**	**50,49**	**269,72**	**116,34**	**36,03**	**15 %**	**71 %**

	CO_2 emissions*	Specific emissions
2008	32,30	0,10
2009	14,13	0,13
2010	26,73	0,09
2011	8,77	0,06
2012	5,11	0,02
Total	**87,04**	**0,08**

* Data are given in tonnes of CO_2 equivalent

Financing

Household thermal systems

Solar thermal systems installed as part of the Sun for the White Carpathians programme were financially supported by the British Know How Fund and the Environmental Partnership. The modular systems used for the first collectors resulted in a payback period of six years thanks to their low cost and subsidies.

The Environmental Partnership provided support to systems covering up to 50 percent of investment costs. At the end of 1998 the programme received a nearly-one-hundred-Kč grant to support further development from the British Know How Fund for installations on public buildings and provided up to 100% of funds for these projects. Households in Hostětín saved on hot water heating as much as they would pay for 1.5 to 2 MWh of electricity annually. Exact financial savings depended on the tariff each household was on and ranged between 1,500 and 6,000 Kč annually. In 2008 as the price of electricity rose so too did the savings of these households. Savings reached 6,400 to 9,000 yearly. Households using solar collectors are also generally less dependent on

market prices and the reliability of the heat distribution network and supplies from far away sources.

Photovoltaic power systems

The photovoltaic power system project located by the municipal heat plant has an interesting ownership structure; it represents a joint investment of four different subjects. The village of Hostětín owns the land it sits on, and also owns a 7% share of the system. The Environmental Partnership, the Veronica Foundation, and the Czech Architecture Fund all have an equal share in the remaining investment, totalling 4.4 million Kč. The Veronica Foundation owns the photovoltaic system on the roof of the juicing plant, which they paid 1.1 million Kč for.

The payback period of photovoltaic electricity systems in the Czech Republic is dependent on state support established in the Act on Supporting Renewable Energy in the form of guaranteed feed-in tariffs. The legally guaranteed feed-in tariff guarantees producers a payback period of 15 years for their investment. The predicted payback period for the investment into the photovoltaic system on the roof of the juicing plant, including maintenance costs, was calculated to be 15 years in 2008 when it was brought into operation. Yields from the first two years of operation however exceeded estimates by 5% on average, which shortens the payback period. Currently, however this entire sector is very unstable due to frequent changes in state guaranteed support and in tax burdens.

Zdroj: archiv ZO ČSOP Veronica

Reed-bed wastewater treatment plant

THE MAIN BENEFITS

- **Significant energy savings**
- Minimal operating costs
- **Treatment capability comparable to classic WWTPs**
- Lifting the ban on further construction

Zdroj: archiv ZO ČSOP Veronica

The reed-bed wastewater treatment plant was built in 1996 and was the first of its kind in eastern Moravia. It is fundamentally an artificial wetland containing common wetland plants (such as common reed and reed canary grass). Wastewater is treated primarily by the bacteria that live on the roots of these plants, which break down organic waste, thus cleaning the water.

Thanks to this treatment plant the 30-year ban on construction was lifted. It was initiated in the 1970s when the Kolelač Reservoir was completed. This measure restricted building in the village. The village, without a wastewater treatment plant, was a significant source of pollution for the reservoir.

The original objective

The Kolelač Stream flows through Hostětín; in 1966 the Bojkovice Reservoir was built on the lower portion of this stream. According to water resource protection regulations a ban on construction was declared in Hostětín, the only village in the reservoir's watershed, which caused significant population decline in the 1980s. When in 1990 Hostětín became independent of neighbouring Pitín, the village council considered solving wastewater management problems and the subsequent lifting of the construction ban to be tasks of prime importance.

In 1992 an independent study was written, which compared possible solutions. The most suitable solution was the completion of a uniform sewage system and the construction of a reed-bed wastewater treatment plant flowing into the Kolelač Stream below the village. Gaining acceptance of this plant however was not simple. Administrative organs cast doubts on the plan, as people had no experience with reed-bed wastewater treatment plants. The district officer of public health refused to approve the project in its first phase due to the unreliability of its treatment effect. In the end however the project was successfully implemented; the reed-bed wastewater plant was put into test operation in July of 1996 and a year later it was brought into permanent operation.

Treatment technology

The reed-bed treatment plant is an artificial wetland planted with common wetland plants. Wastewater is biologically treated in two filter tanks connected to pipes, shafts, and a polishing pond. Mechanical treatment is another element of the process. This takes place in odlehčovacích šachtách, rainwater reservoirs, grit chambers, and shallow combination reservoirs. The self-purification process that occurs in reed-bed wastewater treatment plants is based on filtration through a sand bed and the ability of bacteria to decompose organic pollution. Vegetation contributes to the treatment process by creating favourable conditions for the growth of microorganisms and by simultaneously utilizing released plant nutrients to create biomass.

Table 13 Technical data (planned capacity)

Source: Projekt ČOV Hostětín, VH – atelier, s. r. o., Brno, 1995. Rozkošný 2008

Average daily discharge	0.59 l/s
Solid waste – BOD_5	15,12 kg/den (212 mg/l)
Number of PEs*	280
Size of the filter bed	1 240 m^2 (4,4 m^2 na 1 obyvatele)

* PE - Population equivalent: this terms describes the capacity of a WWTP. One PE is equivalent to the average pollution value created by one person per day, which is 60 g BSK5

Reed-bed wastewater treatment plants are generally recommended for pollution sources with less than 500 inhabitants with a corresponding reed bed size of around 2,500 m^2. For sources of pollution with above fifty inhabitants several beds are used. When used in combination with other technologies reed-bed plants with an area of 5,000 m^2 can be used for settlements of up to around 1,000 inhabitants. For larger sources of wastewater, such plants are not suitable as the area needed for the plant would be larger and high treatment efficiency would be more difficult to achieve. Most such plants fall under the category of small, household treatment plants (for up to ten people) and treatment plants for small villages (with 100-500 inhabitants). The Hostětín wastewater treatment plant falls into the second category with a capacity of 280 people.

Recent experience

One advantage of building the reed-bed treatment plant was that the village could use the existing sewage system and did not have to build a new one. Normal treatment plants require separate sewage systems for wastewater and runoff water, so that the wastewater is not diluted and the treatment plant does not have to expend energy on pumping and cleaning practically clean water. For reed-bed treatment plants separate sewage inflow is also technologically more advantageous, although diluting wastewater does not pose such a significant problem in reducing the plant's efficiency. Therefore, inflow from the unified sewage system that was already partially built in Hostětín works. Another advantage reed-bed treatment plants have over conventional wastewater management methods is that they can absorb large fluctuations in the amount of inflow, such as morning, evening, and weekend peak flows as well as seasonal changes. They cannot go out of operation. Operating a RBWWTP is also significantly more cost effective than a conventional plant. No electricity is needed. The costs for electricity are significant for normal WWTPs. Operating a RBWWTP does not demand much manpower. An employee must check the water level every other day, a process that takes about half an hour. Once a week this employee must check the cleanliness of the shafts.??? Once or twice a year, sludge must be removed from the plant, which is stored at the WWTP in Bojkovice. The treatment plant vegetation is mowed at the same frequency and the cuttings are left to decompose. Samples of treated wastewater are taken four times a year.

