PROPELLETS PROJECT

DELIVERABLE N.7

Publishable result-oriented report

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Co-ordinator: ESCAN, S.A. (ESCAN)

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- Jyväskylä Innovation Oy (JI)
- Renewable Heat & Power Ltd. (RHPL)
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1. INTRODUCTION

The Publishable result-oriented report presents the knowledge and experience acquired during the development of the PROPELLETS Project. Results from previous Work Packages and particularly from the Pilot actions (pilot projects) promoted in each region by partners and regional working groups, have provided updated information on the medium size pellet boilers market in the five European Regions of the partners:

- Region of Asturias in Spain
- Region of Upper Austria
- Region of Central Finland
- Region of Southwest England
- Region of the Province of Florence

The five European Regions present different pellets heating systems development levels, and also different pellets market level. We find well-developed regions as Upper Austria, where traditional oil boilers are no more installed, and they have been substituted nowadays by pellets boilers as the most common system. On the opposite side we can find Spain, where only a few hundred of small and medium size pellets heating systems are running at present in one family homes and small buildings, but with a great potential in the close future. Finland, UK and Italy, in this order, are the ones in the middle, with an increasing number of pellet heating systems each year.

Nevertheless, the typically end-users found in all PROPELLETS regions, as the most attractive and inserted in acquiring small to medium-size pellets heating systems have been:

- Municipal and Community buildings as City Councils, schools, public services buildings, churches, nature dedicated facilities, etc.
- Hotels, Rural Houses, restaurants and similar (services)
- Private flats buildings or big houses
- Fairgrounds
- Small industries, particularly those dedicated to wood issues, or in areas with traditional wood culture
- Offices buildings

In this report it is presented the integration and analysis of the activities developed during the project in each partners region, including the updated situation of the Pilot units promoted, including:

- Existing barriers and incentives to install pellet heating systems
- Best practices found in the region or country
- Pilot actions developed due to PROPELLETS
- Critical comparison of the results of D2 report and the experiences gained in WP3 and WP4
- Main Conclusions and recommendations to help the overcoming of barriers found, in order to implement pellet heating units in the target sectors.
2. RESULTS IN REGION OF ASTURIAS (SPAIN)

2.1. OVERVIEW

PROPELLETS project main objective in the Region of Asturias was focused on starting the pellet heating systems market in the region, considering as key objectives pellet heating systems supply and installation, pellets supply availability, funding incentives establishment, promotional activities organisation and advising to new market actors.

Since the start of the project, Spanish national leader, ESCAN, involving all actors of PROPELLETS Spanish Cluster (36 members by June 2007), has studied, analysed and promoted the installation of 17 pilot heating systems in the Region. The importance of these heating systems in Asturias has been the demonstration of their technical-economic feasibility, and their use for dissemination and promotion of pellets heating systems in the region.

The improvement of the situation of pellets heating systems installed in the region is summarized as follows:

In year 2004, before the starting of the project, no heating systems fuelled with pellets were running in the region of Asturias, and the general awareness on automatic biomass systems was very low. Also, there was interest in the valorisation of regional biomass by different actors, but there was little information, and lack of coordination in the actions.

In year 2005, with the constitution of the Spanish Cluster by PROPELLETS, 10 pellet projects were analysed, 4 of which were funded by the Regional Government (also member of PROPELLETS Spanish working group) and are at present installed. This year, in coordination with the project, the Regional Government launched a pellet heating systems funding line providing approx. 80% subsidies for Municipalities and 30% for private consumers.

Also, the project is presented in Asturforest 2005 (in June), main biomass fair in Tineo (Asturias), and in the Technical Workshops organised by ENERNALÓN (Local Energy Agency) in November.

In year 2006, in agreement with PROPELLETS, a new funding line for pellet boilers was launched by the Regional Government, providing 150-200 €/kW installed. The number of installations under study in the region by PROPELLETS working group was of 20, and new key actors are joining the Cluster (36 members). The number of projects approved was of 13. The socio-economic environment is also positive, and several feasibility studies on pellet mills are being made in the region, also supported by PROPELLETS.

During 2007, the total installed power promoted is over 5 MW, and the schedule is that many new installations will be handled during the coming years.

The summary of the installations by 2007 is:
In year 2007 it is expected double again the power installed projected in the region, with an optimistic forecast of the project’s overall result. The summary of the installations promoted is:

![Table showing installations](image)

Project results will come out also during 2008-2009, as a project typically last for 12-18 months. By the end of the project, it is expected to have the seed of a “pellets heat sustainable economy” in the region, with over 1 MW pellet heating systems power installed. By year 2009, at least 10 MW could be installed considering the projects under development, due to PROPELLETS.
2.2. EXISTING BARRIERS AND INCENTIVES

Pellet heating systems are not yet a common way of heating homes in Spain. PROPELLETS has showed where are the main barriers in Asturias which reduce the degree of development of the project, and also where have been found positive aspects that should be used in order to better promote new installations. Moreover, actions to make the most of these positive aspects and overcome barriers have been provided.

In Spain, both pellets market and pellets heating systems market are at the very first steps. There is still general lack of knowledge on these biomass technologies that will obtain the benefits of PROPELLETS project results in the next years.

If we compare the Spanish situation with other EU27 countries, we can find that market (pellets and biomass boilers) is in the early stage of development, but with a stable continuous increase. Also, Spain will start to grow faster in the following years due to two key aspects: a) the continuous increase in the profitability of pellets systems when compared to electricity energy and oil, and b) the interest showed by private companies in developing the market. Concern on biomass uses in national, regional and local Governments will also provide interesting tools (mainly through institutional support and funding) to favour pellets heating system market.

It should be underlined that by the end of 2007 there will be six energy pellet plants producing in Spain, one in Galicia, one in Vasc Country, one in Catalonia, one in Andalusia, and two in Toledo (many more are projected, but its not clear their final installation). These pellet mills will produce 100.000 – 150.000 t/year, compared to the production of 25.000 – 35.000 t/year in 2006.
These plants could provide pellets to several thousands of pellet heating systems, but only a few hundreds are installed in Spain at present. Therefore the bigger effort should be made in the boilers side (national pellets demand) that could consume those pellets, but also in the pellets production side to reduce pellets price at regional level.

Some key information of the situation of Spanish market at present would be:

- Pellets prize (to customers) is 140-200€/t, lower than EU27 average, and much lower than EU15
- Price of heat produced by pellets is at least 30% cheaper than oil, and five times lower than electricity
- National production is over 150,000 t/year in 2007, that could (e.g.) supply fuel to 4,000 boilers with 200 kW installed power
- National consumption at present is lower than 5% of production -> Spain exports to Portugal, Ireland, United Kingdom, Italy, France, Central European countries... There can be expected an important increase in the production if coal power plants start to co-combust with pellets.
- National boilers available up to 1,000 kW, but not efficient yet. Bigger efficient boilers are from Austria KWB, up to 500 kW which is the limit power for efficient pellets boilers at present. These boilers are usually very expensive for Spanish end-users.

Even when pellets heating systems investment could be higher than other traditional systems, it should be considered the duration of the system and the total figures considering system life. A heating system running for 20 years of production would have the following main costs (percentages):

- System cost: 17%
- Energy: 77%
- Maintenance: 6%

So, even whether system investment cost would be higher of another possibility, reduced energy price obtained with pellets would make the system profitable.

Furthermore, initial investment could be favoured by public funding (Regional Government, National Energy Agency), by providing an interesting percentage even up to 30% for private investment.

Also, there is a possibility of making an agreement with an Energy Services Company (ESCOs) which manages the installation, pellets supply, maintenance, and maybe financing. In this type of service, the ESCO assumes the risk for the whole facility and fuel supply, and the customer becomes an external observer of the heating system.

During the development of the project, a SWOT analysis was performed. The main actions presented in the conclusions of the study, which have been applied to PROPELLETS, are:

- PROPELLETS favours new companies to be boilers installers and distributors, and will have permanent contact with them to assure quality. Also ESCOs will be promoted.
PROPELLETS favours business contacts to obtain other boilers with main European manufacturers (at present contacts with Austria and Finland). There was developed an International Business Mission within the project in 2006.

In order to advice end users, PROPELLETS favours contacts with pellets producers to have real information about pellets availability and expected prizes. Information interchange through a new pellets association would favour market estability. Pellets might be distributed by biomass boilers distributors, assuring its availability. New pellet plants are expected in the region.

Research on new matters will be promoted by PROPELLETS, mainly by University of Vigo, member of the cluster, and ESCAN.

Adviceing by consulting companies and Energy Agencies to end-users is necessary. Also Best Practices and Pilot Projects have to be disseminated when starting the market to avoid bad practices. Technical tours or exhibitions should be promoted at regional level.

PROPELLETS favours technology and training transfer from other countries (by boilers manufacturers)

PROPELLETS favours contacts among key actors, in order to increase pellets production in Northern Spain. It is considered that this increase could reduce pellets prize to customer.

A new pellet plant is under study (first steps) by PROPELLETS Cluster. Sustainability for the region must be analysed.

Incentives by Regional Government are necessary for the first units to be installed (pellets heating systems). This units should be showed (as new best practices) to other potential end-users.

PROPELLETS dissemination is critical for pellet heating systems promotion, due to the low knowledge existing on this sector.

2.3. BEST PRACTICES

1- Biomass heating system replacing coal in a building situated in Madrid (Spain)

The Region of Madrid imports almost 97% of the total energy demand. The production with renewables is scarce, so projects aimed at the production of heating and hot sanitary water are relevant.

A best practice project developed in Madrid has been the substitution of an old coal boiler for a new biomass boiler. The boiler provides heating to 20 flats of 250 m², with a total installed power of 460 kW (information provided by CALORDOM).

The technology of the heating system is Spanish, and the efficiency is over 85%, with a relatively low investment cost.
2- **Mixed biomass and solar system in a hotel in Tarragona (Spain)**

A very good example of biomass use in Spain and sustainable development was the installation of a mixed biomass-solar system in the Hotel Flamingo**** in Tarragona (Spain). The initial solar system was integrated with a new boiler room with two biomass boilers of 100 kW (KWB). With this installation the hotel covers all its hot sanitary water and heat demand during the whole year. The installation obtained subsidies from the Regional Government, and has won the prize “Eurosolar 2005” (Information provided by NovaEnergía).

2.4. **PILOT ACTIONS**

1- **Fuel oil heating system replacement in the village of Villanueva de Oscos, covering the school, the elderly people building and the civic centre. (Asturias)**

Villanueva de Oscos is a village located in the west part of Asturias, with a population of 500 inhabitants, and a typical agricultural and cattle raising economy. The interest of the local authorities in keeping this rural environment has favoured these projects of the substitution of an old oil boiler by a pellets technology.

Buildings capacity is 170 people, 70 at school, 50 at elderly people centre, and 50 at civic centre.
Elderly people building

Construction characteristics: The buildings were mainly constructed with local stone in 1995, with double-glazing. Quality of isolation is high.

Heating installation at present is an oil boiler 15-20 years old with 105 kW installed power, over-designed. Heat emitted by radiators, in good conditions. The yearly fuel consumption estimated is of 10,000 litres of gas-oil (0,65 c€/l)

The pellets boiler selected, to substitute the conventional oil boiler, has been TATANO model K2206 with 80 kW maximum power, and an inertia tank (600 l). The heat will be distributed by using the present pipes and radiators (aprox. 40 units), as they were updated in year 2003.

Main characteristics of pellets that will be used:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>1.12 kg/dm$^3$</td>
</tr>
<tr>
<td>Calorific power</td>
<td>18-19 MJ/kg</td>
</tr>
<tr>
<td>Diameter</td>
<td>5-6 mm</td>
</tr>
<tr>
<td>Length</td>
<td>Max. 30mm</td>
</tr>
<tr>
<td>Water content</td>
<td>Max. 10,0 %</td>
</tr>
<tr>
<td>Ash content</td>
<td>Max. 0,5 %</td>
</tr>
<tr>
<td>Fines</td>
<td>Max. 2,3 %</td>
</tr>
<tr>
<td>Made of</td>
<td>Natural wood</td>
</tr>
</tbody>
</table>

As there is not production of pellets in Asturias at the moment, pellets will be 100% imported from other Spanish regions. To start, pellets will be supplied by a Pellets producer in south Spain, and distributed by a local pellets distributor (AMA). Pellets will be supplied in bulk (truck).

Boiler: the main feature is its power range, an example of other significant features is:
Other heating system main characteristics:

- **Heat exchanger:** The boiler has a two steps horizontal heat exchanger with manual boiler tube cleaning system.
- **Regulation system:** Combustion performance is calculated by the control system considering the composition of pellets. The control system is simple.
- **Noise:** No relevant information on noise available.
- **Complete ash removal from the firebox to a ash container of 25 l volume.** It has to be removed manually. The ashes will be used as fertilizer in local gardens.
- **Safety heat exchanger:** In case of need of reducing residual heat temperature, the safety heat exchanger comes into operation reducing water temperature.
- **No emissions data provided.**
- **Performance = 85-90%**
- **Measurements of the boiler’s room:** The boiler room is l x b x h (meter) = 5 x 2 x 3,5
- **Planned storage system:** The storage system selected is a silo in a room next to the boiler. The storage capacity has been calculated considering two supplies per year: Pellets consumption per year: 20 t. Considering three supplies, storage capacity: 7 t. Volume corresponding to 7 t: 10,5 m3. Built storage of 4,0 x 1,7 x 2,5 meters

**Investment** costs for the pellets heating systems, including boiler, auxiliaries, silo for storage construction, feeding system and connexions to distribution is approximately 30.000 Euro.

