



BUSINESS PLAN

BUSINESS PLAN FOR THE ŠMARJE PRIMARY SCHOOL

Comparative Feasibility Study of Heating with Olive Pomace and Extra Light Fuel Oil

University of Primorska
Science and Research Centre Koper
Garibaldijeva 1
6000 Koper

Koper, February 2010

The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained therein.

1 CONTENTS

1	CONTENTS.....	2
2	INTRODUCTION.....	3
3	ANALYSIS – ŠMARJE PRIMARY SCHOOL.....	5
3.1	supply analysis	5
3.2	organizational and ownership structure	6
3.3	heating technique	6
3.3.1	Technique Currently Used: Heating with Extra Light Fuel Oil (Variant 1) ..	6
3.3.2	Heating System Renovation: Heating with Extra Light Fuel Oil (Variant 2)	7
3.3.3	Heating with Olive Pomace (Variant 3).....	7
3.4	Transportation.....	8
3.5	Economic and financial aspects.....	8
3.5.1	Technical Data.....	8
3.5.2	Investment.....	9
3.5.3	Cost of Energy-Generating Substances	9
3.5.3	Operating and Maintenance Costs	10
3.6	COST-BENEFIT ANALYSIS.....	10
4	CONCLUSION	12
5	LIST OF TABLES, DIAGRAMS AND FIGURES.....	13
5.1	LIST OF DIAGRAMS	13
5.2	LIST OF TABLES	13
5.3	LIST OF FIGURES	13

2 INTRODUCTION

Each major change in the heating system of a certain building or facility requires an economic analysis to envisage the scope of investment and to establish its economic justification.

The business plan includes the following contents:

- Exploitation of olive pomace and pits for energy production
- Evaluation of transportation costs
- Savings in thermal energy supply

In the Republic of Slovenia (RS), there operate twelve registered olive mills processing around 1200 tons of olives per year (depending on the harvest). According to the 2007 Statistical Yearbook of the RS, in 2006 Slovenia boasted 781 ha of intensive olive orchards owned by a number of olive growers (in 2006, their number amounted to 1,639). Owing to ownership fragmentation, it is rather difficult to gather large quantities of pomace and to supply them to interested users who would use them for heating. In order to implement an automatic heating microsystem or a CHP (combined heat and power) system, one needs large quantities of olive pomace, which under given circumstances individual olive growers find them hard to supply.

The data on average annual volume of olives processed in the region of Slovene Istria between 2005–2007 are shown beneath. Table 1 shows annual olive processing by technique.

(Source: *Sonaravno ravnanje z ostanki predelave oljk [Sustainable Management of Olive Residue]*, Annales Publishing House, 2008)

Table 1: Data on olive processing by processing technique

Technique	Olives processed per year (t)	Olive oil produced (t)	Olive residue (t)	Vegetable water (t)
Olive press	284.8	53.81	121	227-284
2-phase process	250.8	48.92	141	200-250
2.5-phase process	688.6	141.87	390	550-688
TOTAL	1224.2	244.6	653	978-1223

Source: *Sonaravno ravnanje z ostanki predelave oljk*, Annales Publishing House, 2008

Table 2 shows moisture content in olive pomace. Moisture contents in olive pomace obtained through the 2-phase and 2.5-phase systems are considerably higher than that in pomace obtained through the traditional method (27.29%).

Table 2: Moisture content in olive pomace and olive residue in tons

Olive processing technique	Moisture content %	Residue with 12% moisture content (t)
Traditional method	27.29	109
2-phase system	65.03	103
2.5 phase system	55.4	297

Olive pomace can be used for heating once it has been dried when its moisture content does not exceed 15%. If not dried, pomace exhibits a lower heating value. To provide an example by analogy with wood: each 10% of water in wood reduce its heating value by 12%, with the difference in energy being used for water evaporation.

In the present business plan, all data on the amount of potential energy are given for heating materials with a 12% moisture content. The same moisture content was exhibited by samples subjected to the measurement of the energy value of olive residue obtained through different olive processing technique. The data obtained were used for all further calculations.

Table 3: Energy value of olive residue

Olive processing technique	Energy value (kWh/kg)
Traditional method	5.15
2.5-phase system	4.56
Olive pits	4.88

Theoretically, the total energy potential of all olive residue in Slovenia is 2,015 MWh, which equals the energy potential of 196,614 l of heating oil. Unfortunately, this huge potential is only poorly exploited. Currently, only around 5% of olive residue is used as a source of thermal energy. According to the data available, only three Slovene olive mills use olive pomace for space heating and sanitary hot water production. Supposing all residue was used for heating and a household (a family house) needed 2,000 l of heating oil per year, the Slovene olive residue would suffice for heating 98 households. At the time being, 95% of residue is returned to olive growers who use it as a fertilizer.