Measurements made from samples taken from the RBWWTP in

Hostětín in 1996-2009 indicate high levels of treatment. Long-term monitoring has discovered treatment to have the following effects: BOD5 88%, COD 79%, insoluble particles 63%, ammoniacal nitrogen 61%, total phosphorous 39%. The studied data demonstrate that there is no significant difference in the effectiveness of removing organic pollutants during the growing season and outside of it. Treatment quality declined in 2000 when the juicing plant began operations. The wastewater resulting from cleaning apples is a source of high organic pollution, and it is therefore now collected and used for irrigating agricultural land.

Building the treatment plant was the first stop on Hostětín's "environmental journey". Through just one act, this small village became famous throughout the entire region, which enabled it to implement other innovative projects. The treatment plant has inspired local officials from other villages, as well as visitors to the plant. The plant has also helped specialists gain information about how this type of treatment works in the long-term in the Czech Republic. At the same time, the construction ban in Hostětín was lifted, which for 30 years prevented the construction of new buildings as well as the renovation of existing ones. Once problems with wastewater were solved, several new buildings were erected. Establishing the treatment plant thus significantly revived the village, which had been undergoing population decline. New jobs were created that enable locals to participate in the operation of the treatment plant. Since 2008 the municipal office has employed two men who had been unemployed for a long time to conduct village maintenance including caring for the treatment plant.

Natural wastewater treatment is an effective method that enriches the landscape, creates suitable habitats for flora and fauna, and does not disrupt nutrient cycles. Water evaporating from plants in the filter bed positively affects the microclimate and enhances the local water cycle. The reed-bed treatment plant provides benefits in the form of ecological stability and enhancing the aesthetic quality of the landscape. A new biotope was created in Hostětín which is very close in nature to natural wetlands. Several species of reptiles and bird, mammal, and insect species that are dependent on wetland and water biotopes have been found here. Two wooden sculptures installed nearby during a sculpting symposium that was organized by the village in 2002 make the site more attractive. The Hostětín wastewater treatment plant has become a favourite place for a walk.

Table 14 A comparison of wastewater treatment in Hostětín and neighbouring Šanov

Source: Hostětín municipal office, Šanov municipal office, the Veronica Centre in Hostětín website, Machů 2007

Type of WWTP	Hostětín reed bed (prices in brackets are adjusted for inflation – and calculated for 2002 15)	Šanov mechanical biological Flexidiblok 100 m^3/day
Brought into operation	July 1996	July 2002
Total construction costs for treatment plant*	1,9 m (2,8 m) Kč	5 m Kč
Celkové náklady na stavbu čistírny i kanalizace	4,9 (7,1) m Kč	16,2 mil. Kč
Total area occupied by WWTP	2 740 m^2	375 m^2
Number of new jobs created	0,1	0,8
Planned number of EP units	280	700
Village population (as of 31 December 2006)	238	503
Population actually connected to treatment plant	236	450

Capital expenditures for WWTP (Kč per one person in the village)	8 100 (11 700) Kč	11 100 Kč
Capital expenditure for utilization at full capacity (Kč per one PE)	6 800 (9 800) Kč	7 100 Kč
Electricity costs 2006 2010 2012	 1 700 Kč 1 910 Kč 1 800 Kč	 120 000 Kč ** 131 000 Kč
Specific electricity consumption for the planned number of PEs	0,04 kWh/EO	43,40 kWh/EO
Amount of sludge removed (annually)	25 tun	90 tun
Average costs for removing and storing sludge (2006-2012)	cca 8 000 Kč	cca 30 000 Kč
Total annual maintenance and operating costs 2006 2010 2012	 43 000 Kč 24 520 Kč 28 115 Kč	 200 000 Kč ** 173 745 Kč
Specific annual operating costs	1,95 Kč/m^3	5,60 Kč/m^3

* The price is calculated based on 2002 prices so that capital invested in building the RBWWTP in Hostětín in 1996 is comparable with the capital investment in building the mechanical biological treatment plant in Šanov in 2002.

** Not available

Financing construction

The costs of building the RBWWTP are comparable with costs for building a "classic" treatment plant at approximately 5–10 thousand Kč per person connected to the system depending upon local conditions. The largest part of the costs go for excavation work (about 30% of total costs) and for filter material and transportation (about 40%).

The total capital expenditures were 4,905,000 Kč (for the sewage system and the WWTP) and besides the village of Hostětín, the following institutions contributed money: The District Office in Uherské Hradište (4,500,000 Kč), the Ministry of the Environment of the Czech Republic, and the River System Revitalization programme (320,000 Kč for building a pond). Total annual operating costs of the RBWWTP make up about 2.6% of Hostětín's budget. Only in 2011 after 15 years of operation did the village as the treatment plant operator, begin charging for sewage.

Income statement of the reed-bed treatment plant (2012)

Costs . . . . . 57 000 Kč
Depreciation . . . . . 36 000 Kč
Income: . . . . . 78 000 Kč
Net income . . . . . + 21 000 Kč

Zdroj: archiv ZO ČSOP Veronica

Zdroj: archiv ZO ČSOP Veronica

Fruit growing in the White Carpathians

BENEFITS

- **Heirloom and regional varieties of fruit trees**
- Orchards based on preserving genetic diversity
- **Chemical-free fruit growing**
- Landscape diversity

Zdroj: archiv ZO ČSOP Veronica

Old orchards and solitary fruit trees are an irreplaceable part of the landscape of the White Carpathians. Thanks to a study of the genetic diversity of local fruit trees and support for the local processing and use of these fruits, traditional extensive fruit growing has undergone a comeback over the past few decades.

The original objective

The White Carpathians are one of the few places in the Czech Republic where heirloom and local varieties of fruit trees receive complex care. In the early-1990s nature conservationists began to work together with fruit growers to map these varieties in order to gain an overview of local genetic diversity. This overview is important for further breeding and for preserving landscape character. It is also important for contributing to the diversity of regional products. If these varieties were to disappear, we would lose valuable characteristics that might be lacking in newly bred varieties, such as having little environmental demands or resistance to diseases and pests. Heirloom and less productive varieties that are part of our cultural heritage may also bring long-term benefits. They will be most safely secured when people grow them in their gardens and orchards.

The wealth of fruit species in the White Carpathians – heirloom and regional varieties

Apple trees | Jadernička, Kožuch, Panenské, Strýmka / local cultivars and seed trees with folk names: Barynáč, Kostečky, Kdoulové, Zárostopky, etc.

Pear trees | Koty, Repovica, Majdalenky, Oharkule, Krehule, Dule, Škaredky etc.