Considering the substitution of direct oil combustion to pellets combustion, the reduction corresponds to 2,6 kg/l oil. The amount of oil substituted is 9.870 litres, so the CO2 reduction is equivalent to 25,7 tCO2/year

*If the heating system had been electrical, the CO2 reduction (considering 0,8 kgCO2/kWhe) would have been 79 tCO2/year.*

**2- Pellets-solar heating system in Quientes (Asturias), substituting electric system radiators and hot water production.**

Quientes is a residential area close to Gijón (200.000 inhabitants). This is a village located in the west part of Asturias, and the end-user had two options: an electric radiators system and electric hot water production or a pellets boiler system and solar panels. The house was constructed during 2006, and the pellets system was also installed during this year.
Quientes is in the west part of Asturias, with a population of 200 inhabitants, and a typical agricultural and cattle raising economy.

Mixed Pellet and Solar System

Construction characteristics: Buildings constructed with expanded cly bricks, with rock wool isolation and. Quality of isolation is high.

Pellets boiler selected has been KWB easyFire USP 25kW, due to the good quality of the boiler together with the compact design. Also the fact of having a local distributor and maintenance company (EOSOLAR) has been important in this section.

Main characteristics of pellets that will be used:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>1.12 kg/dm^3</td>
</tr>
<tr>
<td>Calorific power</td>
<td>18-19 MJ/kg</td>
</tr>
<tr>
<td>Diameter</td>
<td>5-6 mm</td>
</tr>
<tr>
<td>Length</td>
<td>Max. 30mm</td>
</tr>
<tr>
<td>Water content</td>
<td>Max. 10,0 %</td>
</tr>
<tr>
<td>Ash content</td>
<td>Max. 0,5 %</td>
</tr>
<tr>
<td>Fines</td>
<td>Max. 2,3 %</td>
</tr>
<tr>
<td>Made of</td>
<td>Natural wood</td>
</tr>
</tbody>
</table>

There is not production of pellets in Asturias at the moment, so pellets will be 100% imported from other Spanish regions. To start, pellets will be supplied by a Pellets producer in Galicia, and distributed by a local pellets distributor (EOSOLAR). Pellets will be supplied in bulk (truck).

Boiler: the main feature is its power range, an example of other significant features is:
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>25 kW</td>
</tr>
<tr>
<td>Weight</td>
<td>518 kg</td>
</tr>
<tr>
<td>Heating surface</td>
<td>- m²</td>
</tr>
<tr>
<td>Max. Operating pressure</td>
<td>3 bar</td>
</tr>
<tr>
<td>Setting range boiler temperature</td>
<td>70-95 ºC</td>
</tr>
<tr>
<td>Combustion efficiency</td>
<td>89-93%</td>
</tr>
<tr>
<td>Depth</td>
<td>860 mm</td>
</tr>
<tr>
<td>Width</td>
<td>1160 mm</td>
</tr>
<tr>
<td>Height</td>
<td>1430 mm</td>
</tr>
<tr>
<td>Exhaust gas temperature at max. nominal output</td>
<td>160 ºC</td>
</tr>
<tr>
<td>Exhaust gas temperature at min. nominal output</td>
<td>100 ºC</td>
</tr>
<tr>
<td>Electrical performance of ignition</td>
<td>- kW</td>
</tr>
<tr>
<td>Max permissible water contents in fuel</td>
<td>12 %</td>
</tr>
</tbody>
</table>

Other heating system main characteristics:

- Heat exchanger: Three-way, single-flue system that combined with the firing system allows efficient exploitation of the fuel. Turbulators with cleaning function for exchanger surfaces ensure high efficiency without the need for operation. The water-transport system surrounding the burner and the all-round heat insulation minimise heat radiation in operation and during system standstill. All system components are accessible thanks to the simple design.

- Regulation system: All settings can be made with a two-button control in combination with a scroll wheel. The operator is constantly menu-guided. Depending on heat requirements, boiler output is adjusted fully automatically in exactly calibrated stages from standby to full load. The regulation platform is modular in design and expandable. The control system heart is the KWB Comfort 3.0 regulation by microprocessor.

- Noise. No relevant information on noise available. The installation manual from KWB guides to reduce noise effects.

- Ash management: Ash is removed from the system with an easy to handle ash box. All ash fractions from the burner and heat exchanger are collected here without the need for additional mechanical apparatus. The integrated ash compressor extends emptying intervals considerably and ensures increased convenience. The ashes will be used finally as fertilizer in local gardens.

- Security systems. The KWB safety system is multi-stage, each stage being stand-alone, easy to control and consists of the following elements:
  - Backfire-proof and flashback-proof, gas-tight fire shutter that closes without power
  - Drop zone
  - Fuel delivery temperature monitoring
  - Safety temperature limiter
  - Capacitive overfill protection cover in the hopper
  - Electronic monitoring of firing
  - Additional fuel duct for suction systems

  The software constantly monitors proper functioning of the safety system components. In unusual situations, e.g. lightning strikes or power failure, the fire shutter and safety temperature limiter remain fully functional.
The boiler room has been constructed with fireproof door and windows, protected electric system, ventilation system, emergency switches out of the room and manual fire extinguisher.

Investment costs for the pellets heating systems, including boiler, auxiliaries, silo for storage construction, feeding system and connexions to distribution was of approximately 20,000 Euro.

Considering the substitution of a direct gasoil combustion heating system by pellets combustion, the CO2 reduction corresponds to 2.6 kg/l gasoil. The amount of gasoil substituted is 3.120 litres, so the CO2 reduction is equivalent to 8.1 tCO2/year.

If the heating system had been electrical, the CO2 reduction (considering 0.8 kgCO2/kWhe) would have been 25 tCO2/year.

3- Fuel-oil heating system substitution by a Mixed Pellet-Solar heating system in a Rural House

Deva is a village located in the east part of Asturias, close to the Gijón and the seaside, and with a population of 490 inhabitants. The end-user had two options to change his old wood heating system: an oil boiler or a pellets boiler. This particular family have interest in protecting their rural environment and are aware about the use of renewables, and they choosed a mixed solar-biomass system. The heating system was installed during year 2006.

Biomass installation overview

Construction characteristics: The house, composed by two floors of 225 m2, with medium isolation. The old heating installation was an oil boiler 20 years old with 60 kW installed power, and very low efficiency. Heat emitted by radiators, in good conditions. Yearly fuel consumption: 60 tons of local wood

Pellets boiler selected has been a Tatano K2204 50 kW, due to good relation quality-investment. The boiler distributor (AMA) will provide maintenance service. An inertia tank (600 l) was also installed.

Main characteristics of pellets that will be used:


<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>1.12 kg/dm$^3$</td>
</tr>
<tr>
<td>Calorific power</td>
<td>18-19 MJ/kg</td>
</tr>
<tr>
<td>Diameter</td>
<td>5-6 mm</td>
</tr>
<tr>
<td>Length</td>
<td>Max. 30 mm</td>
</tr>
<tr>
<td>Water content</td>
<td>Max. 10.0 %</td>
</tr>
<tr>
<td>Ash content</td>
<td>Max. 0.5 %</td>
</tr>
<tr>
<td>Fines</td>
<td>Max. 2.3 %</td>
</tr>
<tr>
<td>Made of</td>
<td>Natural wood</td>
</tr>
</tbody>
</table>

**Boiler:** the power range is the main characteristic. Other significant features are:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>46 kW</td>
</tr>
<tr>
<td>Max. Operating pressure</td>
<td>3 bar</td>
</tr>
<tr>
<td>Setting range boiler temp.</td>
<td>70-95 ºC</td>
</tr>
<tr>
<td>Combustion efficiency</td>
<td>85-90%</td>
</tr>
<tr>
<td>Depth</td>
<td>920 mm</td>
</tr>
<tr>
<td>Width</td>
<td>1430 mm</td>
</tr>
<tr>
<td>Height</td>
<td>1130 mm</td>
</tr>
<tr>
<td>Electrical performance of ignition</td>
<td>- kW</td>
</tr>
<tr>
<td>Max permissible water contents in fuel</td>
<td>12 %</td>
</tr>
</tbody>
</table>

**Other heating system main characteristics:**

- **Heat exchanger:** The boiler has a two steps horizontal heat exchanger with manual boiler tube cleaning system.
- **Regulation system:** Combustion performance is calculated by the control system considering the composition of pellets. The control system controls the production of hot water by the solar system + pellets system, and feeds the boiler according to overall demand.
- **Noise.** No relevant information on noise available.
- **Ash management:** please indicate where the ash is stored and its treatment.
- **Complete ash removal from the firebox to a ash container of 25 l volume.** It has to be removed manually. The ashes will be used as fertilizer in local gardens.
- **Security systems.** Safety heat exchanger: in case of need of reducing residual heat temperature, the safety heat exchanger comes into operation reducing water temperature.

Investment costs of the heating units, auxiliary system, regulation system, storage facilities, feeding system and accumulators for biomass, and also solar system, was of 20.000 Euro (VAT excluded).

Considering the selection of pellets instead of gasoil, the CO2 reduction corresponds to 2,6 kg/l gasoil. The amount of gasoil not consumed is 8.350 litres, so the CO2 reduction is equivalent to 21,7 tCO2/year.

If the heating system had been electrical, the CO2 reduction (considering 0,8 kg CO2/kWhe) would have been 66,8 tCO2/year.

**4- Base load partial Fuel-oil heating system substitution by a Pellet heating system in a Hospital**
The Hospital “Oriente de Asturias - Fundación Francisco Grande Covián”, is located in Arriondas, main city of the Municipality of Parres, with a population of 5,500 inhabitants. The hospital provides health care to 58,000 inhabitants and visitors of the Western part of Asturias. It is open 24 hours a day, 365 days per year.

The Municipality of Parres has a strong cattle raising economy, particularly from cows, even when during the last years tertiary sector was strongly developed, being at present the administrative and services centre of the Western part of Asturias.

Hospital general overview

Construction characteristics: the hospital has a high level of isolation, but big energy consumption due to the high occupation.

Pellets boiler selected: at present the building has two boiler rooms to provide heating and sanitary hot water to the hospital, adding almost 1,750 kW of installed power. In order to partially substitute this power, the hospital has installed one pellet boiler Buyo 500 kW that will provide the base load. The heat will be distributed by the present distribution system.

Main characteristics of pellets (and alternative biomass) that will be used:

<table>
<thead>
<tr>
<th>Biomass</th>
<th>Pellets and olive stone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>700 kg/dm³</td>
</tr>
<tr>
<td>Heating value</td>
<td>18 MJ/kg (pellet) a 20,5 MJ/kg (olive stone)</td>
</tr>
<tr>
<td>Moisture Max.</td>
<td>10,3 %</td>
</tr>
<tr>
<td>Ash content Max.</td>
<td>1,4 % a 550ºC (olive stone) and &lt;0,5% pellet</td>
</tr>
</tbody>
</table>

Main characteristics of pellet boiler:
Power 465 kW
Max Operating pressure 3,2bar
Water temperature 110ºC max.
Combustión efficiency 88,2 %
Moisture content in biomasa (max) 35 %

Other heating system main characteristics:

- Heat exchanger: for 400 kW, will be installed in the Hospital boiler room.
- Regulation system: Digital control system SEDICAL MCR50
- Noise: 90 DB, at 1 mo
- Ash removal: automatic by a screw
- Security system: automatic control of pressure in the combustión chamber, press control and measures listed in the current regulation for pressure vessels.
- Emissions (according to manufacturer): 250 ppm al 11% O2; 250 ppm CO al 11% O2; 150 mg/normal m3 partículas en suspensión al 11% O2
- Performance: 88,2 %

Investment costs of the heating units, auxiliary system, regulation system, storage facilities, feeding system and accumulators for biomass, and also solar system, is estimated in 100.000 Euro (VAT excluded).

Considering the selection of pellets instead of gasoil, the CO2 reduction corresponds to 2,6 kg/l gasoil. The amount of gasoil not consumed should be 100.000 litres, so the CO2 reduction is equivalent to 260 tCO2/year.

If the heating system had been electrical, the CO2 reduction (considering 0,8 kg CO2/kWhe) would have been 800 tCO2/year.

2.5. ANALYSIS AND GAINED EXPERIENCE

PROPELLETS project has presented a strongly dynamic market in Spain in the last three years, compared to the previous situation. The results presented in the development and conclusions of D2 “Market Analysis” were quite precise of the situation and the activities necessary to promote the pellets heating system market, probably favoured by the fact that the key actors were involved in the project activities afterwards.

Some representative comparisons of the results coming from D2 “Market Analysis” and the experiences gained in the subsequent Work Packages WP3 “Pilot Actions” and WP4 “Educational Sessions” are:

- Pellets production and distribution: There are enough pellets to supply the end-users which install a pellet heating system in every region in Spain. Pellets are provided both by pellet heating systems distributors and pellets producers directly as there is not a pellet distribution system. Pellets cost, from 150-200 €/t is competitive with oil and electricity, and similar than gas. End users have still not much aware on using pellet systems due to little information available. New pellet plants are in project in Asturias, and being installed in other regions.

- Pellet heating systems: Pellet boilers, or pellet heating systems, are now available in Spain, for any installed power needed. There are mainly two typical installations, the one with a medium quality Spanish or Italian boiler (85% efficiency) with a medium investment cost, and higher maintenance, and the Austrian boilers (>90%
efficiency) with a very high investment cost and very low maintenance. Both are
starting its penetration in the Spanish market. The information interchange with
other European countries involved in the project has been determinant in it,
particularly with Austria.