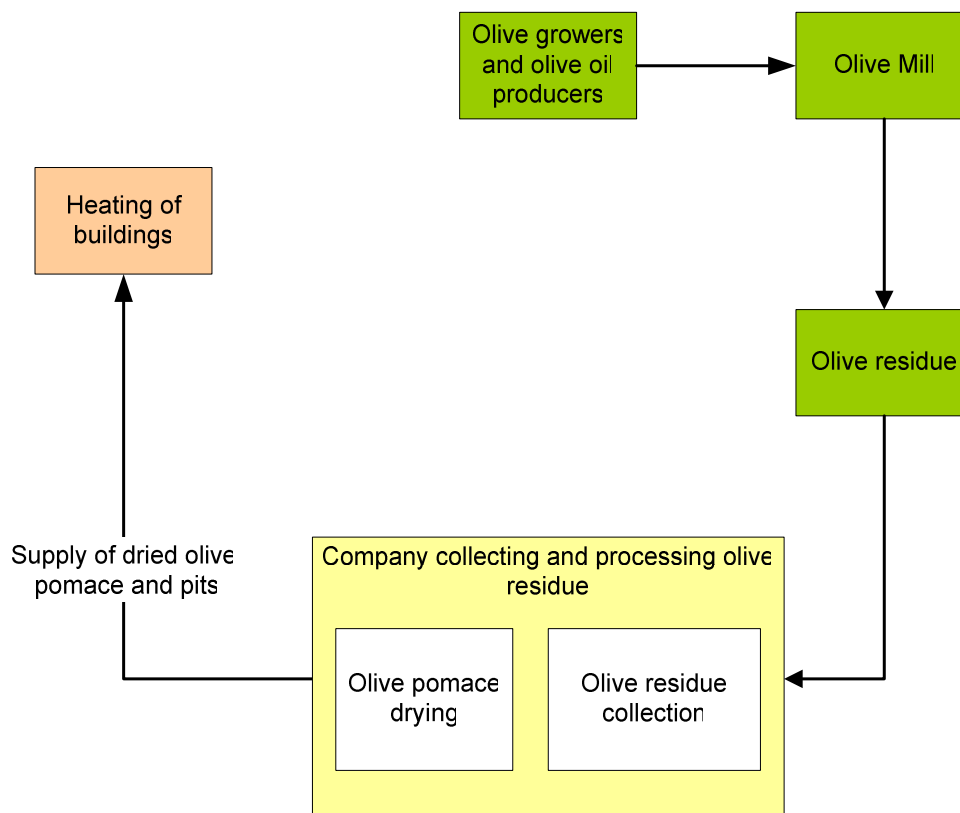
3 ANALYSIS – ŠMARJE PRIMARY SCHOOL

3.1 SUPPLY ANALYSIS

Currently, the Šmarje Primary School (hereinafter: ŠPS) is heated with extra light fuel oil supplied by PETROL, a Slovene energy company.

In accordance with new guidelines of the Republic of Slovenia on the decrease in CO₂ emissions, the City Municipality of Koper is interested in investing in RES in order to modernize the boiler in the ŠPS. With successful promotion of olive residue exploitation for energy-generating purposes requiring sufficient residue supply throughout the whole year, the key role in the residue supply chain would be played by a company purchasing olive residue from olive growers, drying it and supplying it to end-users. Such a supply chain would ensure reliability and timeliness to the end users. In Slovenia, olives are grown only in the Primorska region within a radius of around 25 km (with a few rare exceptions). A strategically located seat of operation would enable such a collection company to cover the entire area of potential olive pomace suppliers.