Plum trees | Durancie (resistant to plum pox) / nearly extinct varieties: Vaňkova švestka, Valtrova, Štolcova, Oulinská, etc. / folk names: Bílé slivky, Švestičky, Sračky, Malé sračky, Okrúhlice, Zelené, Žluté, Pavlůvky

Cherry trees | Dönisenova žlutá, Královská chrupka

Sour cherry trees | various sweet varieties of sour cherry, Královna Hortenzie

Less common fruit species | dogwood berries, mulberries, service tree fruit

Orchards based on preserving genetic diversity

Collectivized agriculture during Communism, the gradual expansion of intensive fruit growing practices, and above all the breeding and introduction of new demanding varieties are the main factors leading to the abandonment and disappearance of extensive fruit growing utilizing trees with tall trunks. Due to the fact that many of the above-listed varieties, grown for generations in tall-trunk orchards and garden,s are endangered (either due to old age or due to a lack of maintenance and care), and some are even in danger of being cut down, they have been grown in "genetic diversity orchards" since the mapping project began. The first such orchard was established in 1991 in Velká nad Veličkou and is part of the Zahrady pod Hájem National Nature Reserve. There are 500 fruit trees of various types growing in a three-hectare orchard, and every year newly discovered varieties are grafted to some trees. A similar orchard containing almost fifty varieties was established by ČSOP Kosenka in 1999 in Poteč, not far from Valašské Klobouky. Two more genetic diversity orchards were later established in Rokytnice and Lopeník in order to evenly cover the area and natural conditions of the region.

These extensively managed demonstration orchards are used for practical education purposes, as is the orchard and garden on the property of the Veronica Centre Hostětín. On an approximately 0.6 hectare area over 50 young trees were planted alongside the original 20 old trees already there. The long-term goal is to create a demonstration orchard, which through an educational trail and fun activities, will get the public involved in preserving heirloom varieties of fruit and in restoring extensively managed organic orchards in the landscape. There are several elements in the orchard supporting biodiversity: snake houses, lizard houses, birdhouses, bumblebee houses, hedgehog houses, insect houses, earwig houses, bat houses, etc. Bees have begun to be kept in the back of the orchard.

Chemical-free fruit growing

For growing heirloom varieties of fruit, the methods that our ancestors used are applied. Experience has confirmed that growing fruit using ecological methods, i.e. chemical-free, can lead to good harvests of marketable fruit. One great advantage for organic fruit growing, if not an actual precondition, is a healthy, ecologically stable landscape. This primarily means there must be landscape and natural diversity, where for every pest there are several predators able to regulate it if it becomes overabundant. If we temporarily completely limit a pest (for example by chemical spraying), we subsequently reduce the occurrence of predators, which could then have problems regulating pest overabundance in the future. It is maintaining diverse interactions in orchards (just like in any other ecosystem) that helps orchards achieve stability without any external, non-natural intervention.

To be successful, suitable, resistant fruit varieties must be used. The best varieties to use are traditional heirloom varieties that have been tested over generations in the region. Theoretically, new varieties that have been specially bred for their resistance could also be grown, but they have not yet been tested in the landscape. We grow fruit on trees in standard tree form (where the crown is 150–180 cm off the ground), preferably grafted to root stock. The trees are set wide apart, allowing the crowns to fully develop. There is of course also biologically diverse grassy undergrowth, which is a building block of the biodiversity of the extensively managed fruit orchard.


Autor: Kateřina Pařízková

Eco-friendly orchard

This type of orchard has its advantages and disadvantages:

- ⊕ **Greater resistance to fungal diseases thanks to greater air permeability between crowns and the fact that the leaves, fruits, and wood all dry more quickly.**
- ⊕ **Thanks to resistant varieties, ecological stability, and the intentional support of biodiversity there is no threat of an outbreak of pests or disease, which means that expenditures on chemical protection are practically non-existent.**
- ⊕ **Thanks to the orchard's closed nutrient cycle, costs related to fertilizing are lowered.**
- ⊖ Lower yield per hectare in comparison to intensively managed orchards (by about 30 to 50%).
- ⊖ Harvesting fruit from taller trees is more difficult. Some of the harvest must be slated for processing (e.g. dried fruit, juice, jam, distilled beverages, etc.)

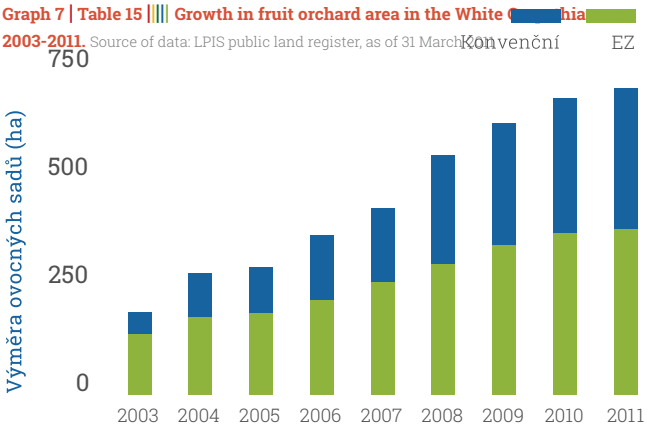
Recent experience

Although the White Carpathians are not an important region for intensive fruit growing in the Czech Republic, fruit growing has undergone significant developments over the past several decades. Data from the LPIS public land use register demonstrate that the area of registered fruit orchards in the White Carpathians grew by more than 2.5 between 2003 and 2011. This significant increase was caused on the one hand by the establishment of new orchards, and on the other by renewing the management of old orchards and re-registering them.

Although the share of newly established orchards cannot be exactly determined, there has been an extraordinary boom in fruit growing. The area of organic fruit orchards exceeds the area of conventionally managed fruit orchards. (There are a total of 388 ha of organic orchards in comparison to 326 ha of conventional orchards). They are evenly distributed throughout the region. The main impulses motivating this boom were subsidies for maintaining organic fruit orchards and subsidies for establishing intensely managed orchards. Subsidies by themselves would not have motivated farmers, if there were no possibilities to sell certified organic fruit on the market. The local juicing plant provides such an opportunity. The juicing plant also shares information about possible subsidies with potential orchard owners.

Non-organic juice is also made from apples from local gardens and small orchards, which significantly contribute to landscape and biodiversity protection. The extensive management of these orchards is very similar to organic management; however due to the small areas they cover and high overhead costs, most of these orchards will not be certified organic.

Graph 7 | Table 15 | Growth in fruit orchard area in the White Carpathia 2003-2011. Source of data: LPIS public land register, as of 31 March 2011



Year	2003	2004	2005	2006	2007	2008	2009	2010	2011
Fruit orchards	194	285	304	369	438	560	632	690	715
Share of newly categorized orchards (growth)		32 %	6 %	17 %	16 %	22 %	11 %	8 %	3 %
Index (2003 = 100%)	100 %	147 %	157 %	190 %	225 %	288 %	325 %	355 %	368 %

It is not expected that orchards will expand rapidly due to dependence on marketability and purchase prices. These are demanding, long-term investments. Faster growth in orchards is also prevented by a lack of good standard form fruit trees being produced by nurseries and by the lengthy grafting process. (It is necessary to wait one to two years before the tree grows to the required height). Young trees (formed by grafting scions onto rootstock with half-length or full-length trunks) begin to bear fruit after ten years. All of these factors may contribute to the slow growth in orchards. On the other hand, caring for fully-grown extensive orchards is less difficult than intensively managed orchards (cultivated for example using spindlebush forms.)

