

of innovations and thus increased the production capacities or provided for a lesser wear of materials, which on the long run brings lower costs and better utilisation of not only raw materials but production line as well.

With continued successful functioning, the company is also striving for economic growth and opening of new jobs on the account of increased production that would be possible, according to the company's director, only with a high investment in the ORC system for the cogeneration of electric energy. The company has all the resources to upgrade the existing system into a system of cogeneration, except that it should initially be stabilized after the investment cycle into the pellet mill, or should get an external partner to implement the necessary upgrading.

In fact, the company has already acceded to its upgrading through its distribution service. This concerns primarily distribution of loose goods in specially adapted containers with the system that enables loose goods to be blown into storage facilities. With this system, the company wishes to gain advantage with the customers who have boiler rooms and storage containers adapted to this mode of fuel supply.

## 7. Conclusions

The company Energija narave is certainly a good practice case, given that it was a successful tender and, later on, a successful investor in the wood biomass district heating system. After the initial failure, the company did not give up, but successfully exploited the available capacities by developing a pellet production plant. At the same time, it invested much time and money in the preparation of the project itself. In the very first year it thus endured the trial period, successfully started the production and presented its products on the market.

The company's employees are innovative people who constantly search for bottlenecks with their continuous control of the production chain and have successfully introduced a number of solutions. They are especially proud of their improved cutter knives in the cutting mill. With a minor modification, the knives are usable more than twice, due to which the grinding costs have been significantly reduced.

In cooperation with various research and energy institutes, such as the Slovenian Forestry Institute and TeTol, they aim even higher by producing top quality products and confirming this by appropriate European certificates. With their case they are also partaking in the preparation of MSc thesis.



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# PRODUCTION AND SUPPLY OF WOOD BIOMASS

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## 1. General

The company Energija narave d.o.o. was founded in 2009 in the Gorenja vas – Poljane Municipality for the specific project of energy contracting, i.e. wood biomass district heating (WBDH) for the need of GC Todraž. In the very same year, the project of a public-private partnership in the energy source replacement (switch to renewable energy resources) was embarked upon in GC Todraž. The investment was successfully implemented in 2010, when wood biomass heating was introduced in December as well. The old extra light heating oil boiler with a power rating of 1,900 kW was replaced wood chips boilers with a total nominal power of 1,000 kW. Despite the reduced capacities of the new modern boiler, it became clear as early as after the first heating season that GC Todraž would not come to life in full. This means that the envisaged heating requirements were completely overrated. The wood biomass boiler room was thus underutilised, but just when the investment began to seem unpromising, the success story has only just begun.



The company Energija narave opted for a new project: production of pellets, with which energy surplus was to be utilized. During the preparation of project documentation, several variants were studied, including those by which the investment costs would indeed be raised to millions of euros, but then the investment would enable them a co-production of heat, electric power and pellets. The technological model for the co-production of pellets was selected rationally, but still in such a manner that would enable them to raise the model to a higher standard, i.e. co-production of electric power. For the selected production chain, the company currently uses 80 % of all produced heat, while the remaining 20 % is used for the needs of energy contracting in the area of GE Todraž.

The company currently employs three people in the production and sales sectors. Apart from that, the production is regularly visited by the company's director who invested much of his spare time in the pellet mill. With regard to the positive response on the market, new jobs are also created by the company. All workers have been selected from the local community, providing them with suitable professional qualifications.

## 2. Description of the company's activities

The process line consists of several steps adapted to the type of input raw material. Pre-grinding or raw material and sieving is necessary during the first phase with regard to the type of input of raw material and its granulation, which then proceeds to the rough grinding process and on into the storage container, from which raw material is transferred into drying room. From here, raw material travels to the dry raw material storage container, and eventually to the fine grinding mill. The finely ground raw material is then supplied via dry raw material storage container to the press. The produced pellets are then sent to the cooling procedure and via sieve to the pellets storage container, where they are ready for packing and further handling.