- Socio-economic factors: Regions with tradition in wood or agro exploitations are
  more open to biomass activities. New business on biomass, as installers,
maintenance and energy companies, as well as biomass distributors starting to
work, and together with other key actors as Regional Government, are pointing at a
sustainable development in the region of Asturias and employment favour. Also,
there is still some thinking by general people as "biomass = low development" that
should be avoid by keeping dissemination and information activities at all levels.

- Quality and service: While pellets market is starting, a strong quality and service
  control should be made to avoid bad examples in the new projects developed. At
  present, the new pilot actions in Asturias have been supervised by PROPELLETS
  and quality is high, but it could be expected a decrease in this matter when many
  more installations are developed at the same time. Some actions that should favour
  quality and service are the improve of the training in the installers and maintainers
  of pellets systems, the supervision by experts of the new installations carried-out,
  and the advising by engineering and consulting firms in the new projects.

- Legal and institutional factors: Pellets market should be considered relatively as
  new in Spain, so there is still very low knowledge on regulation for biomass heating
  systems in houses and buildings. This usually leads to delay in acceptance of
  projects, and sometimes can cause problems in later installation development. As a
  main, times for administrative documents are very slow, and can lead to changes in
  minds of end-users that wish to have funding before the beginning of the
  installation. The change in this situation should be conditioned by existing
  regulation in other European countries, as Austria, where Ö-Norms for biomass and
  pellets are working at present.

- Environmental factors: One of the benefits of installing pellet heating systems is the
  improvement of the environment. Together with the better economic figures
  presented when compared to oil and electricity heating, this should be clearly
  promoted to favour its market. Environmental results can be even better than
  expected if we substitute an old conventional energy system, with low efficiency
  (typically 60-70%) by a new high performance pellet system with over 90%
  efficiency. Also, regulation in Spain is still scarce, and only conditions for particles
  and CO are predominant, although too strict regulations are not recommended.

2.6. CONCLUSIONS AND RECOMMENDATIONS

Pellet heating systems are a reality in the Region of Asturias at present. A strong effort
has been made in integrating Public Administrations, energy agencies, companies,
associations, and other key actors efforts in the direction of covering end-users needs
and interests.

Some later barriers found have been the confidence by end-users on the distribution of
pellets for their new systems and the own pellets distribution, still scarce in the region.
Also pellets boilers have a high investment cost for the average Spanish family
economy, and this may delay the market penetration. The dedication of economic
resources by new pellet companies and associations, will result in the availability of
new trucks for pellets distribution (2007) and probably at least a new pellet plant by 2008, enough to stabilize the regional market.

Two important incentives of pellet heating systems are the lower cost of pellets when compared to gasoil, and their ecological sense. Also, the good performance of the already installed systems gives confidence both to installers and end-users about their implementation in other places.

Most of the main importers and distributors of the pellet systems are also providing a very good service to their professionals and customers, and advising for the first units installed has been helpful.

The creation of new regional biomass platforms and associations would be helpful for the market stabilization, as they could provide practical information, advising, bring new products to the regional market, manage pellets supply (e.g. buying one truck to share by several companies), assuring the supply by preparing good agreements with producers, etc.

3. RESULTS IN UPPER AUSTRIA

3.1. OVERVIEW

In Upper Austria, the wood pellet market development experienced a rapid growth within the last years. Basis of this successful market development is – in addition to a range of businesses which are active in this field and which have their headquarters in the region – the implementation of a comprehensive mix of measures, ranging from information & awareness raising activities and training & education measures to subsidies and R&D and quality control. Right from the beginning, the Upper Austrian market development was driven by consumer interest, supported by the regional government and the R&D efforts of the boiler producers to improve the technical performance of installations. The ambitious goal of doubling the share of modern biomass heating systems until 2010 was defined by the Upper Austrian government through the regional energy action plan.

Additionally, the Upper Austrian network of green energy companies “Ökoenergie-Cluster” (OEC), managed by the O.Ö. Energiesparverband, supports the market development by well targeted promotion measures to improve the quality of supply.

Although pellet heating systems were very well established in the small-scale sector – more than a third of new built one-family-houses are equipped with a pellet heating system – there was low demand in the mid to large scale sector due to lack of awareness and trust in the possibility of using pellet installations in this scale from the majority of potential users.

In 2005, when the PROPELLETS project started, 2,100 new pellet heating systems were installed and during the year of 2006, 2,400 new pellet heating systems were set
up in Upper Austria. In total, Upper Austria has approximately 12,000 pellet heating systems installed.

The figure below shows the tremendous increase during the last few years:

![Pellets Central Heating Systems in Upper Austria](image)

Some figures characterising the Austrian and Upper Austrian pellet market situation are:

- Pellet production capacity in Austria increased from 2,500 t (1995) to 600,000 t (2006).
- There are 15 large-scale producers of wood pellets and a wide network of trading companies.
- 15 companies of biomass boilers more than 1,500 employees produce a turnover of nearly half a billion € – in total, there are about 30 pellet boiler manufacturers in Austria (most of them active in the small-scale sector). They are European export leader - their export share is more than 50 %.
- 5 Upper Austrian (out of 10 Austrian) pellet boiler companies produce installations above 90 kW.

There are subsidies for pellet heating systems from the Austrian and regional government. Biomass plants outside the residential sector receive up to 44 % of their investment costs.

Pellets in Austria are subject to high fuel quality requirements, the quality is regulated by the Austrian industrial standard ÖNORM M 7135. The Austrian industrial standard ÖNORM M 7136 defines the quality management for transport and logistics for wood pellets and ÖNORM M 7137 regulates the storage of wood pellets at the end user's place.

During the last two years various actions were implemented to increase the demand for mid and large scale pellet heating systems. To start a market for pellets heating systems, different actors have to be incorporated at the same time, which means both
the "supply side" (pellets & boiler suppliers) and the "demand side" (building owners) must be established:

An important step at the beginning of the PROPELLETS project was done by identifying pioneers showing best practices and by starting pilot projects to overcome the lack of awareness. In the initiation stage, six best practices were identified in Upper Austria. Meanwhile, the list of existing pellet heating plants in the higher capacity range in Upper Austria includes more than 25 installations.

Municipalities and companies in Upper Austria have increased interest in receiving information on how old oil/gas heating systems can be replaced with biomass heating systems. The activities realised during the PROPELLETS project help to raise the awareness for biomass heating systems although there is still big competition from gas and district heating systems. Further projects for biomass heating systems in larger buildings will follow in the future.

During the last two years, various promotion and dissemination actions have been implemented to support the PROPELLETS project and pellet heating systems in higher capacity ranges:

**Workshop "Pellet boilers with a capacity of > 100 kW"**
On 27 June 2005, 26 market actors met to discuss possible applications and market opportunities for pellet heating systems with a capacity of more than 100 kW. The objective of the workshop was to give an overview of the current development status, to discuss about existing barriers and to find strategies for a market upturn for larger pellet heating systems.

**Site-visit 26 January 2006**
On 26 January 2006 a technical site-visit was organised in which 10 energy advisors of ESV took part. The aim of this site-visit was to show how larger pellet installations run
in practice and to make energy advisors aware of the possibility to use pellets also for larger buildings.

**European Pellets Forum 2006, European Pellets Conference 2007**
The European Pellets Forum 2006 and the European Pellets Conference 2007 were organised within the World Sustainable Energy Days 2006 & 2007 by the ESV in the frame of the PROPELLETS project. More than 600 participants from all over the world took part in each of the events. The events provided in-depth information on pellet technology, innovation and market trends and also offered a platform to discuss new co-operation projects.

**Exhibition: Energiesparmesse 2006 & 2007**
In the frame of the international conference World Sustainable Energy Days, most conference participants also visited the Energiesparmesse, the leading exhibition and trade show on energy efficiency and renewable energy sources and made business with the exhibiting PROPELLETS partner companies.

**Seminar: Larger pellet heating systems, 26 – 27 Sept. 2006**
In September 2006, the ESV organised a training seminar "PROPELLETS project, educational session in Upper Austria: larger pellet heating systems". The participants informed themselves about the most important technical issues, including planning, construction and operation of pellet heating systems in higher capacity ranges. 28 participants - persons responsible for energy in companies & institutions, installers, planners, energy advisors, architects and ESCOs, took part in the seminar. Several PROPELLETS partners also presented their project experiences.

**Brochure: "Pellet Heating Systems for larger buildings"**
The PROPELLETS brochure "pellet heating systems for larger buildings" was produced in German and English according to the work programme. The brochure of four pages informs about pellet heating plants in Upper Austria, the pellets characteristics and shows three installation examples. The brochure can be downloaded from the website and was successfully distributed at international conferences and exhibitions.

**Poster: Pellet heating systems for larger buildings**
ESV's PROPELLETS poster shows information about realised pellet heating systems in larger buildings in German and in English and was published in December 2006. It was mainly used at the poster presentation during the European Pellets Conference 2007 and the Energiesparmesse 2007.

All those activities realised since the beginning of the project helped to get a better overview of the potential market for mid and large scale pellet heating systems. There was also regular contact with the key actors of the PROPELLETS activities – pellet boiler producers, installers, heating planners, architects, energy advisors and ESCOs.
3.2. EXISTING BARRIERS AND INCENTIVES

Presently, the pellet market in Upper Austria is characterised by

- Small installations for one family homes (below 25 kW) only
- High quality pellets (pellets standardisation system ÖNORM)
- Stringent emission standards for pellets
- An advanced boiler design
- An important boiler industry and
- An efficient pellet distribution network.

The market development in the pellet and wood chip sector was satisfying during the last 2.5 years although it must be admitted that the wood chip market developed better than the pellet market. This was mainly due to the fluctuations of the pellets price and consequently the decreasing interest and trust of the consumer regarding pellets. Thus the main barriers can be summarised as follows:

- One of the main barriers is the low demand for large scale pellet boilers due to the lack of awareness and trust in the possibility of using pellet heating systems in larger buildings from the majority of potential users. Various educational activities (e.g. seminar "Larger pellet heating systems", brochure "Pellet heating systems for larger buildings") developed within the PROPELLETS project helped to overcome this barrier.

- The competition with gas and district heating systems is still severe. Particularly in cities district heating systems are very common and for the user it is more convenient to connect to the district heating grid than installing a pellet heating system. Gas still has the image of being "green energy". This has to be clarified to the potential users.

- As the production costs for pellets are higher than for wood chips, pellets are more expensive. Wood chips are locally available from farmers and potential users preferred to install wood chip boilers in the past. However, potential operators also make use of the possibility to install a wood chip heating system which is equipped with additional devices for pellets use.

- Lack of experience in the planning / operation of larger pellet heating systems. During the last two years, pellet boiler producers invested in R&D for pellet boilers with a higher capacity range. Five Upper Austrian pellet boiler companies, all of them key actors of the PROPELLETS activities, produce installations above 90 kW.

- Lack of know-how from planners, installers and architects. Larger pellet heating systems require technical experience regarding installation and maintenance. The seminar "larger pellet heating systems" focussed particularly on the most important
technical issues, including planning, construction and operation of pellet heating systems in higher capacity ranges.

- Pellet boilers are more expensive than oil or gas boilers. Comparing the investment costs of an oil, gas or pellet heating system, the pellet heating system is most expensive. However, calculating the annual costs, the pellet heating system is the cheapest alternative. Moreover, pellets are a CO₂ neutral fuel.

- Lack of awareness about the possibility of third party financing. Third party financing enables a company or municipality to install a pellet heating system without any investment costs for the user of the heating system. The ESCO (Energy Service Company) realises the planning, financing and the installation of the heating system and also acts as operator. The heat is sold at a fixed price to the user. Upper Austria has established a special funding system to promote third party financing (TPF).

- Pellet price fluctuation caused great uncertainty among users of pellet heating systems. The increase of the pellet price during last winter caused great irritation among the users. The reasons for this "price hike" was the extremely cold winter 2005/2006, resulting in a high demand and long inaccessibility of forests and that some pellets producers saw an opportunity for a short term profit. In the meantime the pellet price decreased and stands again at a lower level.

Pellet price development from Oct 2006 to May 2007 (price in Euro per ton):

Quarterly prices related to the energy content / € cent / kWh: pellet and fossil heating oil extra light development between January 2000 and June 2007:
The Upper Austrian pellet market is still a growing sector and although it experienced some difficulties last year because of the pellet price fluctuation, various arguments in favour of pellet heating systems exist:

- **Subsidies**
  Companies and municipalities can apply for regional and national subsidies for the installation of pellet heating systems.

- **Third Party Financing**
  Third party financing (TPF) enables a company or municipality, to install a pellet heating system without any investment costs for the user of the heating system. The ESCO (Energy Service Company) realises the planning, financing and the installation of the heating system and also acts as the operator. The heat will be sold at a fixed price to the user. Upper Austria has established a special funding system to promote TPF.

- **Lower running costs**
  Although the investment costs are higher for pellet heating systems, the running costs are much lower compared to oil or gas heating systems.

- **No dependency from gas / oil**
  Pellets are a locally available biomass fuel, there are lower transport costs and forest residues potential is better used.

- **Increasing pellet production capacities**
  Pellet producers in Austria will increase their production capacities, to avoid scarcity of pellets during the heating season.

The graphic below shows in red the Austrian pellet production and the grey bar indicates the consumption of pellets in tons:
Stocking of pellets
One reason for the high pellet prices resulted in the shortage of wood pellets in Austria. To avoid this situation in the future, the pellet producers agreed on having a certain quantity of pellets on stock for the Austrian market.

Showcase Best Practice Examples
By promoting best practice examples of larger pellet heating systems, municipalities and companies become aware of the advantages of running a pellet boiler in larger buildings.