Fruit drying kiln

A fruit drying kiln is located in the garden of the Veronica Centre. It has stood there since the early-19th century; however in the mid-20th century it stopped being used and fell into a state of disrepair. After a long pause, lasting perhaps fifty years, fruit once again began being dried in it in autumn 1998, when members of the Hostětín local chapter of the Czech Union for Nature Conservation renovated it. During the drying season, approximately three tons of fruit are dried annually.

Zdroj: archiv ZO ČSOP Veronica

Public lighting (ŠETRNÉ???)

HLAVNÍ PŘÍNOSY

- **Energy efficiency**
- Improved lighting of public spaces
- **Reduced light pollution**
- Rapid payback period on investment

Zdroj: archiv ZO ČSOP Veronica

The public lighting system in Hostětín is energy efficient; it has reduced electricity consumption by nearly a quarter. High quality light fixtures reduce light pollution, which has a positive impact on human health, increases public safety, and helps protect biodiversity. Another positive aspect of high quality light fixtures is that they contain very little mercury.

The original objective

The previous street lighting system consisted of outdated high pressure mercury-vapour lighting fixtures from the 1960s and 1970s and newer high pressure sodium-vapour lamps. Street lighting was not able to do its job well. Areas that need to be lighted – streets and the village square – were poorly lit, and more over light was directed into gardens, windows, people's eyes, to the sides of where it needed to be directed, and into spaces far from the village. In places the colour of the light was definitely poor. Moreover, the public lighting system was relatively energy demanding.

The Environmental Partnership collaborated with the regional association of the Environmental Partnership for Sustainable Development (EPSD) and Philips Lighting in order to renovate the public lighting system. One pilot project was identified in each of the six member countries of the EPSD. The Environmental Partnership suggested Philips donate state-of-the-art light fixtures with the idea that the general public would hear about these fixtures when they visited the centre that was then in planning.

Technology

In Hostětín the existing 32 working light fixtures were replaced with modern and energy efficient fixtures. To improve lighting distribution, an additional eight fixtures were installed along the main street (one of these will be installed once a new pole is installed). In 2007 another three lights were installed between the edge of the built-up area of the village and the railway stop.

Do svítidel byly většinou použity účinné sodíkové výbojky Masters o příkonu 50 W se žlutým světlem. Pro náves byly zvoleny 60W výbojky řady CosmoPolis. Včetně předřadníku mají tyto zdroje účinnost přes sto lumenů na watt.

The village was divided into three lighting zones based on pedestrian frequency and

vehicle frequency and speed: Zone 1 - the main street where there are the most people and where automobiles travel the fastest. The largest amount of light is needed here; Zone 2 - streets where locals occasionally drive requiring medium-levels of lighting; Zone 3 - footpaths, which require relatively little lighting.

Mercury vapour is the original source of light both in light bulbs as well as in high pressure mercury lamps. They are still used in rural areas because they do not require any special devices to be lit up. (Modern sodium-vapour lamps must have ballasts with ignitions capable of supplying thousands of volts.) After light bulbs, they are the least energy efficient sources of light and contain the most mercury.

The new white lamps used in Hostětín have an extraordinarily low mercury content (1 mg of mercury per lamp). Most of the other lamps used (high pressure sodium-vapour lamps with a longer lifetime and lower energy consumption) contain 12 mg of mercury in every lamp.

Recent experience

The installation of new light fixtures in Hostětín radically lowered the harmful effects of public lighting (i.e. light pollution1), and at the same time the illumination of streets and sidewalks was increased by two to three times original values. In contrast, there is now ten times less light illuminating areas next to areas intended to be illuminated as well as the sky. This change is visible when you compare the light emitted by Hostětín at night with lights from nearby villages and towns. At the same time electricity consumption has been reduced by one third – the consumption of the entire system has been lowered from 4.6 kW to 2.9 kW.

Comparing electricity consumption in the new and old lighting system is interesting. Approximately 17 MWh of electricity was consumed annually before the new energy efficient lighting system was installed. Upon installation energy consumption dropped to 11 MWh. Consumption was therefore reduced by a third, even with the addition of eight completely new light fixtures.

* In the Czech Republic legislation mentions light pollution (in the Air Protection Act), but it only authorizes municipalities to regulate light intentionally directed into the sky. The absence of strict regulations has meant that most new and renovated public lighting systems have been improperly designed and that glare and light trespass are almost omnipresent at night. Good examples of public lighting are rare and have been installed only thanks to well-informed engineers, wise local officials, and/or conscientious companies.

Financování projektu

In the Czech Republic legislation mentions light pollution (in the Air Protection Act), but it only authorizes municipalities to regulate light intentionally directed into the sky. The absence of strict regulations has meant that most new and renovated public lighting systems have been improperly designed and that glare and light trespass are almost omnipresent at night. Good examples of public lighting are rare and have been installed only thanks to well-informed engineers, wise local officials, and/or conscientious companies.

Tabulka 15 Cena rekonstrukce a položek

	Plátce	Částka v Kč	Procenta z celkové rekonstrukce
Sada svítidel a výbojek	Philips	133 710	55,5 %
Demontáž a montáž svítidel, spojovací materiál	Obec Hostětín	107 000	44,5 %
Celkem		240 710	100 %

Návratnost investice

The cost of renovating the public lighting system was highly affected by the value of the donation from Philips. The company donated state-of-the-art light fixtures; if less expensive equipment had been used, renovating the system could have been as much as one third less costly. However, thanks to this gift the light fixtures in Hostětín are of high quality. They should last 20 to 30 years with lamps being changed every five to six years. The investment made in renovating lighting is calculated to be paid back in 11 years accounting for a 7% annual increase in electricity prices. When additional costs associated with replacing all of the lamps every six years the payback period is 13 years. Once this period has expired nearly 33,000 Kč annually will be saved on public lighting costs.

Supporting the local economy

Supporting the local economy

The local multiplier

Regional money flows can be calculated and illustrated by using an indicator known as the LM3 local multiplier. This tool for measuring regional money flows was developed by the London-based organisation new economics foundation (nef). It is grounded in the original Keynesian concept of studying the national economy through the effect of governmental expenditures. This modified version of the indicator enables the role of small organisations, companies, and villages and towns in the local economy to be studied. The local multiplier is only an indicator; it does not represent an exact value, but instead it gives insights into money flows. We can however use this simple indicator to gain insight into the more complicated issue of how local economies work.

To calculate LM3 first the total expenditures of the studied subject are determined. The next step involves determining how much money was spent locally (i.e. how much money was paid to local suppliers and employees in the study region.) In the third step how much of this locally spent money is once again spent locally is examined (i.e. how much money local suppliers and employees paid by the subject spend locally.) The amounts determined in each of the three steps are summed up, and the sum is divided by the total of expenditures spent in the first step of the study.