## 3. Technology and productivity

### Drying

When deciding on which technology to use, the company dedicated most of its attention to the selection of a suitable raw material drying room, with which the energy surplus of the existing WBDH system would be used. When fully operational (7,000 hrs per year), the boiler room can produce around 5.3 GWh of heat envisaged to dry the raw material, or about 10 % less if losses in the network are taken into consideration. After surveying several different possibilities, the investment in raw material belt drying system turned out to be the best variant among them all. Saw dust is shifted via storage container and transporter to the rough mill and further on to the belt, where it is left to dry. The dried out material



is dosed into fine mill via transporter and then through dry raw material storage container to the press. With the power input of 1,150 kW, the capacity reaches 1.5 tons of dried raw material per hour.

### Conditioning

Prior to the pressing (pelleting) procedure, the well dried raw material is to be exposed to water vapour for 10 to 20 minutes in order to enable the raw material to be evenly moistened and a liquid layer of particles created on the surface. This procedure is called conditioning and is highly significant if top quality of the end product – pellets – is to be achieved. Another method of conditioning is the application of biological additives which, however, is not favoured by the company Energija narave.

### Pressing

Grinding, drying and conditioning procedures are followed by pressing of the input raw material into the end product – pellets. A constant raw material supply and homogeneously ground raw material with a constant water content between 8 % and 13 % is a predisposition for a successful pressing of the pellets. The company Energija narave opted for Italian press manufactured by ZEPPI with the capacity of 1,000 kg/h. The effects of the press depend on several factors, while the planned annual production oscillates around 5,000 tons. Daily effects are influenced particularly by the functioning of the press itself; after six months of functioning, 95% capacity of the entire mill is achieved.

### Cooling of the pellets

The last but no less important procedure prior to packing of the pellets is their cooling. Drying, conditioning and frictional forces during pressing cause the material to heat up. The temperature of produced pellets thus varies between 80 and 90 °C. Through cooling, the mechanical strength is increased and water content reduced, which means that cooling prior to storing is essential. In the refrigerator, the pellets are cooled with the aid of ventilation.

## 4. Investment

The investment in pellets production, which includes the system of grinding and drying of raw material, the pellet-making machine, sieving and cooling systems as well as transport and packing systems amounts to 591,100 EUR. The financing model envisages 60 % of own funds and 40 % of loans raised. With the reached 20 % rate of yield, the expected return on the investment is 7 years.

Planning	33,400 EUR
Construction works	45,000 EUR
Heating system	35,000 EUR
Drying room	307,700 EUR
Pellet mill	260,000 EUR
Storage place	30,000 EUR

Table 1: Investment breakdown

When WBDH Todraž was founded, the entire required documentation for the acquisition of incentives from the Ministry of Economy's Cohesion Fund was prepared and submitted. On the basis of this documentation,

the company also acquired incentives for the construction of wood biomass boiler room. Apart from it, the company has signed a contract for heat supply to the RWBH Todraž.



## 5. Market and raw material hinterlands

The company Energija narave endeavours to produce and supply high quality pellets. These are made of different wood residues (saw dust, woodchips, side trimmings, offcuts, bark, slabs ...) of spruce wood (80 %) and deciduous tree wood (20 %). Despite the fact that the production is carried out in one of the most forested areas in Slovenia, where forest cover exceeds 70 % of the area, data on wood potentials in its surroundings had been gathered prior to the project implementation. It was established that at least 26,000 tons of wood biomass was located within a radius of 30 km (most of it within 20 km). The established quantities suffice for the envisaged production. But as the company wanted to play it safe, it signed contracts with five major and a few minor constant suppliers, with which it agreed on regular supply during the cycles stipulated in advance. This means that the company has secured permanently quantities of the needed raw material, which is kept in a roofed depot with a capacity of 5,000 stacked m<sup>3</sup>. The price of wood biomass as the input raw material greatly depends on transportation costs.

## 6. The company's goals and vision

As the company has been dedicating most of its attention lately to the quality of its products, it wishes to introduce a system for a constant control and, in turn, to provide for a constantly high quality of its pellets. As it aims high, it seeks to introduce a system in the shortest possible time that will satisfy the requirement for the acquisition of ENplus quality certificate, which is based on the European EN 14961-2 standard.

Apart from providing for the highest quality of its pellets, reduction of costs is one of the major factors in the development and upgrading of the company's production. Together with a permanent supervision of separate production elements, the company has introduced a number