Communicating the image effect of biomass
Pellets are a domestic fuel – that means national income and less dependency from imports. The pellet standardisation system (ÖNORM) guarantees high quality fuels and pellets are carbon neutral and have low emissions.

Pellets standardisation system
Pellets in Austria are subject to high fuel quality requirements, the quality is regulated by the Austrian industrial standard ÖNORM M 7135.

3.3. BEST PRACTICES
As an exemplary best practice case, the pellet heating system for the health hotel Aspach is explained.

Best Practice: Pellet heating system for the health hotel Aspach

Overview
The “Revital Aspach”, a health centre, was opened in June 2004. The hotel is located in the municipality Aspach in the district Innviertel. The motivation for the pellet heating
system with 500 kW power came from Dr. Gerhard Beck, managing director of Revital Aspach: “We opted for a sustainable solution in order to be independent of fossil fuel.”

![Image of Revital Aspach](image)

**Background**

The therapy centre “Reha Sport Aspach” was opened in 1991 and was expanded in 2004. It offers rehabilitation and physical medicine, preventive medicine, sports medicine as well as a “Medical Spa”. The Revital Aspach has 63 single rooms and 21 double rooms, a restaurant, a café, a garden with sun terrace, a modern medical-therapeutical infrastructure, a therapy pool as well as large areas for medical training therapy.

Since two separate energy supply sources are necessary, the health hotel would have liked to install a second pellet boiler, however the building was connected to the biomass district plant which delivers heat from wood chips.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Installed power</strong></td>
<td>500 kW</td>
</tr>
<tr>
<td><strong>Fuel</strong></td>
<td>pellets</td>
</tr>
<tr>
<td><strong>Heated area</strong></td>
<td>app. 3,000 m²</td>
</tr>
<tr>
<td><strong>Third Party Financing (TPF)</strong></td>
<td>no</td>
</tr>
<tr>
<td><strong>Total investment costs</strong></td>
<td>€ 70,000 excl. VAT</td>
</tr>
</tbody>
</table>

**Technical aspects**

In total, an area of approx. 3,000 m² has to be heated. During the summer months the 500 kW pellet boiler (KÖB) is used for the hot water supply. In winter, primarily the biomass district heating plant delivers the required energy, the pellet heating works as a support system. Every 3 to 4 weeks 16 t of pellets are delivered. A tank truck blows the fuel in the storage room, from where it is carried by an auger to the boiler. The size of the storage room is 40 m³, has a capacity of 24 tons and is equipped with a sloping ramp. The boiler, the district heating transfer station, the distributor and the control system are located in the boiler room which has a size of 5 x 8 m.

**Economical aspects**
The investment costs of the pellet heating system were about 70,000 Euro. A biomass system installed in a company receives up to 44 % public support of the investment costs by the federal and regional government of Upper Austria.

In order to track the energy consumption, an energy accounting is done on an excel-file. Through comparisons, valuations and readjustment by the technician, the hotel management tries to reach a constant decrease in energy consumption.

**Summary**

According to the company's technician, since the initial start-up, there were no troubles or bigger breakdowns. The Revital Aspach would again invest in a pellet heating system at any time.

### 3.4. PILOT ACTIONS

As an exemplary pilot project, the pellet heating system for the road maintenance office in Wels is explained.

**Pilot Project: Pellet heating system for the road maintenance office in Wels**

**General Overview**

In the road maintenance office there are three gas boilers installed. Due to energy efficiency reasons and to reduce CO₂ emissions the control system was replaced and a pellet heating system was installed. The new heating system was realized by using the Third Party Financing scheme. The pellet boiler has been in use since the start of the heating season in autumn 2006.

**Technical Summary**

**Boiler Power and Energy Demand**

The chosen pellet boiler has 110 kW and the energy demand is 150,000 kWh/a.

**Heat distribution**

The existing distribution system will be used and a new buffer storage system installed.

**Fuel demand**
The fuel demand will be around 32 tons per year, which means approx. 3 fillings per year.

**Economic Data**

**Investment costs**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler, control system and hydraulic system</td>
<td>67,000 € + VAT</td>
</tr>
<tr>
<td>Storage system and additional equipment</td>
<td>16,000 € + VAT</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>83,000 € + VAT</strong></td>
</tr>
</tbody>
</table>

**Operation costs of the heating system**

Costs for pellets: approx. 6,300 € + VAT

**Subsidies**

National and regional subsidy: approx. 20,000 €

**Cost effectiveness**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost for gas</td>
<td>Approx. 11,700 € per year</td>
</tr>
<tr>
<td>Costs for pellets</td>
<td>Approx. 6,300 € per year</td>
</tr>
<tr>
<td><strong>Savings</strong></td>
<td><strong>Approx. 5,400 € per year</strong></td>
</tr>
</tbody>
</table>

**After-Sales Service**

With the pellet heating system there will be additional after-sales service costs of around € 300 per year.

**CO₂ Savings**

Compared to the present consumption of gas, the CO₂ savings are about 39 tons per year.

An energy advisor of ESV supported the pilot projects with his know-how, he accompanied the persons involved in each project and assisted them with defining a concept (technical aspects and economic data) as well as giving information on different funding schemes.

**3.5. ANALYSIS AND GAINED EXPERIENCE**
Since the beginning of the PROPELLETS project in 2005, the market development for pellet heating systems has been positive. The market is still growing but at a slower pace than originally expected. Small scale boilers are very well established in Upper Austria, more than one third of new one-family-houses are equipped with a pellet heating system.

There is still a comparatively low demand for the installation of mid and large scale pellet heating systems, due to the lack of awareness and trust from the majority of potential users. The price fluctuation for pellets and a few bits of negative press ("Higher fine dust emissions through biomass heating systems") also caused great irritation among the users. After the normalisation of the price and the correction of the fine dust emission discussion, it is expected that the interest in pellet heating systems for mid and large scale capacities will rise again.

![Figure from www.wikipedia.com](www.wikipedia.com)

Considering the product life cycle for pellet boilers, the market in Upper Austria is not yet fully developed: small scale boilers have reached the growth stage and are entering the maturity stage, while large scale boilers are still situated in the "introduction stage".

The wood chip boiler market developed better than expected, as the price for the wood chips were not subject to those fluctuation experienced for the pellets. Depending on the fields of use and the local conditions pellets or wood chips can be the better choice. Following parameters should be taken into account when choosing the biomass fuel:

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Arguments for pellets</th>
<th>Arguments for wood chips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output range - Fuel demand</td>
<td>„smaller plants“ (&lt; 100 kW), lower annual fuel demand</td>
<td>„bigger plants“ (&gt; 100 kW), higher annual fuel demand</td>
</tr>
<tr>
<td>Required space</td>
<td>Small storage room</td>
<td>Storage capacity is no problem</td>
</tr>
</tbody>
</table>
Delivery | Traffic is a sensible topic (residential area etc.) | frequent fuel-delivery is no problem
---|---|---
Staff | No staff is necessary for operation and maintenance | Staff for operation and maintenance is available
Fuel | standardised fuel (constant quality) | Use of different quality classes possible (different water content)
Fuel supply | Supply via fuel businesses | Local creation of value with the use of wood chips, with rural environment possibly cheap supply
Wood resources | no existing own wood resources | Own wood resources are existing
Fuel costs | Long-term supply contracts at attractive conditions are possible, contracts on heat supply | Normally cheaper than pellets, ev. combination with cheap saw by-products possible, contracts on heat supply

The matrix shown above was developed during the PROPELLETS project with the input of the market actors such as pellet boiler producers, installers, heating planners, energy advisors and ESCOs. Potential users who have easy access to large quantities of wood chips and can dispose of a large storage room prefer to use a wood chip boiler while potential users who require a highly standardised fuel with constant quality and low maintenance of the biomass boiler prefer the installation of pellet boilers.

The brochure "Pellet heating systems for larger buildings" (English) and "Pelletsheizanlagen für größere Gebäude" (German) was distributed at national and international conferences and exhibitions. The brochure shows three Best Practice examples and helps to overcome the information barriers potential users might have regarding pellet heating systems for larger buildings.

In general, lack of information of the potential users regarding the different options available for mid and large scale pellet boilers is one of the biggest barrier pellet boiler producers are confronted with. To resolve this lack of information an educational session was organised in September 2006. The participants informed themselves about the most important technical issues, including planning, construction and operation of pellet heating systems in higher capacity ranges. 28 participants - persons responsible for energy in companies & institutions, installers, planners, energy advisors, architects and ESCOs, took part in the seminar. The participants also appreciated the information received on technical and legal details as well as fuel supply, subsidies and financing. Several PROPELLETS partners presented their project experiences and during the site-visit a 110 kW and 50 kW pellet heating system was inspected. In October 2007 the training session will be repeated.

In the market structure analysis it was also mentioned that biomass heating systems need storage rooms. Potential users might therefore prefer to install a gas or district heating system for which no storage room is necessary. To create new tools for the
successful market development of mid and large scale pellet heating systems, two pellet boiler producers and key actors of the PROPELLETS project have developed a container solution for a pellet heating system. The container is a heating solution for terraced houses and buildings without cellars. It comes fully assembled and is installed within a few hours. The pellet boiler is the core of the heating system. The pellets are transported automatically from the textile storage system to the boiler by a screw. The capacity of the pellet boiler ranges from 8 to 224 kW.

The development of the container opens a completely new market for pellet heating systems for larger buildings as there is no necessity for a storage room any longer. The energy container might be used for future pilot projects and should help to increase the acceptance for large scale pellet boilers.

Pellet heating systems including the new developed container solution can be financed by a Third Party Financing scheme. Third party financing enables a company or municipality, to install a pellet heating system without any investment costs for the user of the heating system. The ESCO (Energy Service Company) realises the planning, financing and the installation of the pellet heating system and in general, is also responsible for the operation, fuel supply and maintenance. The heat is sold at a fixed price to the user. The container has the additional advantage that it can be removed easily if, for example, the requirements for the heating system or the use of the building change.

3.6. CONCLUSIONS AND RECOMMENDATIONS

Renewable energy heating systems account for 76 % of the heating installations in new-built one-family houses in Upper Austria. Especially the wood pellet market penetration saw a strong development in the region in the last few years. In 2006, approximately 12,000 wood pellet central heating systems were in operation and the pellet production rose up to 600,000 t.

The pellet market in Austria is characterised by small installations for one family homes (below 25 kW) only, high quality pellets (pellets standardisation system ÖNORM), stringent emission standards for pellet boilers, advanced boiler design, an important boiler industry and an efficient pellet distribution network. The market for mid and large scale pellet heating system is not yet fully developed, although recently also five Upper Austrian pellet boiler companies produce installations above 90 kW.

During the last 2.5 years, the ESV monitored the market in order to know how many pellet installations above 100 kW do already exist. In 2005, only six installations were in
operation in Upper Austria, by the end of 2006 more than 25 installations were planned or in operation.

So far, the following arguments against larger pellet installations were used: higher pellet prices compared to wood chips, the higher investment costs of the pellet boilers compared to oil and gas boilers, the high presence of wood chips in the power range of >100 kW and the low awareness for large-scale pellet installations by potential users such as companies, public bodies and housing associations.

The ESV with its key actors tried to overcome those arguments by a comprehensive mix of measures, ranging from information & awareness raising activities and training & education measures to subsidies and R&D and quality control.

The PROPELLETS project helped to stimulate the Upper Austrian pellet heating market. Key actors are motivated to promote large-scale pellet boilers which should lead to an increase of the number of installed pellet heating systems in larger buildings.

Summarising it is evident that the need for information will continue beyond the project. It is not a short term process to have an increased awareness of large scale pellet boilers in Upper Austria but it takes a few years of well targeted actions until these heating systems are well known to municipalities, companies and social housing associations.

4. RESULTS IN CENTRAL FINLAND

4.1. OVERVIEW

Propellets pilot area is Hirvaskangas region, which is a small village in the borderline of several municipalities. This was chosen a pilot area due to several reasons. This is an developing and growing area at main highway, the area have small industries as well as housing areas. The town centres of nearby municipalities have district heating networks and the district heating is the first choice whenever it is available and thus the town centres are not potential sites for pellet heating. In the area there were few private houses with pellet heating, but it was not common.

The project stated with development of brochure directed specially to this small area of about 550 households. An information package with brochure, pellet heating guide book and general information and contact information to advisors, installers and equipment suppliers was sent to all households and businesses in the area.

As an follow-up two mini seminars with information booths and equipment show were arranged. The first seminar was arranged together with local bank office with invitation specially for those intending to build a new house during next couple of years. Second show was arranged at the village centre with invitation to all people living in the village. Both happenings attracted about 20 interested families, including some small scale property developers intending to sell land for housing and intending to offer heating
service to builders (Muhlunieni, land title change in process; Leppänen, development started already).
The municipal authorities have been visited in all surrounding municipalities and the persons applying building permit are given information on pellet heating option.

All industries in the area have been contacted and information on pellet heating has been offered.

The contacting has led to feasibility evaluation of pellet heating option to several targets. Pellet heating feasibility has been evaluated for four schools in Äänekoski municipality, one school in Uurainen municipality and five different targets in Laukaa municipality (special school for disabled with two separate building groups, prison and tree nursery, central fish farming development unit) and one university research institute in Konnevesi municipality. Feasibility has been evaluated also for one pre-cast concrete mill, one furniture factory and one restaurant/gas station.

At one private housing development (Leppänen) area a feasibility study of regional heating network was studied for three different groups of houses.

The project work and studies have led already to investments and several targets are in the process of detailed evaluation.