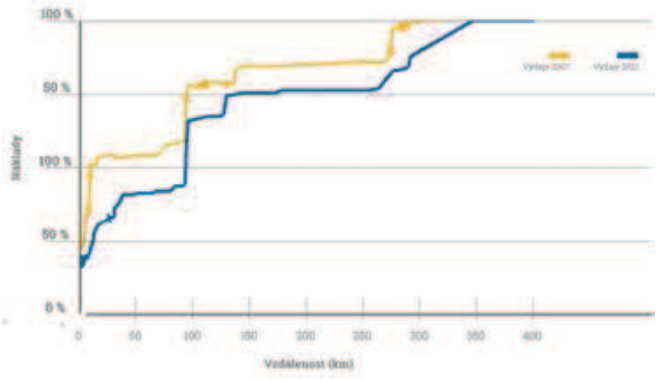
Juicing plant

When the juicing plant's local expenditures in the 2006 financial year were analyzed, the LM3 was calculated. The area in which money was spent locally was defined as being 25 km from Hostětín.

In 2006 the LM3 score was 1.63. This means that for every crown spent locally (i.e. spent within 25 km of Hostětín) it generates an extra 63 hellers in the local economy. For comparison with later development the LM2 should be calculated for local expenditures, i.e. how much money the juicing plant paid to suppliers coming from within 25 km. The LM2 score was 0.34 (meaning that 34 % of all spending was made within 25 km of the plant; the rest of the money went to suppliers further afield).

In order to determine current trends as well as the share of local costs in running the juicing plant, "accumulated costs by distance" should be calculated. For each expenditure, the distance between Hostětín and the headquarters of the company/organisation supplying the cost item was calculated as the crow flies. These suppliers were then arranged from closest to farthest and the accumulated costs were calculated.

Graph 7 LM2: accumulated costs by distance



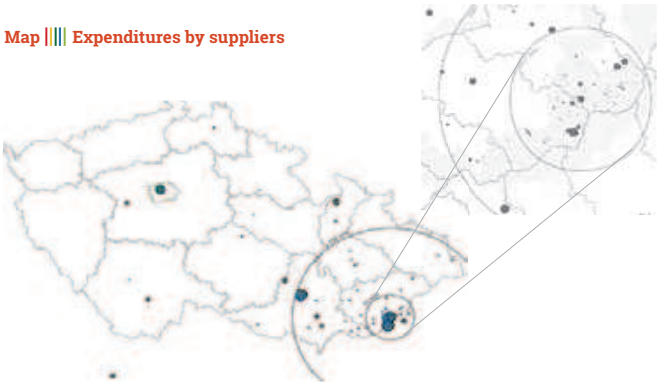
Based on a comparison of results from 2007 and 2012 it is clear that the level of local spending decreased significantly. Changes in the bottling system had the most significant impact on this change: juice is filled into non-returnable bottles on the new filling line. O-I Sales and Distribution Czech Republic, s.r.o., headquartered in Dubí u Teplic (which is 400 km from Hostětín), supplies glass bottles to the juicing plant. Thus, the share of local expenditures made within 25 km significantly declined.

Similarly the local impact of the juicing plant can be expressed by the average distance from the plant where 80% of its expenditures were made. Whereas in 2007 this distance was 138 km, in 2012 this imaginary line had moved almost double its distance to 269 km.

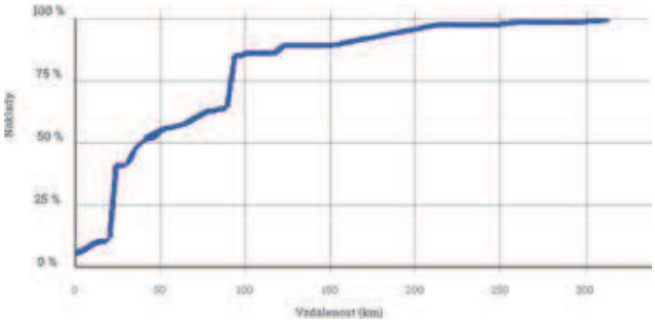
Table 16

Year	LM2 | ????			LM2 = 80 %
	25 km	100 km	300 km	Distance [km]
2006	34 %	-	-	-
2007	54 %	77 %	100 %	138
2012	32 %	66 %	87 %	269

Map Expenditures by suppliers



Graf 8 Nákup jablek – kumulované náklady podle vzdálenosti



Increased sales of organic juice have fuelled greater production. Supermarkets and health food store chains easily bought up organic products; non-organic juices had a harder time selling. TWC thus focused on addressing orchard owners and trying to motivate them to changing to certified organic fruit growing.

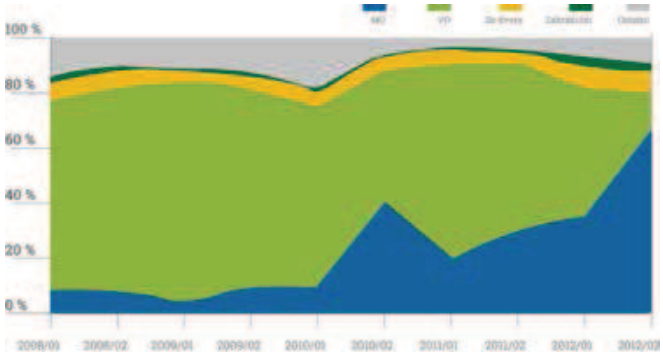
Analysis of sales figures from 2008-2012 indicate that wholesalers (including chain shops) make up the largest group of purchasers. This group had a significant drop in sales in 2012, whereas the revenue of retailers increased. Thus, currently the position of retailers is improving. Retail is thus the second most important segment; in 2012 however it accounted for more than half of all revenue.

Other sales channels are relatively stable, both absolutely and relatively. Farm sales include sales made directly at the juicing plant and at the neighbouring Veronica Centre. Foreign customers are exclusively from Slovakia and considering the fact that Hostětín is near the border these sales are essentially regional in nature.

Table 17

	Wholesale	Retail	Farm sales	Foreign sales	Other
Percentage of sales	59,5 %	23,4 %	5,5 %	1,5 %	10,1 %

Table 18 | Percentage of sales by channel biannually in 2008-2012



The juicing plant employs one local person full-time and four additional people part-time. Including seasonal workers the juicing plant created the equivalent of 3.5 full-time jobs in 2007. The calculated full-time job equivalent grew from 2.5 in 2001 to 3.5 in 2007. The number of permanent positions and the number of seasonal workers has slightly grown over the years. Some of the seasonal works are people who have faced long-term unemployment. The new highly automated machinery and fluctuations in purchasing raw materials do not contribute to creating new jobs at the juicing plant.

The Veronica Centre

To evaluate regional money flows we once again used a simplified form of the local multiplier. The Veronica Centre spends money on purchases from many small suppliers. For this reason we have dropped the third round of calculating the local multiplier - LM3. To do so it would have been necessary to ask a large number of small suppliers where they spend their money.

LM2 indicates that the Veronica Centre spends most of its money locally (roughly 67%). The largest local costs go towards salary expenditures (44.4% of total costs), food, furnishings for the passive house (mainly furniture), and heating. The Veronica Centre currently (in 2013) employees ten people, three of whom solely run it. These employees live directly in Hostětín. The other employees who work on the Veronica Centre's programme activities either live in the region or directly in Hostětín.