Figure 1: Chain of olive residue supply for heating purposes



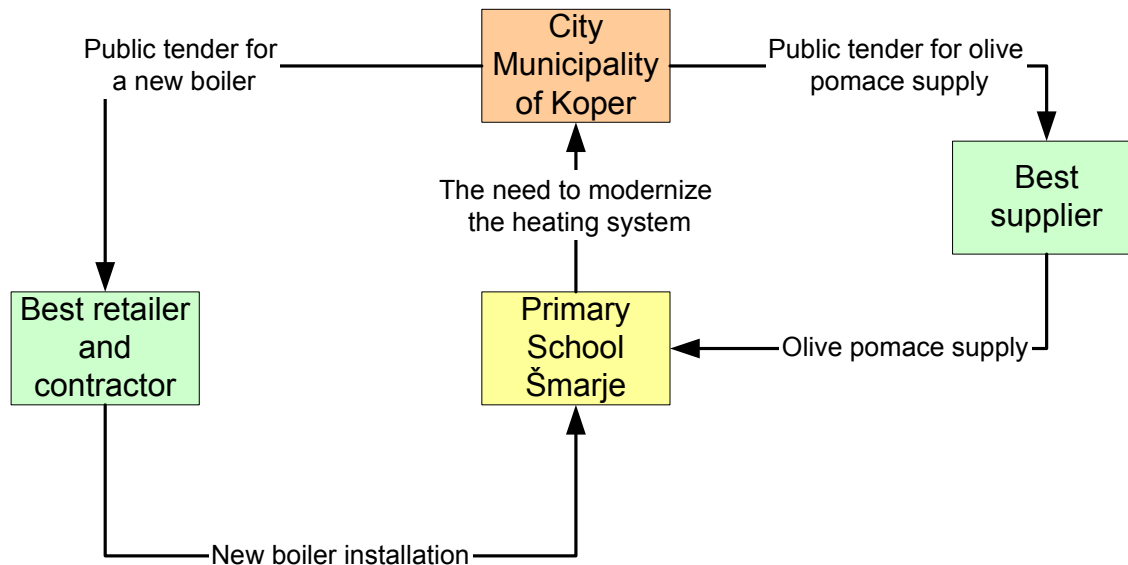
The ŠPS intends to exploit olive residue only for heating purposes and is not interested in implementing a CHP system. The investment will not be financed through subsidies

since currently there is no public tender open. In view of that, the business plan deals with certain items within the same chapter and focuses only on space heating.

3.2 ORGANIZATIONAL AND OWNERSHIP STRUCTURE

As the owner of the ŠPS facilities, the City Municipality of Koper covers all maintenance costs and adopts decisions on financing. The Municipality could issue a public tender in order to choose the supplier of the energy-generating substance, the retailer of the necessary equipment and the contractor in charge of renovation and maintenance. The Municipality is therefore responsible for entire organization.

Figure 2: Scheme of selecting the best contractors for heating a public building



3.3 HEATING TECHNIQUE

3.3.1 Technique Currently Used: Heating with Extra Light Fuel Oil (Variant 1)

The ŠPS is currently heated with extra light fuel oil. The total heated surface area covers 3,368 m², of which 1,040 m² are used for classrooms and teachers' offices, 292 m² for the kitchen and the dining hall, and 636 m² for the kindergarten. The remaining surface area is used for administrative offices, toilets, corridors with staircases and auxiliary rooms. The current boiler room houses two old boilers with a power of 350 kW and low energy efficiency of approximately 70%.

Figure 3: ŠPS and the boilers currently used



In the last five years, the average fuel oil consumption amounted to 31,000 l or 310 MWh of thermal energy, of which 238 MWh were consumed for heating the facility, while the rest was lost owing to poor efficiency of the heating appliance (boiler) and the appertaining equipment.

3.3.2 Heating System Renovation: Heating with Extra Light Fuel Oil (Variant 2)

The renovation would include the replacement of both boilers and other equipment with a modern boiler using fuel oil. New boilers boast a much higher energy efficiency and, consequently, generate lower heating costs. The energy efficiency of the new boiler would be around 93%. The calculation of the thermal energy needed for heating the building was made on the basis of average energy consumption per square metre of heated area in the last five years. The new heating system would be composed of:

- Boiler (400 kW)
- Circulating pumps with frequency regulation
- Automatic regulation system

3.3.3 Heating with Olive Pomace (Variant 3)

According to the Variant 3, the ŠPS would replace extra light fuel oil with olive pomace. Dried olive pomace would be supplied by a company collecting and supplying dried residue. A decrease in the consumption of the energy-generating substance would be achieved by the installation of a less powerful boiler since the two boilers currently used are too powerful. The energy efficiency of the new boiler would be around 93%. The calculation of the thermal energy needed for heating the building was made on the basis of average energy consumption per square metre of heated area in the last five years.