4.2. EXISTING BARRIERS AND INCENTIVES

European market price for pellet has been rising. This has also affected the local pellet price. Last year pellet price for consumers rised remarkably. This year also larger facilities have experienced higher pellet prices. This had some positive impacts, smaller wood processing plans have been encouraged to invest in pellet production. The market leader in pellet production in Europe, Vapo Oy, has published two new pellet mill investments in Finland, one mill close to our target region.

On the other hand, pellet boiler sales has suffered from the increasing pellet price. Customes have been confident, that pellet price will be stable, but due to recent price increases, they have lost their confidence. Pellet boilers have about 15 % market share in new houses and it has been rising steadily. Recently, heat pumps have gained 30 % market share even it is based on electricity and electricity prices are fluctuating even more.

Finnish government introduced a small incentive for those who change from fossil fuels to pellet. The window for application was open only for a short time, but the number of application exceeded the money budgeted. This spring the application for grant was also open for a short period. The total investment grant is about 15 % of the price of equipment. In addition you may get some tax benefits related to work on pellet storage.

The support scheme for private households is very modest and does not make big difference on the viability of pellet heating, but it is a positive signal from government side.

Larger, commercial pellet heating plants enjoy different support scheme. Entrepreneur, company or housing company may get an investment grant when they change from fossil fuel to pellets. The grant varies between regions depending how much funds they
have allocated to this kind of support activities, typical values are 15 – 25 % of the total investment costs. This is a meaningful amount and may be the necessary incentive to make the heating plant commercially competitive against other means of heating.

4.3. BEST PRACTICES

Tarvaala pellet heating plant

The fast developing segment in pellet heating is the heat supply contracting in capacity range of 500 – 2000 kW. Outside company takes care of all investments and the customer is charged by consumed energy. Below are several examples of such cases with several heat supply companies.

Jyväskylä University of Applied Sciences has their agricultural training facilities in the Tarvaala village, in Saarijärvi. In the same complex there is also vocational school of agriculture training facilities. The schools decided to give up existing oil heating and ask bids from outside heating service providers. Competitive bidding was organised and Vapo won a ten year contract to provide all heat to the said facilities. Vapo ordered the plant from local package plant manufacturer Tulostekniikka Oy.

The picture below shows the package heating plant delivered as one piece and behind the plant there is the prefabricated pellet storage. Installation of this kind of package plants is very fast, if the piping work for connection has been done beforehand the plant can be operational in few days from the delivery. Boiler capacity is about 700 kW with 80 m3 storage.
Summassaari spa/hotel pellet heating plant

This is a recent contract between Vapo Oy and Spa Hotel Summassaari. Vapo will invest in pellet fired heating plant and deliver heat based on ten year contract. Plant will be similar to nearby Tarvaala plant. Pellet storage is a 80 m3 silo, which can take a full truck and trailer load of pellets each time it is filled. Pellet unloading will be pneumatically to silo with the truck unloading equipment. Pellet delivery trucks are modified from animal feed pellet delivery trucks.

Peurunka spa pellet heating

Energy company Fortum is the heat supplier at Peurunka spa. The existing heating plant is using heavy fuel oil and the capacity is about 3 MW. The energy company has decided to invest to 1 MW pellet boiler, the unit will be parallel to existing oil fired unit. The operation mode will be such that if the heat load is below 200 kW, only oil fired unit is used, otherwise the pellet unit is used topped with oil again during coldest days if the peak load exceeds the pellet boiler capacity. The plant has building permit, foundation is under construction and the plant is under construction at the manufacturing plant. This plant will be operational by the end of 2007. The heat supplier for Peurunka is the largest power company, Fortum.

Finbio office building pellet heating

Finbio offices are within the city area of Jyväskylä. The premises were oil heated even it is within the district heating service area. JSP/Central Finland energy agency organised a competition for best ideas in promoting pellet heating. Pellet boiler installation company Ekopel won the competition with their service package including all necessary equipment and services from one source.

As part of the prize, Vapo, as competition sponsor, offered Ekopel opportunity to install their first reference unit at Finbio office building, owned by Vapo. Ekopel delivered the complete installation including refurbishment of boiler room. The main components were locally produced boiler/burner from HT-Energo, mechanical and electric installation by Ekopel staff and their subcontractors and storage built by Ekopel. The unit has capacity of 50 kW and has been running since May 2006. Open house has been organised to show pellet heating in practise in city area. The open house attracted some 50 visitors during one afternoon.

Pellet delivery system

Pellets are available in 20 kg bags in hardware stores, 700 kg bags delivered to your house and in bulk delivered by specially designed trucks with pneumatic unloading system. The storage must be fitted with suitable piping, air filtration etc.

The truck deliveries to private houses taking 3 – 6 tons at one time was a bit problematic. Either the truck was loaded with the ordered volume and the unloaded volume was estimated with some other means. At present trucks with reasonably accurate scale are available and the ordered volume can be accurately delivered from
a full truck. A truck leaving pellet mill can take full load and unload the ordered volumes to several customers like oil trucks.

4.4. PILOT ACTIONS

Hirvanen school, 120 kW

One of the first investments in the area was contracting of Hirvanen school. The municipality of Uurainen decided, after the feasibility study, to arrange a competitive bidding of the heating service for the school. The bidding process led to a contract and the heating service started with pellets during November 2006. JI assisted in the feasibility study, organisation of competitive bidding and in contract preparation. The existing oil boiler was left for eventual peak loads. The experience after first winter is very positive, the capacity was need was estimated very accurately, because the boiler was running with full capacity during winter but the oil boiler was not needed. The reliability of the system has been satisfactory after initial start-up period when the final adjustments were made to the boiler. The boiler is equipped with remote alarm system which will give alarm to person in charge mobile phone in case there is any misfuction in the heating system.

The Hirvanen School, the feced area is the underground pellet storage, boiler room is in the cellar next to the pellet storage.

Parma, 1 MW

The biggest pellet heat contract in the area is heating service for Parma pre-cast concrete mill. The contract includes heating service of one megawatt with maintenance of one megawatt existing oil boiler for peaks and service periods. The mill needs process heat year round and thus the annual heat sales from pellet heated plant is about 3000- 5000 megawatt hours. This plant started operation in June 2007. Contract
The price is divided in two parts, fixed part is tied to consumer price index and the variable, energy part, is tied to published wood/pellet fuel price by 50% and to oil price 50%. The customer feels that this indexing system protects them well against any changes in fuel prices. Even the oil price was dropping, the pellet heat remains competitive and if the oil price is increasing, the heat price is increasing less dramatically. In this arrangement the heat supplier take risk regarding oil price fluctuations.

Housing development area

At the private housing development area four private houses have invested in pellet heating, the developer have invested in on 50 kW pellet boiler at his premises. There are plans ready for small regional heat network. The present 50 kW heating plant will be expanded and heat will be supplied from the plant to one terraced house and six private houses. This will be invested during summer 2008. During 2007 four private houses were built on this area with all having pellet heating. During 2008, additional 5 houses will be built and at least four have selected pellet heating. Small heating networks covering 4 – 10 houses will be evaluated in this region.

Pellet storage built above the entrance of the building, boiler room is behind the left door in the picture.

Two targets in Laukaa, Senaatti kiinteistöt

Two of the Laukaa targets will come to public bidding. The property owner will like to have an external heat supplier and will offer ten year contracts for heating two of the studied targets. The bidding for remaining targets will come later after experience is gathered from the first two contracts. The bidding will be during 2008. One target is Laukaa prison, the estimated capacity is 700 kW. The second target is the vocational school for disabeled children, capacity will be 1000 kW. Both targets will be served by external heat supplier, competitive bidding for contracts will be arranged 2008.

Ääeneseudun Energia Oy
Ääneseudun energia Oy, local heat and power supplier will build at Hirvanen village centre a new heating plant serving a restaurant/gas station complex and surrounding small industries. The plant is unique in a sense that the base fuel is wood chips but the plant will be equipped with pellet feeding. The idea is to upgrade the fuel during cold days in order to meet the heat needs without using fuel oil. Similar plant is planned for another village in Äänekoski, Sumiainen village (about 1 MW).

Hirvaskangas ABC restaurant/gas station complex (opened during May 2007) will be supplied by wood heated plant.

**Pellet mill**

A local sawmill/wood processing plant (Suolahden Höyläämö) invested in pellet production plant. The mill has dry wood based by-products like wood shavings, sawdust and off-cuts for 6000 – 10000 tons a year. This amount will be refined to pellets for local markets. The mill is producing precut knot free pine products for the furniture industry. Thus their by-products contain large portion of knots, this leads to extremely high energy content of pellets but at least by now they have not achieved very high strength for the pellets. At the moment, best customers for this plant are the slightly bigger users than single homes.
New heat supply company

During the project a heat entrepreneur company Ääneseudun Biolämpö Oy has been established. Their first contract was Hirvanen school and second contract Parma concrete mill. They invest in plant, maintain the plant, procure fuel and deliver all heat required by customers in both cases. Their third contract is fuel supply and maintenance for Hirvanen village wood chip/pellet plant.

4.5. ANALYSIS AND GAINED EXPERIENCE

The development of pellet heating has been as good as expected. The difference is that although we do not know all private persons invested in pellet heating, it is expected that the development is positive but could be faster. The major part of new houses are built in areas served by district heating. In Äänekoski the district heating is very competitive option and when available it is recommended to join the heating service. District heat produced in Äänekoski town centre is produced in wood fired co-generation plant. District heat is also available in all other town centres. Individual house heating is not usually competitive against district heating when DH is available.

On the other hand the development of larger boiler segment has been very encouraging. The expected volumes are already exceeded and the coming new projects will still increase the pellet use in the area. The positive development is expected to continue, because a new local heat producer has been established and will continue to promote pellet heating in the area.

Together with the good examples of heating plants, the local pellet production plant will increase the confidence in the area and will support the good development of pellet heating. The competitiveness of pellet heating in private households should be improved in order to get also that segment to grow faster.

4.6. CONCLUSIONS AND RECOMMENDATIONS
Pellet heating has achieved a good position in our target area. The development is guaranteed by established heat supply companies and pellet mill, who both will continue the promotion work of this project in the area.

The present price situation and the competing fuel prices allow the good development of pellet use in larger installations. The heat supply contracting business is expected to continue and expand. The heat buyers can create a good competition when they open a heating service for competition. There will be several nation wide heat suppliers offering pellet heating (Fortum, Vapo, Vattenfall) and there are a number of local heating service producers (like Ääneseudun Biolämpö Oy).

The main threat for the development of pellet heating has been recent pellet price increases. This has hit both domestic and professional pellet users. The reason for pellet price increase in partly the high pellet price in Europe, where the pellet use is increasing due to lucrative support schemes. Export market price is important to Finnish pellet producers, some 80 % of pellets produced in Finland is exported to other European markets. Although there are several pellet producers, the pellet market is dominated by Vapo Oy, the largest pellet producer in Europe operating in addition to Finland in Sweden, Denmark Poland and the Baltic Countries.

On the other hand pellet production in Finland has increased up to the level that all dry rawmaterial is used, and new plants built or under construction will have to produce pellets from fresh sawdust. The drying will make the manufacturing process more costly.

The recently increased pellet price has created a lack of confidence in the market. Of course, the supplier of competitive technologies will try to take advantage of the situation as well as they can. This lack of confidence can be seen in the sales of pellet equipment in the domestic market. One year ago there were long delivery times due to very high demand. This high demand continues in larger installations but not in the domestic sector.

The establishment of local, smaller pellet mills is helping in the confidence building. It is expected, that the availability of pellets is guaranteed in the future, if the pellets are made near by. The local producers are not so keen for export market and they have sold pellets at slightly lower price than the market leader.

One obstacle for pellet for domestic market has been the lack of good service. House owner, who is interested in pellets must buy separately pellet boiler, storage, mechanical installation (plumbing) and electrical installation. This has eased a bit when two companies giving full service has been established in the area (see Finbio premises example above).

The housing industry together with boiler manufacturers are developing a boiler room kit system, where a complete boiler room can be lifted to house under construction. This will help the pellet boiler installations especially in new private houses.

The easy solution for the more rapid development is, of course money. In case higher subsidies were used, the pellet market would develop faster. The past two trials for small subsidy showed its power for changing heating systems
5. RESULTS IN SOUTHWEST ENGLAND

5.1. OVERVIEW

The wood pellet industry in South West England has been growing steadily since the beginning of Propellets. At the start of the project there were only 4 wood pellet boiler installations, which included the first two primary schools which were “pilot projects” for Somerset County Council (Local Authority) and two small private houses. This represented 175kW of installed capacity using about 40 tonnes of pellets per annum, which were imported.

By June 2007 there were an estimated 22 wood pellet boiler installations representing over 2,000kW of installed capacity with an estimated usage of over 500 tonnes per annum. Although, in absolute numbers of boiler installations and installed capacity, the numbers are still small, an analysis of those installations (given in Table 1) does show very promising signs;

1. The pellet boilers are now supplied by a local pellet producer (Brookridge Timber) or a local pellet distributor (The Energy Crops Company), rather than relying on imported pellets.

2. There have been a number of high profile commercial/public sector installations, most notably;
   - Bath and West Showground; 500kW pellet boiler heating an exhibition space
   - Jubilee Wharf; High profile community centre in Cornwall
   - Wilderness Centre; Educational centre run by the Forestry Commission
   - SCAT; Pellet boiler at the Genesis Centre, a sustainable conference building
   - Pitts Cleave; New build office/workshop space for start-up companies (see below photos of official opening and the pellet boiler installation)
   - Ilfracombe Council Offices; The first local government offices to install pellet heating
   - Guys March Prison; the first prison in the UK to employ biomass heating
   - Bristol schools pellet boilers

3. In addition, three local authorities (Local Government) are now starting to role out a wood pellet boiler installation programme; Dorset County Council are installing the first two pellet boilers in schools, South Gloucestershire District Council (Bristol area) have installed the first 3 pellet boilers in primary schools and Devon County Council are installing the first pellet boiler in a new build primary school.