The existence of the centre has an impact on the economy of Hostětín. The centre buys most of its ingredients for cooking in the local shop; visitors to the centre spend money there. Food, which cannot be purchased in Hostětín, such as meat, fruit, vegetables, and organic food, is purchased elsewhere (mainly in nearby Slavičín and Bojkovice).

When the Veronica Centre was built supporting the local economy was preferred as well. Local construction workers and tradesmen were employed by the general contractor to work on the building. The construction foreman was a resident of Hostětín who contacted tradesmen from the region. Most of the construction workers were from the Uherské Hradiště district. There was significant use of local renewable materials including: wood for cladding, straw for insulating one wall and the roof, and adobe bricks.

The municipal heating plant

The LM2 score in 2007 was 2.30. This means that each crown spent locally generated an additional one crown and thirty hellers for the local economy. It is important to note about Hostětín's heating plant that its spends the most money on wood chips; this money stays in the region (and local wood chip suppliers tend to spend their money locally). Salaries are another expenditure that completely stay in the region. The heating plant spends money outside of the region on electricity and on maintaining the boiler.

Environmentally friendly tourism

The model projects and the beauty of the White Carpathians have made Hostětín a popular destination for visitors. The Veronica Centre strives to make tourism sustainable, just like all of the other work it does. Many different types of tourism can meet the criteria of sustainable tourism. All of them however involve contact with local institutes and natives.

The fundamentals of sustainable tourism

- A tolerant relationship to the natural, cultural, and social environment
- The utilization of environmentally friendly technology
- Endeavours to support local communities (socially and economically)
- The quality of the experience, but also respecting the needs and habits of local people (by involving them in planning and decision-making)
- Emphasis on local heritage
- Attempts to utilize local natural resources, local food, and the services of local people
- Minimizing negative impacts and energy use, recycling

Trails through the landscape

If local heritage is left uninterrupted, the main characteristics of a region my go unnoticed or unvalued. In order to interpret local heritage a educational trail entitled "Naokolo Hostětína" was created, which teaches visitors about how people used to live and work and how they celebrated holidays. An imaginary local guide depicted on panels arranged along the trail recounts how wood used to be transported from the forest, what crops people used to grow and where, how children whiled their time away on the pasture, how fruit was used and where it was the most abundant. The visitor learns many interesting things about the landscape; each stop along the way is related to a specific place and historical event. The informational panels themselves are actually landscape sculptures. Their creator, Rostislav Pospíšil, joined together in them elements of the White Carpathian landscape: wood, stone, and people. People are represented in the sculptures by work and iron, which has helped people plough fields and cut down trees since time immemorial.

Educational trails are excellent for attracting people into the countryside and for introducing the beauty of the local area to them. There is another educational trail serving this purpose as well named "Sochy v krajině". A total of fifteen wooden sculptures are located on interesting sites, historic, natural, or otherwise, and are connected together by a marked trail. A third educational trail in Hostětín is called "Po zelené Hostětínem" and focuses on the village's environmental projects. A detailed map of each educational trail has been published.

Modern forms of tourism have also found a home here, specifically geocaching. Several caches have been located in significant places nearby Hostětín.

Other forms of environmentally friendly tourism

- Guided walks focusing on interpreting the landscape's geomorphology, fauna, and flora.
- "Trips with a story" where guests can choose from several trips each with its own story to tell, such as a local historical legend or fairytale.
- Landscape trips
- Educational activities and workshops for tradespeople
- Overnight programmes
- Camps for children and their parents

The Apple Festival, which has been held annually in late-September since 2001, is an important activity supporting local tradesmen, traditions, and fruit-growing. The festival is organized by the Veronica Centre, Traditions of the White Carpathians, and the village of Hostětín. This festival which connects tradespeople and providers of products and services certified by the Traditions of the White Carpathians with an environmental, cultural, and


Zdroj: archiv ZO ČSOP Veronica

Sustainable tourism certification in Hostětín

One of the tools used to develop environmentally friendly tourism are voluntary certification programmes involving ecolabelling.

Environmentally friendly service

The Environmentally Friendly Service label is similar to the Environmentally Friendly Product label. This label can be awarded to providers of accommodation. A hotelier may be awarded a Czech ecolabel or a European flower ecolabel. The certifying body for ecolabelling in the Czech Republic is Cenia - the Czech Environmental Information Agency (www.ekoznacka.cz).

At the Veronica Centre we fulfill the relatively strict requirements of the Environmentally Friendly Service certification by:

- attaining maximum energy efficiency thanks to passive house technology (insulation, windows, energy efficiency, heat recovery ventilation, heat regulation, energy efficient lighting, etc.)
- using biomass energy (from the local heating plant) and solar energy (from solar collectors)
- exclusively purchasing electricity generated by renewable resources
- being equipped with appliances with energy ratings ranging from A+ to A+++++
- using rain water for cleaning and flushing toilets, using a dual flushing system, environmentally friendly cleaning products (e.g. by purchasing concentrated products in 5-l containers)
- introducing a plan for waste reduction and recycling which includes recycling aluminium, composting organic waste, minimizing the use of disposable products and individually wrapped food products, etc.
- by cooking with organic, Fair Trade ingredients, using local food
- using recycled paper and cleaning products with an ecolabel
- using natural materials for interior decorating, FSC certified wood products, natural linoleum, etc.
- providing environmental education to employees and guests
- using local plants (fruit orchard with heirloom and regional varieties of fruit, herb garden), organic farming.

Eceat quality label

The Eceat Quality Label is a prestigious international label for providers of sustainable tourism services (www.eceat.org). The label is awarded by ECEAT (the European Centre for Ecology and Tourism). Since the early-1990s ECEAT has been the only organisation in the Czech Republic working to develop agritourism and eco-agritourism.

This label differs from the Environmentally Friendly Service label by the fact that it primarily focuses on the services provided and only deals with the greenness of buildings secondarily. Accommodation services must meet fulfil basic standards in accessibility, hospitality, access to information, safety, furniture, and catering.

In order to be awarded the Eceat Quality Label the Veronica Centre focused on ten points:

1. **Awareness raising among guests. Giving guests information about how to protect the environment and about local wildlife and culture. Distributing information materials and specialized magazines. Guests can go on field trips to see model environmental projects. There is an information system as well as educational trails in the village. A library with environmental publications is available to the public.**
2. Environmentally friendly land use. The land is farmed using environmentally sound methods. The centre offers and purchases organic food, local food from local farmers (potatoes and vegetables), local craft products (Traditions of the White Carpathians), and juice produced right in the village.
3. **Environmental water and energy management. Recycled materials (old bricks and straw) were used to construct the building, and local products and natural materials were preferred.**
4. Green building. The building's design and construction were guided by "green architecture" and incorporates passive heat gain, insulation, the use of local materials and furnishings, etc.
5. **Waste Facility management methods reduce the amount of waste produced (e.g. single serving sized packaged food is not served for breakfast, disposable products are not used, etc.) Green office management methods are used in the office.**
6. Public transportation. The centre actively promotes public transportation. It makes available train and bus schedules. Guests who arrive on bicycle or by public transportation are offered a discount. Bicycles can be stored in the building, and the Veronica Centre holds a „Cyclists Welcome" certificate.
7. **Protecting natural heritage. The Veronica Centre utilizes environmental farming methods in the orchard and herb garden. They share information about and promote these methods. It promotes environmental forestry, including utilizing the products of such forestry (the furniture in the rooms is made of FSC wood). It organizes topic-based educational events (nature conservation and landscape protection courses, fruit growing courses, "Rural Landscape" conferences, etc.) and collaborates with conservation organisations.**
8. Protecting cultural heritage. The Veronica Centre focuses on traditional local cuisine and customs; the menu includes traditional, but in today's world less common, foods, such as buckwheat, millet, wheat, polenta, etc. Organic food and local food (vegetables and potatoes) are primarily served. The Veronica Centre organizes the annual Apple Festival, which supports local craft and cultural heritage. It also organizes courses focusing on traditional trades, and pre-Christmas craft and trade activities. In collaboration with civic associations in the village it organizes cultural and social activities: a carnival, a children's day event, a St. Nicholas Day party, etc.
9. **Supporting the local economy. The centre purchases local food from local farmers (potatoes and vegetables), the products of local tradesmen (with the Traditions of the White Carpathian label), juice produced right in the village in the local juicing plant, and utilizes the services of the local shop. Local residents work in the Veronica Centre, including operating staff, the cleaning staff, the kitchen staff, guides, the maintenance man, etc. Projects focusing on sustainability in the village also contribute to the local economy. (See more in the chapter Supporting the local economy)**
10. Improvement. The Veronica Centre continuously endeavours to improve and perfect the services it provides, to improve and enhance the use of green technology, to find new suppliers of local food, etc.

Cyclists Welcome

"Cyclists Welcome" is a nation-wide certification system which guarantees the quality of room and lodging services, campgrounds, and tourist attractions for cyclists. This certification tells tourists that a lodging, dining, or other facility has a bicycle-friendly environment, including bicycle stands, lockable rooms, tools for basic bicycle maintenance, facilities for washing and drying clothes, cycling maps, etc. Look for the green and white label with a smiling bicycle to identify certified service providers.

www.cyklistevitani.cz

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Education for Sustainable Development

The projects implemented in Hostětín have created an ideal environment for educating people about sustainable development. The exceptional concentration of environmental projects in the village and many years working with the public form the base of the Veronica Centre's educational programmes. The unique infrastructure of the village means that people are not taught using models, but actual projects. Education here is truly "hands-on".

Education for sustainable development (ESD) focuses primarily on:

- Understanding the connections between the economic, social, and environmental aspects of development, at the local, national, and global level
- Viewing sustainable development as a holistic and system-based approach aimed at creating an economically prosperous society while at the same time respecting social and environmental connections and limits
- Developing competencies (knowledge, skills, and attitudes) for democratic and free decision-making in people's personal interests and in the public interest in accordance with the law and with the principles of sustainable development

Source: Strategie vzdělávání pro udržitelný rozvoj České republiky (2008 – 2015) [Education for Sustainable Development Strategy in the Czech Republic (2008 – 2015)]

The educational programme in Hostětín is based on collaboration and exceptional cooperation with academic institutes, public administration, others NGOs, and the business sector. The creation of each educational activity is inspired by the work of both Czech and foreign organisations. We have collaborated with groups such as the Centre for Alternative Technology (CAT) from Wales and the Europäisches Zentrum für erneuerbare Energie (EEE) from Güssing in Burgenland, Austria.

Field trips visiting environmental projects

The most basic and most frequent method used to educate people include field trips around Hostětín. Visitors are introduced to each of the model projects in the village. Their importance for the village is explained, as are their impacts, which are put into context. Prearranged group trips are the most common. These groups usually come from schools, local government (mayors, representatives, etc.), and NGOs. These tours are also a regular part of overnight educational activities and recreational stays.

Excursions are made to fit the desires and needs of each group. There are different tours for the general public, for specialists, and for children which includes extra interactive activities. As a rule foreign visitors receive tours in English, but German tours can be arranged, as well as French and Russian to a limited degree. A printed guide containing basic information and data about each project is available for individual visitors.

The Veronica Centre also offers field trips to nearby villages and through the local countryside that are especially focused on green building, organic fruit growing, local products and the local economy, and nature conservation in the White Carpathians.

Educational programmes

for nursery, primary, and secondary schools

The Veronica Centre offers programmes lasting from several hours to several days. Educational programmes include: A Great Climate, Sustainable Development, Renewable Energy, I Drink Juice, and You?, The Trades of Our Ancestors, Living Gardens, In Search of the Treasures of the White Carpathians, The Herbs of Our Grandmothers, and Fair Trade.

These programmes frequently include field trips which introduce the projects in Hostětín to students through games and activities.

Currently, the Veronica Centre offers one overnight stay programme entitled Sustainable Development with All of Your Senses. Over the course of three to five days students

learn about climate protection, saving energy, renewable energy, organic farming, responsible shopping, sustainable transportation, and green households. As part of the programme students must complete a group assignment, wherein they must analyze data from their own town or village, household, or school and propose ways to introduce sustainability there. They learn how to work with questionnaires, how to analyze relationships, write press releases, and propose solutions for improving their school or town. Team-building activities are held throughout the course, and therefore it is especially suitable for newly formed groups.

For several years the Veronica Centre has organized a yearlong contest for primary and secondary schools in the Zlín Region entitled the Zlín CO_2 League, where the students work on climate change-related topics. The contest was held for the fourth time in the 2011/2012 school year and won the international U4Energy award. The Veronica Centre's ability to work with schools lent it to being the coordinator of the international Eco-Schools programme in the Zlín Region*

* Eco-Schools is an international programme aimed at improving waste, water, and energy management at schools and the school environment itself through student-led system change. The programme supports collaboration between students, teachers, school directors, and local communities. Nineteen schools in the Zlín Region are involved in the programme, ten of which have already been awarded the international title of "Eco-School".

Interdisciplinary conferences

Thanks to a broad range of relationships and contacts made within and between people from the public, private, and non-profit sectors, an interdisciplinary conference has been traditionally held. These conferences are primarily for students, doctoral candidates, university educators, and specialists from various fields that do not usually work together to meet. The first such conference, Rural Landscape, has been held here since before the seminar centre was built. It was held for the tenth time in 2012. The second conference, Sustainable Energy and the Landscape, was held for the third time in 2012. The aim of these conferences is for people to exchange views and to establish contact and cooperation between specialists and students in various fields. The agenda of these conferences is evenly divided up to include the academic proceedings, group work, field workshops, experiments, and other educational activities. The proceedings of each conference are peer-reviewed and published.

Internships

for secondary school students and university students

The Veronica Centre regularly works together with schools and offers internships to students and can also provide them with consultation on term papers, bachelor's theses, and master's theses. Internships focus on gaining theoretical knowledge about sustainable development and gaining practical experience in how non-profit organisations work. Therefore interns do not just take part in educational programmes; they also help out with administrative work, project management, and event preparation in order for them to gain career skills.