The new heating system would be composed of:

- Boiler (400 kW)
- Olive pomace storage tank

- Storage unit for accumulated heat (2 x 2,000 l)
- Olive pomace feeder (snail)
- Automatic ash disposer
- Circulating pumps with frequency regulation
- Automatic regulation system

3.4 TRANSPORTATION

The Primorska region generates around 700–1000 tons of (fresh) olive pomace per year, with the annual production depending on fruitfulness of olive trees which is affected by several weather-related factors. Transportation costs include the costs of the potential volume of all pomace collected in the area (within a radius of 25 km) plus the costs of combined transport of dried pomace. According to our estimation, the latter range from €7,542 and € 8,977 and include the following two items:

- Removal of fresh olive pomace from olive growers: €5,274 – €6,277
- Delivery of dried olive pomace to buyers interested in using them for heating: €2,269 - €2,700

The calculation is based on a transportation fee of €30/ton per 100 km.

3.5 ECONOMIC AND FINANCIAL ASPECTS

3.5.1 Technical Data

Table 4 shows the comparison of main technical data related to all the three heat generating variants.

Table 4: Comparison of technical data

	Variant 1 (ELFO)	Variant 2 (ELFO)	Variant 3 (Olive pomace)
Thermal energy consumption (MWh/year)	238	238	238
Boilers	Extra light fuel oil: 2 x 350kW	Extra light fuel oil: 400 kW	Olive pomace: 400 kW; heat storage unit: 2 x 2,000 l
Boiler efficiency (%)	70–75%	93%	93%
ELFO consumption (l)	31,000	26,000	0
Olive pomace consumption (t/year)	0	0	54

Heat generation with the technique currently used (Variant 1) requires 31,000 l of fuel oil per year, while heat generation in accordance with Variants 2 and 3 would annually require 26,000 l of fuel oil and 54 ton of dried olive pomace respectively.

3.5.2 Investment

The costs arising from the renovation of the entire boiler room and the implementation of the new heating technique are shown in Table 5. Total costs of the purchase and installation of a modern boiler and its appertaining equipment (Variant 2) would amount to €32,600. Variant 3 envisages the purchase and installation of a new boiler and its appertaining equipment, with their costs amounting to €76,000. In addition, the replacement of the energy-generating substance would require the renovation of that part of the building that would house the olive pomace storage tank, with the estimated costs of relevant construction works amounting to €12,300. Total investment costs prior to the new boiler start-up would thus amount to €88,300.

Table 5: Investment

	Boiler with equipment	Construction costs	Total
Variant 2	€32,600		€32,600
Variant 3	€76,000	€12,300	€88,300

3.5.3 Cost of Energy-Generating Substances

The building consumes 238 MWh of thermal energy per year. Table 6 shows the costs of energy-generating substance for all the three variants: heating with extra light fuel oil with or without system renovation and heating with olive pomace. The annual costs of heating in accordance with Variant 1 (heating with extra light fuel oil, no system renovation) amount to €18,620. The estimated annual costs of heating in accordance with Variants 2 and 3 (extra light fuel oil after system renovation vs. olive pomace) would amount to €15,689 and €6,600 respectively. The calculation was made on the basis of the current price of fuel oil and the envisaged price of olive pomace €26/MWh.

Table 6: Annual costs of energy-generating substances

Annual costs	Variant 1 (ELFO)	Variant 2 (ELFO)	Variant 3 (Olive pomace)
Olive pomace price	/	/	€26/MWh
ELFO price	€62/MWh	€62/MWh	/
Fuel price	€18,170	€15,239	€5,900
Costs of electric energy	€450	450	€700
Total costs of energy-generating substance	€18,620	€15,689	€6,600

3.5.3 Operating and Maintenance Costs

Smooth operation of the heating system requires occasional minor repairs. Operating and maintenance costs are slightly higher in the case of heating with olive pomace (Variant 2). Higher costs arise from the fact that such a heating system needs more frequent maintenance since it is composed of a different type of feeder (the snail operates on machine drive) and a bigger number of components.