4. A large Farmer Cooperative “Country Wide Farmers” have installed their first wood pellet boiler within a retail outlet and are planning to expand this to all 20 of their stores across the region and will be a major retail outlet of pellet stoves and domestic pellet boilers.

5. A large wood fuelled boiler cluster has been established in Bristol with 11 boiler installation corresponding to over 3,000kW. Of these, 7 are wood chip boilers and 4 are wood pellet boilers.
**Table 1; Wood Pellet Installations by 01 June 2007**

<table>
<thead>
<tr>
<th>Project</th>
<th>Location</th>
<th>kW</th>
<th>Cumulative Total (kW)</th>
<th>Building Type</th>
<th>Boiler Type</th>
<th>Estimated pellet usage (tonnes)</th>
<th>Cumulative Total (tonnes)</th>
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<td>P&amp;H (Denmark)</td>
<td>4</td>
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<td>Cornwall</td>
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<td>175</td>
<td>school</td>
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<td>12</td>
<td>40</td>
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<tr>
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The expansion of the wood pellet industry in the South West has been supported to date by three events supported by Propellets. A 4th, larger workshop/conference, is currently being organised for 27th September 2007 which will pull together all work under Propellets to date.

**CWF RENEWABLE FUELS CONFERENCE, 8th Feb 2007, Worcester Rugby Club**

Countrywide Farmers plc, together with its partners hosted an event to examine a sustainable biomass supply chain and to outline a range of biomass supply chain services for households, communities and business. The purpose of the day is to provide a comprehensive overview of the biomass supply chain and outline opportunities available to those wishing to play a role in the sector.

The event was very successful with over 100 delegates attending from a range of sectors including Local Authorities, commercial and industrial sectors as well as private individuals.

Part of event was focused on wood pellet technology, production and markets which was presented by Dr Robin Cotton of Renewable Heat and Power Ltd. This 40 minute presentation outlined the PROPELLET project and promoted the technology of wood pellet heating and wood pellet fuels. The panel discussions included RHPL who answered questions on PROPELLETS and on all aspects of wood pellet usage. Brochures on PROPELLETS were available.

**Debut MOD SUSTAINABLE ENERGY conference, 14th June 2007, SCAT, Taunton**

During the project, RHPL under the Propellets project have been working closely with the Ministry of Defence (MOD) to look at applying biomass heating at MOD sites across South West England. The MOD are the single largest landowner in the UK and have many thousands of buildings which require heating.

A major one day event on renewable energy with a major workshop on biomass was held with over 120 people attending and c. 60 people attending the biomass workshop.

Dr Robin Cotton of RHPL ran the 30 minute workshop which was attended by architects, consultants and specifiers for projects within the MOD estate. The PROPELLET project was outlined with literature being available.
BSF School Pathfinders, Biomass Boilers Workshop 10th July 07, Taunton Rugby Club,

A one day workshop was held on 10th July 2007 for specifiers and energy service managers for all Local Authorities within the South West. Dr Robin Cotton ran the workshop which covered examples of best practice, pellet production, availability, pellet quality, economic analysis etc. The purpose of the event was to inform specifiers and build confidence in the technology and security of fuel supply.

Hartpury College, Gloucester, 24th October 2007

Aim of the Conference/Workshop

The wood pellet market is now becoming established in the South West. The first pellet mill is now operational in the South West (Brookridge Timber) which produced 3,000 tonnes last winter and expects to produce 6,000 tonnes this winter. There are a number of companies based in the South West specializing in the installation of wood pellet boilers at the small, medium and large scale. A number of stove shops have started to stock wood pellet stoves as part of their offering. However, the market at this time is still relatively small.

The aim of the conference was to bring all the stakeholders currently in the wood pellet market together with potential stakeholders at a single day event. The following will be speaking or exhibiting;

1. Wood pellet producers and distributors (e.g Brookridge Timber, Energy Crops, RES Heat and Power, BioJoule)
2. Wood pellet machinery manufacturers (e.g. Kahl presses, SPC, CPM)
3. Wood pellet boiler installers (e.g. Wood Energy Ltd, Econergy Ltd, Eco Exmoor, Treco)
4. Stove shops already supplying wood pellet stoves (e.g. Whendron Stoves)

The audience comprised of

- Sawmills, joineries, wood residue producers
- Stove shops thinking of selling wood pellet stoves
- Heating companies thinking of offering wood pellet boilers/stoves
- Industry and business looking at wood pellet heating technology
- Local Authorities looking at wood pellet heating technology
OPENING OF TAVY BUSINESS CENTRE WITH NEW PELLET BOILER
16th March 2007, Tavistock, Devon

A new 25kW pellet boiler system was officially opened by the local Member of Parliament at Tavy Business Centre near Tavistock in Devon. This is a series of new office buildings designed for new “starter businesses”. The concept of heating the centre with wood pellets was proposed by RHPL under the PROPELLETS project which coincided with the construction of a new pellet processing facility at Brookridge Timber.

The pellet boiler is fed from an 11m$^3$ pellet storage silo which is filled pneumatically by pellet tanker. Below shows the new business units and the official opening of the centre.

Cluster Organisations

An important aspect of the project are the cluster organisations who play a central role in helping to build a wood pellet fuel market. These include potential suppliers of wood pellet fuel (either as manufacturers or as wholesalers), stove shops who are increasingly offering wood pellet stoves as an option on the traditional log stove, pellet boiler suppliers and local government bodies, at both a city level or regional level. In addition, not-for-profit organisations (e.g. Energy Agencies) and consultancies play an important part in demonstrating technology or providing information on pellet technology and are key partners in Propellets.

In total 151 organisations have been added to the cluster list. The market sector of each of these organisations is broken down and shown graphically below.
5.2. EXISTING BARRIERS AND INCENTIVES

A SWOT analysis has been undertaken for the South West of England. This comes at an important time in growth of the wood pellet industry. The first pellet boilers and pellet stoves have now been installed with some buildings having 2-3 years of experience with the heating systems. In addition, there is one pellet mill in the region now operational with others under consideration. The existence of local pellet production is starting to have a major impact on wood pellet industry in the region as it gives more consumer confidence to security of supply and price stability as well as achieving political goals of bringing local production to the region with the economics benefits and jobs that this brings.

This emergence of the wood pellet industry in the South West also coincides with substantial and sustained increases in fossil fuel prices. Whilst this is a European wide increase, it could be argued that this price increase has been more significant in the UK where there have been traditionally low fossil fuel prices due to North sea reserves of oil and gas. The fossil fuel price increases have recently taken fossil fuel prices to levels where they are now generally higher than wood pellet fuel.

Therefore, we are now in a situation where all the various elements required for a wood pellet market to grow exist. The question is how that growth is facilitated and the pitfalls of a new industry are avoided such as poor quality pellets or poor quality installations due to lack of experience.

The following analysis looks at the strengths and opportunities in this emerging market, but also some of the factors that could limit this growth.

Analysis development

The following show the development of the SWOT analysis corresponding to the region of South West, in the framework of the situation in the United Kingdom.

The objective of WP2 “Market structure analysis and promotional activities identification” is to identify barriers for pellets heating systems promotion and to select the necessary promotion actions to overcome those barriers.

The UK pellet market is now starting to be established with the first pellet boilers and pellet stoves being installed and new pellet production capacity under construction. New players
are starting to enter the emerging market. A SWOT analysis has been employed for South West England that identifies the Opportunities, Threats, Weaknesses and Strengths of the emerging pellet market.

In order to carry out this analysis and to have the information regarding to the regional projects, factors that are external to the region will be considered, that is, factors of the macro setting that are going to affect the region positively or negatively. In addition to these, factors which are internal to the region and that can equally influence its functioning in a positive or negative way will be considered. The external factors are the Opportunities and Threats whereas the internal ones are named Strengths and Weaknesses.

**Strengths**

1. Wood pellets have the potential to become a major industry across South West England and play an important role in reducing the CO₂ emissions from within the region

2. The South West has a number of urban centres but is largely a rural economy. Large parts of the South West have no access to the natural gas network and rely on oil and LPG for heating and hot water. Due to the recent rise in the cost of fossil fuels wood pellets are now competitive against oil and LPG.

   The typical delivered price of pellets in bulk in the region (based on imported pellets) is approximately €220/tonne delivered, equivalent to 4.4€ct/kWh, compared with oil at approximately 4.8€ct/kWh and LPG at approximately 6.8€ct/kWh,

3. The South West has an indigenous sawmilling industry who are in need to find outlets for the wood residues from the milling activities. Therefore, there exists the possibility of local production of wood pellets.

4. The South West has a large farming sector and hence the potential exists for the pelletisation of agricultural residues.

5. There already exist a number of pellet boilers (see Table 1) and pellet stoves (estimated to be over 200 to date) that people can see in operation to enable potential users to become familiar with the technology.

6. A network of heating engineers has been established who are able to install and service domestic pellet stoves and boilers. These heating engineers have undergone hands-on training on technology specific appliances.

7. High quality technology is now available (primarily from Austria) which has technical support e.g. trained engineers, spare parts available etc.

8. Local pellet production is due to start in 2006 which will have a major impact on the expansion of the wood pellet market in the region.

9. Promotional campaigns and renewable energy events have started to increase awareness of the technology to both the private and public sector.

**Weaknesses**

1. Although the region has a number of sawmills and joineries and has a large agricultural sector, the amount of indigenous raw materials for pellet production will be ultimately limited and hence this could limit the expansion of the sector.
2. Due to the innovative nature of these pellets heating systems (>150 kW) there is still little experience in this sector, and there is need of information and dissemination. There needs to be increased trust and understanding particularly within the public sector.

3. Socio-economic factors, one of the most important aspects is going to be the lack of guidance in the purchase these systems, as they are not so well known by the public or private end users.

4. Legal-institutional factors, are the limitations the systems are going to come across related to delays in the granting of permits, long amortisation periods, lack of interest or knowledge from institutions, lack of legislation.

5. The nature of wood pellet fuel means that storage is required. This may not be possible due to space restrictions, particularly in the urban areas.

6. The emerging local pellet production needs to be monitored for quality. Sub-standard pellets would damage the emerging industry.

7. Building regulations within the UK do not accommodate high efficiency pellet stoves, but class them in the same category as log stoves. This means that the flue systems, for example, that are required to meet UK building regulations are larger diameter (and hence more expensive) that is necessary from a technical point of view.

Opportunities

1. The nature of the region means that the wood pellet heating has the potential to become a major heating technology. The sawmills and farming industry have an opportunity to generate local pellet production to drive the industry.

2. There is now national government programmes to support the technology of pellet appliances in the form of capital grants and interest free loans. Also companies can benefit from Enhanced capital allowance (ECA) whereby the costs associated with the pellet installation can be written down within 1 year.

3. The pellet market represents new opportunities for heating engineers to add a new technology to their expertise. Training in wood pellet heating gives a competitive advantage to the company.

4. Socio-economic factors, are related to the use of an indigenous resource substituting an imported resource (gas, oil), leading to a reduction in external dependences, and improving the balance of the region. All fossil fuels are imported into the region.

5. The idea that there should be an obligation for all new public sector building projects to achieve 10% of the buildings energy needs from renewable sources. If implemented, this would result in a major opportunity for the wood pellet fuel to rapidly expand.

Threats

1. The wood pellet industry must compete with both fossil fuels (natural gas, oil and LPG) and other renewable technologies such as wood chip and ground source heat pumps. The region has a number of companies promoting and installing ground source heat pumps.
2. Poor pellet quality will have an adverse effect of the emerging market.

3. Technological factors, related to the availability of new heating technologies can be weak and due to the innovative nature of the project can exist lack of experience in the distribution, storage, operation/maintenance and installation. There can be only a few proven technology options available at the project demand scale (>150 kW), and availability of these boilers can be difficult.

4. Quality and service, an important threat is going to be the location of the production or distribution companies of both pellets heating systems and pellets, in some regions. This can affect in a significant way the decision of the substitution of the boilers by end users.

5. Socio-economic factors, the lack of information and the unawareness of society, in general, may cause the low demand of pellets heating systems

5.3. BEST PRACTICES

The use of wood pellets as a fuel is relatively new to the UK but is rapidly becoming a real alternative to fossil fuels. The South West is becoming the region leader in the UK directly supported by the Propellets project.

The first pellet boilers appeared in the South West in 2003 which two small units (15kW and 25kW “Ecotec” pellet burners) which were used as demonstration units to heat buildings and to show people the technology. These units were introduced by Renewable Heat and Power Ltd. The following year two domestic pellet boilers were installed and a small number of pellet stoves.

In 2004 Somerset County Council (one of the several local government authorities in the region) decided to install pellet boilers within two primary schools to test the technology and gain experience. These systems were installed by a local heating company Wood Energy Ltd which has now grown to become the market leader in the UK. The two pellet systems have been successful but ran for the first two heating seasons on pellet fuel imported from abroad as there was no local pellet production.

In 2006 two initiatives were undertaken to establish local pellet production. Brookridge Timber, a medium sized local sawmill in Devon, has installed a 1 tonne per hour pellet press and is now in full production, although the majority of pellets are actually exported out of the region. A second pellet mill at Southwood Recycling in Somerset has installed a smaller 0.3 tonne per hour pellet press, although this is not currently fully operational.