Students from the Department of Environmental Studies of Masaryk University come to Hostětín to do their internship at the Veronica Ecological Institute. They are involved in educational programmes and organizing activities for the public, they are introduced to how the model projects work in practice, and they learn how to work in the demonstration orchard.

Partnership with academic institutions

The unique environment in which Hostětín is located draws many universities to conduct field trips, regular field courses, and summer schools here. Students either come with their teacher and their own agenda, or they utilize the programmes offered by the Veronica Centre and the educators based at the Veronica Ecological Institute. The Veronica Centre regularly works with the following schools: Masaryk University (Faculty of Social Studies, Faculty of Education), Brno University of Technology (Faculty of Architecture, Faculty of Civil Engi-

neering), Mendel University (Faculty of Forestry and Wood Technology, Faculty of Agronomy, Faculty of Horticulture,) Charles University (Environment Center, Faculty of Social Sciences), Palacký University (Faculty of Science), Slovak University of Technology in Bratislava (Faculty of Civil Engineering), Tomas Bata University.

Seminars, training, courses, and summer schools

Seminars and courses can be prepared for the general public and specialists. These events are taught by both internal and external specialists. The most popular topic recently has been fruit growing, which focuses both on theory and practice. Participants learn for example how to plant and treat fruit trees, how to process fruit, etc. Other popular topics include green households, natural gardens, and green building, including education and consultation about passive houses and green building technology. For covering this topic the Veronica Centre draws from its membership in the Passive House Centre network.

Every year a summer school focused on nature conservation and fruit growing is held for the public.

Not all visitors participate in educational programmes, but nonetheless the educational methods developed by employees of the Veronica Centre are of such a nature that they have some effect on visitors whose primary interest in visiting Hostětín was not to be educated. One of the elements contributing to this is the ecological footprint classroom which was spread out throughout the building in 2012.

The Veronica Centre on one hand directly educates people at its seminars and courses and during its training, and on the other hand has on indirect influence on visitors. Every single visitor to the centre learns about environmental issues, even people who have come just for holiday. One of the ways the Veronica Centre teaches people indirectly is through the passive house technology information system. The ecological footprint classroom also contributes. It presents ideas about how to behave "green" in your daily life. In order to demonstrate these ideas it utilizes environmentally friendly products and appliances, herbs, traditional foods, and recycled products alongside informational posters and a quiz. Indirect education is also accomplished through three educational trails around Hostětín, inviting visitors to explore the landscape and introducing them to the wildlife of the region and how people here used to live and how they live today.

The Veronica Centre also boasts a comprehensive website (hostetin.veronica.cz), a series of publications covering the model projects in Hostětín, and a library, which all also serve to educate the public.

Education for municipalities

All aspects of Hostětín (including how technology is used, how the village is organized and works, and how finances are obtained) make it a valuable model for small towns and villages not just in the Czech Republic, but in Europe as well. Local government officials are one of the most important groups of people who come to Hostětín for education and to gain experience. Most foreign visitors have been mayors from Slovakia, but Hostětín has also been visited by groups from Ukraine, Romania, Bulgaria, Austria, Great Britain, Belgium, France, the Baltic countries, etc. Employees of Veronica are also frequently invited to take part in educational events focused on sustainable development and sustainable energy for local governments so that they can talk about their experiences in Hostětín.

Corporate education

Hostětín can offer a unique and inspiring environment for corporate education. In addition to each company's own programme the Veronica Centre offers educational activities related to the environmental projects in Hostětín and nature conservation as well as special training about sustainable office management. It has recently started offering team-building activities as well.

Details about the educational programme in 2011

For the approximately 7,300 visitors to Hostětín the following educational programmes were prepared:

- Fifty-three guided trips
- Fifty-eight educational programmes for primary and secondary schools
- Six overnight programmes
- Fourteen programmes for universities
- Fifteen open houses in the passive house
- Seventeen one-day seminars
- Seventeen multiday educational events (such as the Rural Landscape conference, the Sustainable Energy and Landscape conference, the celebration of International Passive House Day, the summer fruit growing school, the Apple Festival, multiday seminars, etc.)
- Four overnight programmes for families with children and other target groups.

Educational programme topics:

- **Sustainable regional development, the local economy**
- **Sustainable energy and climate protection Green building**
- **Fruit growing, local food, organic agriculture**
- **Water in the landscape**
- **Biodiversity protection and sustain**
- **Udržitelná spotřeba**

Zdroj: archiv ZO ČSOP Veronica

Veronica Centre Hostětín visitor statistics in 2011

Total	7 304
Schools (primary, secondary, tertiary)	1 794
Interest groups, NGOs	395
Public administration	171
Businesspeople	42
Others	4 902

Zdroj: archiv ZO ČSOP Veronica

Conclusion

The village of Hostětín demonstrates that the transition to a low-carbon economy and a sustainable society is not just an empty phrase, but a real possibility. Each project has been demonstrated to be effective in Hostětín and can be transferred to other cities and villages, both in the Czech Republic and elsewhere. Assuming that regional, national, and European investment funds are properly set up, similar projects can be implemented on a wider scale than they are today. If projects like the ones in Hostětín are to become the norm all depends on social demand and political will.

Why we have been successful

Most of the projects in Hostětín have been pioneering, pilot projects of regional and even national importance. A rare situation arose in which several institutions and people with the motivation to demonstrate that making society sustainable is not only possible, but realistic as well, worked together to prove just that.

The success of projects in Hostětín has been dependent on several factors, but from the very beginning strategic partnerships between the village of Hostětín (with limited resources but with active leadership) and the following organisations have played a key role:) a:

- **Non-profit organisations including primarily the Ecological Institute Veronica, the Traditions of the White Carpathians civic association, and the Environmental Partnership, which provided inspiration, specialists, international contacts, multiple sources of finance, project management, personal energy, and new partnerships, for example in the commercial sector, with the embassies of other European countries, etc.**
- **Local government offices (initially mainly with the District Office in Uherské Hradiště and later with the Regional Office of the Zlín Region, with the Bojkovice Local Action Group and Micro-Region, etc.)**

Hostětín would not be what it is today without the people who initiated each of its projects. Local government officials playing critical roles included Drahomír Orsák, the former mayor, and Radim Machů in particular, who still acts as a point of contact between the intellectually-focused NGO partners and the day-to-day life in the village. He is mostly responsible for the success of the juicing plant and also contributed to all of the other projects. The current local government has a positive attitude towards these projects which has created a favorable environment for these projects and educational programmes to thrive and expand.

From the very beginning Miroslav Kundrata, who was born in Hostětín and is a member and co-founder of the Ecological Institute Veronica and the director of the Environmental Partnership, has brought the projects together. The Environmental Partnership and the Veronica Foundation contributed a large part of co-financing funds to the projects. Large investments in the village would not have been possible without progressive district, and later regional, officials including Jaroslav Hrabec (reed-bed wastewater treatment plant) and Miroslava Knotková (biomass heating plant).

Yvonna Gaillyová was responsible for most of the projects and today is one of the most important people integrating activities for developing environmental projects in Hostětín. Jana Tesařová, the first director of the Veronica Centre, played a key role in its development and professionalization.v Hostětíně.