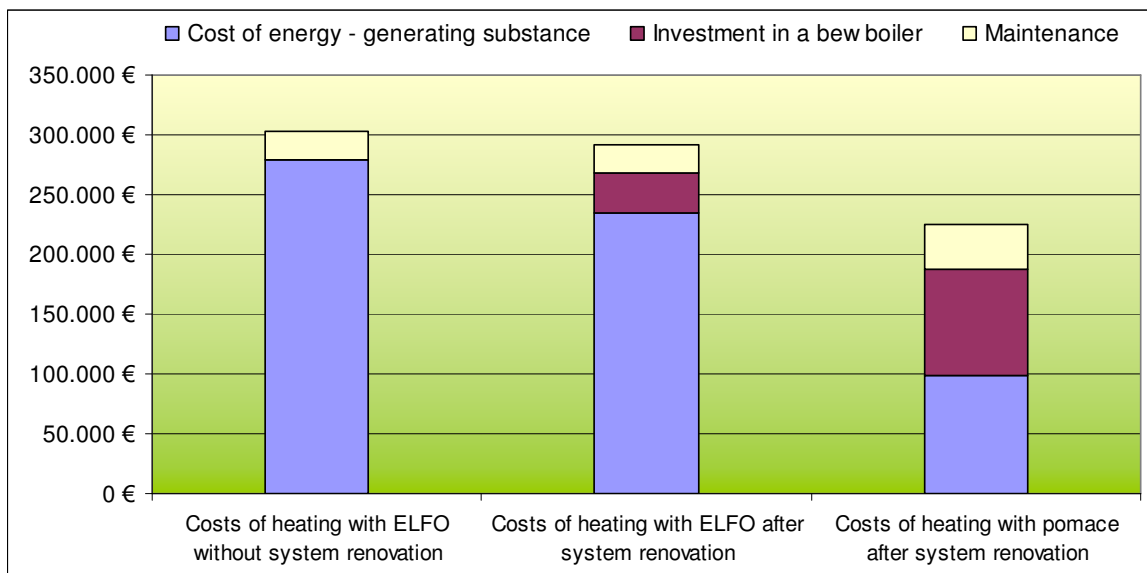
Table 7: Operating costs and labour costs

Annual costs	Variant 1 (Boilers currently used - ELFO)	Variant 2 (Boiler room renovation - ELFO)	Variant 3 (Olive pomace)
Labour costs	€600	€600	€1,100
Other operating and maintenance costs	€1,000	€1,000	€1,400
Total annual operating and maintenance costs	€1,600	€1,600	€2,500

3.6 COST-BENEFIT ANALYSIS

Diagram 1 shows annual costs of heating for both variants (extra light fuel oil vs. olive pomace) for the next 15 years. Variant 1 envisages that the existing system of heating with extra light fuel oil will stay in use and, consequently, there will be no need to renovate the boiler room and to purchase a new boiler. The costs of heating and maintenance within the next 15 years would then amount to €303,000. Variant 2 envisages the boiler room renovation and the use of the same energy-generating substance (fuel oil). In this case, the estimated costs of investment, maintenance and the energy-generating substance would amount to €291,235 in the next 15 years. Variant 3 (heating with olive pomace) envisages the renovation of the boiler room, the installation of the new equipment and the use of a new energy-generating substance, with estimated total costs for the same period amounting to €224,800. The calculation was made on the basis of the current price of fuel oil and the envisaged price of olive pomace.

Diagram 1: Heating costs within 15 years – ŠPS



For the envisaged period of 15 years, the difference between total costs of heating with extra light fuel oil after system renovation and heating with olive pomace amounts to €67,135, with the latter being more economical than the former. The calculation was made on the basis of the current prices of the two energy-generating substances and regular maintenance of the heating systems. However, it has to be stressed that an increase in the price of fossil fuels would automatically lead to an increase in the price of renewable energy sources (RES). In this case, the RES prices would change in accordance with the situation on the market.

4 CONCLUSION

In conclusion, it has to be emphasized that in future large quantities of olive pomace obtained through olive oil processing will pose a major problem to olive oil producers. The pomace will still be partly deposited over the soil in olive orchards, while the rest could be carted away to the nearest dumping area, which however is not reasonable. (Relevant Slovene legislation still regards olive pomace as waste and does not encourage new investments.) Therefore it is highly recommendable to encourage the exploitation of olive pomace and pits for energy-generating purposes. Thus we will not only diminish the use of fossil fuels and decrease the quantity of waste deposited in dumping areas, but also protect the environment from pollution. Successful implementation of the project proposed will be the best promotion of the use of olive pomace as a RES.

5 LIST OF TABLES, DIAGRAMS AND FIGURES

5.1 LIST OF DIAGRAMS

Diagram 1: Heating costs within 15 years – ŠPS.....	11
---	----

5.2 LIST OF TABLES

Table 1: Data on olive processing by processing technique	3
Table 2: Moisture content in olive pomace and olive residue in tons	3
Table 3: Energy value of olive residue	4
Table 4: Comparison of technical data.....	8
Table 5: Investment	9
Table 6: Annual costs of energy-generating substances	9
Table 7: Operating costs and labour costs.....	10

5.3 LIST OF FIGURES

Figure 1: Chain of olive residue supply for heating purposes	5
Figure 2: Scheme of selecting the best contractors for heating a public building.....	6
Figure 3: ŠPS and the boilers currently used.....	7