Two other events have increased the pellet availability. Firstly, Welsh biofuels Ltd, based just outside the region in South Wales has come into full production and is delivering pellets into the region, albeit is very small quantities. Secondly, a large 50,000 tonne pellet production facility at Balcas in Northern Ireland is now in full production. Through an agreement with a newly formed pellet distribution company “The Energy Crops Company” a pellet storage facility has been set up in the South West of England ready to supply the market as it is expected to grow rapidly in 2007.

Therefore, a pellet boiler has three options to acquire pellets with a forth expected in 2007 giving real price competition and building confidence in security of supply.

During 2006, the first medium to large scale wood pellet boilers were installed within the South West including the 500kW system at the Royal Bath and West Showground, Jubilee
Wharf a high profile community building in Cornwall and several community halls. In addition, the domestic pellet stove and boiler market is starting to expand, with perhaps more than 100 installed systems operational.

There are now over 20 installation companies who could potentially install wood pellet boilers within the South West of England. However, the majority of these companies only offer domestic systems but at least 6 offer systems above 100kW. Also, the majority of larger systems are based on wood chip fuel rather than wood pellet fuel but this is likely to change because of local pellet production.

A map of non-domestic wood pellet installations (and wood chip installations) and pellet production and storage facilities is shown overleaf.
Wood Heating Systems in SW England
June 2007

Key
- Wood Pellet boilers operational
- Wood Pellet boilers under construction
- Wood chip boilers operational
- Pellet Production
- Pellet Storage facility
Economics of Wood Pellet Fuel in South West England

Because there are a number of options for wood pellet suppliers and the amount of pellets supplied is increasing, there is now becoming a market price for wood pellets. However, the price paid will still be dependent on quantity of pellets required and geography (i.e. full or part lorry loads and distances from pellet production facilities). The figure below shows current wood pellet prices, based on bulk pneumatic delivery, in comparison to wood chip prices and the fossil fuel prices. The shaded area shows typical variation.

Currently wood pellet fuel is approximately equal to oil and mains gas, but not significantly cheaper. This means that wood pellets are still limited to situations where economics are not the main driver, for example:

- Local Government where environmental issues, carbon savings, using locally produced fuel etc are important
- The domestic market where environmental issues outweigh the higher cost of pellet appliances for the end user
- Situations where high energy costs exist e.g. sites using bottle propane

There is a growing market for pellet stoves in the UK with several hundred now operational, with perhaps over 100 in the South West. The price of bagged fuel is now becoming available at a standard price of approximately Euro 230/tonne plus the cost of delivery. This price, whilst not competitive with bulk oil, does seem to be an acceptable price for the market and pellet stove and small boiler sales are starting to increase.

The Benefits of Wood Pellets

Wood Pellets are a renewable, low carbon fuel that is already widely used and often economically available throughout the UK. Its production and use also brings additional environmental and social benefits. Pellets are a sustainable fuel that can both offer a
significant reduction in net carbon emissions compared to fossil fuels and also has many ancillary benefits:

- Wood pellets can be sourced locally, from within the South West, on an indefinite basis, contributing to security of supply
- UK sourced wood pellets offer local businesses opportunities and support for the rural economy
- The establishment of local networks of production and usage allows financial and environmental costs of transport to be minimised
- Modern wood pellet systems are highly sophisticated, offering combustion efficiencies comparable with the best fossil fuel boilers.

**Wood Pellet Boilers**

There are a large number of wood pellet boilers now available on the UK market. The majority of them are imported from Austria, although machines from other countries, particularly Danish and Swedish are available with one UK manufacturer. Below shows the cutaway of a small Okofen boiler and a 300kW industrial Binder boiler, both from Austria.

Typical features include

- Fully automatic feed
- Automatic ignition
- Capacity control
- Remote system control and monitoring
- Typical efficiency 90% +
- Very low ash remain – c.0.5-1.0%
**Wood Pellet Storage**

Wood pellets have the advantage of a high bulk density and high energy density. For example, wood pellets typically have a bulk density of 600-700kg/m³, approximately 3 times the density of wood chips. In energy terms 1 tonne of wood pellets is approximately equal to 500 litres of heating oil.

Therefore, storage can be fairly compacted, typically 1-2 times more storage volume that equivalent oil storage or similar storage with 1-2 times more deliveries per year.

There are several storage options for wood pellets available in the UK. This includes steel pellet silos (e.g. MAFA from Sweden), flexible bag systems (up to 10m³) and also modified shipping containers.

The photos below show a 100kW boiler with MAFA hopper and layout of the installation.

Below shows a flexible bag silo (Okofen) and a containerised pellet boiler and pellet silo (top container)
Local Pellet Production

Southwood, Somerset
There is a Swedish machine (SPC AB) installed in Somerset (see below) capable of an Output 300kg per hour and is designed for 24 hour operation, giving a potential annual production capability 2000 tonnes per year. The plant has been operational, but issues with power supply quality, quality and consistency of raw material and a change of ownership in 2006 has meant that the plant is yet to come into full production.

Brookridge Timber
Brookridge Timber is a medium sized sawmill in Devon which produces kiln dried sawn timber with shavings for horse bedding as a by-product. The process produces 1000 tonnes of kiln dried sawdust per year and substantial off-cuts which had historically had little or no market.
The pellet press is a Kahl flat bed system from Germany and produces 1000kg/hour with a capability of 8,000 tonnes/year. The system was fully commissioned in June 2006 and is now in full production. The plant has bagging facilities and now ships bagged pellet fuel across the UK and has recently won a contact to supply pellets to Ireland.

**Pellet Lorry facilities**

There are now three pellet lorries which offer pneumatic pellet deliveries in the South West. Below shows the lorry owned by Welsh Biofuels and the lorry used by Brookridge Timber.
Examples of Boiler installations

The Manor House Hotel is 19th century country manor with 81 bedrooms and offers a range of facilities including indoor swimming pool.

Wood Energy Ltd installed a 500kW Binder pellet boiler as a containerised unit, with full electrical and mechanical installation within the container. A second container was used as the pellet storage unit designed for pneumatic delivery of wood pellets. The Binder boiler has a fully automatic cleaning system of the heat exchanger tubes, exhaust gas recirculation to allow the combustion temperature to be controlled to avoid clinkering and an exhaust gas cyclone to remove fly ash.
5.4. PILOT ACTIONS

Since the start of the PROPELLETS, 18 installations have been promoted in the region, adding 1,910 kW. These are the figures corresponding to June 2007, so more facilities will be installed by the end of the project.

PILOT PROJECT 1 : BATH & WEST, SOMERSET

General overview

Somerset Fair Place is located in Southwest England, in a rural environment, and the building has low insulation quality. Before, several stoves with a very poor performance, and not enough heating power formed the heating system.

Building general overview with new pellets boiler

Construction characteristics are based on metal sheet, without other insulation.

Technical Summary

The suggestion made by RHPL was to install a new container pellet heating system in Somerset Fair Place, due to the possible temporally of the place. In case that in 2 or 3 years the Fair Place changes to other situation, the heating system could be easily removed and installed again.

The calculation of heating demand was of 500 kW power installed, needed to cover the necessities of the place.

Heat distribution will be made through a flexible system, able to be moved in case the facility also moves to other place.
Hot air distribution by means of flexible system

Pellets will be provided by the local pellet mill, presented in the previous sections, producing now with a 1 t/h pelletizer. The characteristics are standard:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>1.12 kg/dm$^3$</td>
</tr>
<tr>
<td>Calorific power</td>
<td>17 MJ/kg</td>
</tr>
<tr>
<td>Diameter</td>
<td>5 - 6 mm</td>
</tr>
<tr>
<td>Length</td>
<td>max. 25 mm</td>
</tr>
<tr>
<td>Water content</td>
<td>max. 10.0 %</td>
</tr>
<tr>
<td>Ash percentage</td>
<td>max. 0.5 %</td>
</tr>
<tr>
<td>Abrasion (dust)</td>
<td>max. 2.3 %</td>
</tr>
<tr>
<td>Made of</td>
<td>Wood</td>
</tr>
</tbody>
</table>

Pellets price depends on the amount requested. An average could be 230-250 €/t.

The technology selected has been BINDER brand due to RHPL is distributor of BINDER, they have the container system, and reliability is high.

The planned storage system is a container situated at the top of the container for the boiler. A truck with a pneumatic system fills it up.

Boiler installation
The main information is presented in the following table:

<table>
<thead>
<tr>
<th>Description</th>
<th>The Royal Bath and West of England Society (RBWES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact person</td>
<td>Jane Guise, Chief Executive</td>
</tr>
<tr>
<td>Action</td>
<td>Substitution of portable oil heating systems by a 500kW containerised pellet system</td>
</tr>
<tr>
<td>Insulation quality</td>
<td>Low</td>
</tr>
<tr>
<td>Yearly Energy demand</td>
<td>520,000 kWh</td>
</tr>
<tr>
<td>Yearly pellets Consumption</td>
<td>100 tonnes</td>
</tr>
<tr>
<td>Type of pellet</td>
<td>Wood</td>
</tr>
<tr>
<td>Calorific Value</td>
<td>19MJ/kg</td>
</tr>
<tr>
<td>Delivery</td>
<td>Pneumatic</td>
</tr>
<tr>
<td>Heating System Installed Power</td>
<td>500 kW</td>
</tr>
<tr>
<td>Fuel storage</td>
<td>Container system approx 25m³</td>
</tr>
<tr>
<td>Ash handling</td>
<td>To be used in land as fertilizer (rural area)</td>
</tr>
<tr>
<td>Heating System Investment</td>
<td>95,000 €</td>
</tr>
<tr>
<td>Full Cost (installed)</td>
<td>190,000 € (including infrastructure)</td>
</tr>
<tr>
<td>Technology, Make and model</td>
<td>Binder, 500 kW, to be installed by Wood Energy</td>
</tr>
<tr>
<td>Financing mechanisms</td>
<td>50 % Private funding  50% Government</td>
</tr>
<tr>
<td>Socioeconomic and Environmental Impact</td>
<td>Promotion on clean technologies through exhibitions and general usage of the showground. Avoids 135 t/CO₂ year</td>
</tr>
<tr>
<td>Project development</td>
<td>Installed November 2005</td>
</tr>
<tr>
<td>Remarks</td>
<td>Very high profile project</td>
</tr>
</tbody>
</table>

PILOT PROJECT 2: JUBILEE WHARF, CORNWALL

General overview

Jubilee Wharf, Penryn (Cornwall) is a Multi-purpose environmental building including community workshops, studio space and a community centre to include child care, community café, office space and business units. It was built during year 2006.

Building overview

It is an innovative building designed, through use of renewable energy and sustainable energy solutions the project aims to be carbon neutral.
Technical Summary

Due to the interesting meaning of the building, it was proposed to install a pellet heating system instead of the initial idea of a traditional oil system.

The boiler selected was a binder 75 kW, with an estimation of 20t of consumption of pellets per year.

Pellet heating system boiler room and boiler installation

Pellets will be provided by the local pellet mill, presented in the previous sections, producing now with a 1 t/h pelletizer. The characteristics are standard:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>1.12 kg/dm³</td>
</tr>
<tr>
<td>Calorific power</td>
<td>17 MJ/kg</td>
</tr>
<tr>
<td>Diameter</td>
<td>5 - 6 mm</td>
</tr>
<tr>
<td>Length</td>
<td>max. 25 mm</td>
</tr>
<tr>
<td>Water content</td>
<td>max. 10.0 %</td>
</tr>
<tr>
<td>Ash percentage</td>
<td>max. 0.5 %</td>
</tr>
<tr>
<td>Abrasion (dust)</td>
<td>max. 2.3 %</td>
</tr>
<tr>
<td>Made of</td>
<td>Wood</td>
</tr>
</tbody>
</table>

Pellets price depends on the amount requested. An average could be 230-250 €/t.

The main information is presented in the following table:

<table>
<thead>
<tr>
<th>Description</th>
<th>Jubilee Wharf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact person</td>
<td>Hill Dunster</td>
</tr>
<tr>
<td>Action</td>
<td>Community Building</td>
</tr>
<tr>
<td>Insulation quality</td>
<td>High</td>
</tr>
<tr>
<td>Yearly Energy demand</td>
<td>94,000</td>
</tr>
<tr>
<td>Yearly pellets Consumption</td>
<td>20 toones</td>
</tr>
<tr>
<td>Type of pellet</td>
<td>Wood</td>
</tr>
<tr>
<td>Calorific Value</td>
<td>19MJ/kg</td>
</tr>
<tr>
<td>Delivery</td>
<td>Pneumatic</td>
</tr>
<tr>
<td>Heating System Installed</td>
<td>75kW</td>
</tr>
</tbody>
</table>
PILOT PROJECT 3: NAW DEBATING CHAMBER (WALES)

General overview

A relevant pellets boiler was promoted during 2005 in the NAW Debating Chamber of Wales. This relevant administrative building will give confidence to politicians, professionals and general people on the good performance of biomass heating systems, more even considering it has been designed as a sustainable building.

Technical Summary

The heating system is based on a 360kW Binder wood pellet boiler, which was calculated it would save approximately 200 tonnes of CO2 per year.

The project started during the year 2005, and it was in commissioning phase in October of that year. The official opening was in March 2006.

The main information is presented in the following table:

<table>
<thead>
<tr>
<th>Description</th>
<th>NAW Debating Chamber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact person</td>
<td>Robin Cotton</td>
</tr>
<tr>
<td>Action</td>
<td>Debating Chamber</td>
</tr>
<tr>
<td>Insulation quality</td>
<td>High</td>
</tr>
<tr>
<td>Yearly Energy demand</td>
<td>423,000</td>
</tr>
</tbody>
</table>

NAW Debating Chamber of Wales
Yearly pellets Consumption | 90 tonnes
---|---
Type of pellet | Wood
Calorific Value | 19MJ/kg
Delivery | Pneumatic
Heating System Installed Power | 360kW
Fuel storage | 46.2 m³
Ash handling | Automatic deashing system
Heating System Investment | €85,000 aprox
Full Cost (installed) | €160,000 aprox
Technology, Make and model | Binder 360 kW
Financing mechanisms | Partially public funding
Socioeconomic and Environmental Impact | This is a high profile, award winning community building on the harbour at Penryn in Cornwall, Avoids 200 t/CO₂ year
Project development | Public start in 2006
Remarks | Very high profile project

PILOT PROJECT 4: NEW OFFICES BUILDING

General overview

An strategic pellet heating system was promoted in the first project by West Devon District Council heating community workshops and office space for small start-up companies.

Technical Summary

A new 25 kW ENTEC pellets boiler was installed in this new high isolated business centre, that was working at full load by the start of 2006. The yearly pellets consumption is estimated in 13t. The pellet heating system was included in the total investment of the building.

The main information is presented in the following table:

<table>
<thead>
<tr>
<th>Description</th>
<th>Pitts Cleave</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact person</td>
<td>Tim Bevan</td>
</tr>
<tr>
<td>Action</td>
<td>New build &quot;incubation&quot; workshops/office building</td>
</tr>
<tr>
<td>Insulation quality</td>
<td>High</td>
</tr>
<tr>
<td>Yearly Energy demand</td>
<td>60,000kWh</td>
</tr>
<tr>
<td>Yearly pellets Consumption</td>
<td>13 tonnes</td>
</tr>
<tr>
<td>Type of pellet</td>
<td>Wood</td>
</tr>
<tr>
<td>Calorific Value</td>
<td>19MJ/kg</td>
</tr>
<tr>
<td>Delivery</td>
<td>Pneumatic</td>
</tr>
<tr>
<td>Heating System Installed Power</td>
<td>25kW</td>
</tr>
<tr>
<td>Fuel storage</td>
<td>7.2m³</td>
</tr>
<tr>
<td>Ash handling</td>
<td>Automatic deashing system</td>
</tr>
<tr>
<td>Heating System Investment</td>
<td>€19,000</td>
</tr>
<tr>
<td>Full Cost (installed)</td>
<td>Unknown</td>
</tr>
<tr>
<td>Technology, Make and model</td>
<td>Entec Firefox PK25</td>
</tr>
<tr>
<td>Financing mechanisms</td>
<td>Financed as part of the main building</td>
</tr>
<tr>
<td>Socioeconomic and Environmental Impact</td>
<td>This is the first project by West Devon District Council heating community workshops and office space for small start-up</td>
</tr>
</tbody>
</table>
5.5. **ANALYSIS AND GAINED EXPERIENCE**

The wood pellet industry in South West England is at an important stage in its development. The key features required for a rapid expansion of a wood pellet industry now exist;

- Local pellet supply
- The availability of high quality wood pellet boilers
- Trained technicians to install and support pellet boiler installations
- Historically high fossil fuel prices
- Government support schemes for renewable energy technologies
- Government drivers and incentives to reduce CO$_2$ emissions
- Environmental concerns about global climate change

However, the market has actually expanded rather slowly in terms of boiler systems on the ground and installed kW. To date the number pellet boilers promoted in the region has increased from 4 at the start of PROPELLETS to 22 to date, corresponding to an increase from 175kW to just over 2,000kW of installed capacity. This is shown graphically below.

However, there are strong indicators that the market could now expand very rapidly. The reasons for this are as follows.

- Regional pellet production has now been available for the first heating season. During that time a marketing campaign (led by Propellets) has promoted the wood pellet industry and this has now led to awareness that wood pellet fuel is not “imported from abroad”. This has taken time and is still an on-going campaign.

- Key sectors are now gaining their first experience of wood pellet boilers e.g. Local Government (schools, public buildings etc.) as well as the commercial sector. Several local authorities are ready to rapidly expand wood pellet heating across their building stock

- There are an increasing number of wood pellet boiler installers who offer pellet boilers in the region. To date there are 12 such suppliers within the Cluster established by Propellets
5.6. CONCLUSIONS AND RECOMMENDATIONS

For a wood pellet industry to expand rapidly in a region, it is essential that two key factors exist;

- Perceived and actual security of pellet fuel availability
- A “critical mass” of pellet boiler installations that people can visit and speak with owners about experience and generally build up confidence that a) the technology works and b) there is support for the technology (e.g. companies who can maintain and service boiler installations)

This has taken time, but there is strong evidence that the South West is starting to reach a “critical mass” where there is sufficient confidence that the public and private sector see that wood pellet heating is an economic and technically attractive method of reducing CO₂ emissions and reducing heating costs.

Clusters are starting to emerge where multiple boiler installations are taking place. In particular Bristol, Gloucestershire and Devon, largely driven by local government and the existence of the pellet mill in Devon are becoming a “focus” for wood pellet boiler technology.

Propellets has been instrumental in working within these areas to ensure that confidence exists within decision makers. A major South West pellet event is now planned for 27th September 2007 where all the major boiler suppliers, potential pellet fuel suppliers, local authorities and other key organisations will be brought together.
This event will demonstrate that wood pellet fuel is a strong and viable technology and industry within the South West and, showing case studies of other EU counties where wood pellet fuel is a mature industry, will build confidence for the rapid expansion in the wood pellet industry within South West England.

**Key work to December 2007 and beyond**

To ensure that a rapid expansion follows over the next 6 months and coming years, Propellets work will focus on the following;

1. Continuation with the major promotional and educational programme to continue to raise awareness
2. Ensure that initial clusters of pellet boilers are successful and that pellet boiler installation programmes that are underway in many local government authorise are successful and continue.
3. Work with sawmills and companies producing wood residues to help establish additional pellet suppliers in other areas within the South West region.

**6. RESULTS IN ITALY – FLORENCE PROVINCE**

**6.1. OVERVIEW**

The project activities in Italy have been met with much interest of market actors and users, which are interested in the opportunities of applying pellets for larger systems, besides the already developed Italian market for stoves.

The main activities by ETA were contacts with many possible heat users, which had relatively high (specific) heating costs. Most of them were municipalities, especially those with buildings that still depend on heating oil.

Also, some innovative users were contacted. Finally efforts were made to set up complete chains.

The efforts with an innovative character were:
- Cogeneration project with biomass supply problems.
- Agri-pellets production with special technology that uses much less
- Retrofit with burners instead of substitution of whole boilers.
- The research of boilers that go also on agri-pellets.

Initiatives with supply chains were:
- Social help association for service (purchase and maintenance), integrated with municipality users (Monsummano)
- Pellet production with agricultural residues (entrepreneur of Pistoia; municipality of Palena, Province of Trento, lately with the municipality of Rosignano ManagEnergy).

Also an attempt was made for cooperation between two partner countries: Italy and Finland. The Finnish Propellets partner was in contact with a heat supplier that was interested to transfer a financial approach for heat delivery service to Italy.
A number of factors hindered the progress of larger heating systems with pellets:
- Until February 2007, the financial support was very weak.
- Natural gas is still the big competitor and technology is easy and cheap to install.
- Price variations for pellets, but even its availability was a problem in some periods of time, decreasing the confidence of the users.
- Very slow decision making processes of municipalities
- Low responsiveness of enterprises and the need to follow them every day.
  The last two points are based on the busy time schedule of the average.
- Financial institutes are very restrictive in providing loans.

Therefore, the objective of 1000 kW installed capacity will be reached during 2008-2009, as there are several projects that can be realised in this or the next year. The installed power 610 kW, previsions for 2009 are 1744 (including Rosignano).

As positive factors that will push the progress ahead are:
- Natural gas Security of Supply becomes a problem.
- The genuine interest in agri-pellets.
- A steep increase of environmental awareness, fed by mass media.

In conclusion, the positive effects that have been reached by Propellets in Italy are:
- Awareness of the opportunities to use pellets also in boilers and plans to do it.
- Realisations in the private sector.
- The dissemination of the agri-pellets had a positive effect on the project, especially because it comes in a moment that many entrepreneurs started to produce pellets. On the consumers side, we looked to technologies that are able to burn lower quality pellets and found several technology providers (also Italian) for this.

The developed and implemented projects in Italy were (see further in the text):
- A new hotel (Rosa degli Angeli) in the Province of Trento, 200 kW.
- A factory of large switchboards (for railways) in Province of Milano, 400 kW.
- Low investment for large savings at home. It shows a way to let the main boiler work much less.

The projects that will be realised within 2009:
- Rosignano 647 kW (but probably much more in order to use self made pellets);
- Farm in Tuscany, 77 kW.

The not yet realised projects were:
- Monsummano municipality with two schools and two sport centres: 526 kW. They declare to have lost interest because of the barriers and experiences with the price.
- Palena municipality with two schools: 430 kW. The financial reasons are the main barrier against quick realisation, but interest is still present.
- Calenzano municipality, cogeneration with biomass: 3500 kW input chemical power. This project is unsure and depends on several political factors
- Large hotel in Montecatini Terme: partial substitution of 900 kW of natural gas boiler. A prefeasibility study and visits were made but there was no response.

The achievements outside Italy (according to the need to stimulate also the market outside the partner countries):
- A new pelletising technology production plant of 1 ton/hour was implemented by an Italian stove producer in Bulgaria, after strong support of ETA,
- Assistance was given to the Renewable Energy House of the EREC in Brussels, to install there an 80 kW pellet boiler of KWB.
An activity by ETA to resolve the mentioned problem with loans, was that recently contacts were taken with the National Confederation of Craftsmen (CNA) in order to research the opportunities to get easier guarantees for loans. They pointed to new initiatives of Regions to make it easier to find capital (for example the Region of Tuscany has a guarantee fund ”Fidi Toscana” for several types of socially and environmentally important loans with amounts that are absolutely sufficient for any pellet heating system).

A last opportunity, with important impact, was found in the Municipality of Rosignano. A pellet chain of production and utilisation is now studied under a contract of ManagEnergy. It will be described under “Successful cases”.

6.2. EXISTING BARRIERS AND INCENTIVES

Main Barriers:

- Until February 2007, the financial support was very weak or non existing. If there was support, it was only for a short period and for a limited geographical area. Therefore, the trust in this support was low.
- Natural gas is still the big competitor, technology is easy and cheap to install.
- Price variations for pellets, but even its availability was a problem in some periods of time, decreasing the confidence of the users.
- Very slow decision making processes of municipalities.
- The limited technical knowledge of municipal services leads to diffidence.
- Low responsiveness of enterprises and the need to follow them every day.
- The lack of existing and nearby examples and support.
- Italy “believes” in pellet stoves (like in USA).

Incentives:

- After February 2007, the financial support became much stronger with the Financial Law of the new Government (http://www.governo.it/GovernoInforma/Dossier/energia_clima/index.html). It gives a fiscal detraction of 55% in 3 years for everyone (citizens and other owners of buildings) that increases in some way the energy efficiency of the building, including biomass boilers.

6.3. BEST PRACTICES

USE OF PELLETS FOR MODERN HEATING OF HOUSING

Amga Energia srl (www.amgaenergia.it) of San Muro Pascoli, in the province of Cesena, is a service company that operates in various sectors: lighting service, checking and maintenance of systems, heat supply and the use of biomass for the production and the use of pellets. The heat supply service consists in the design, realisation and management of biomass heating plants. The user pays this on the base of their heating hours. This approach led to the realisation of over 30 plants in a few years. Many other projects are going to be realised. The success of this activity is due to the convenience and the comfort of the offered service: the old boiler of the user is replaced with a pellet boiler, and considerable savings are realised on the heating bill. Often, the company itself
pays the investments for the plant, financing the costs with the supply of the heat. Using pellets will reduce the needed space for fuel (or its running time is increased), compared to other biomass types. The transport, handling and the filling of the stores are also easier.

Amga Energia produces partly the pellets itself, saving on their costs and keeping better control on the entire energy chain. Therefore, a good competitivety is reached. Amga uses pellets also for their own offices, using a model CS 500 of 580 kW of the constructor D’Alessandro Termomeccanica (www.caldaiedalessandro.it). This boiler has a underfeed burner, and a 3 stage tube array for the heat exchanger in the combustion room, inspection doors, a variable speed feed screw, a hopper for the pellet supply and a fuel supply controller.

Pellet used for heating a hotel in Lana (Bolzano), Italy

Since 2000 the building of the Teis Hotel in Lana (Bolzano) is heated by pellet through a boiler that produces totally 540 kW.

Background
A small district heating network fueled by a pellet plant has been installed in the Teis Hotel located in Lana, in the Italian province of Bolzano. Since August 2000, when the plant became operational, pellets heat up the about 10,300 m² area of the hotel.

Technical facts and function
The automatic plant installed in the Teis hotel is composed of a KS 5 boiler with an output of 540 kW.
The boiler is equipped with mechanic devices able to guarantee the correct functioning of the boiler feeding device (conical screw).

View of the Teis Hotel

Local district heating
The local district heating network is about 50 m long and brings heat to the hotel buildings to be used for all the hotel needs.
An emergency boiler, fueled by gas oil, is also available.

Management
One person is enough for managing the boiler. It has been estimated that the annual maintenance time is about 50 hours, while the administrative management requires 10 hours/year.

The total volume of the boiler box together with the auxiliary spaces for district heating is about 10 m³.
The storage silo has a volume of about 100 m³, but a very rational logistic solution as for the fuel store allows not to waste space to be devoted to the machine box.
6.4. PILOT ACTIONS

The following sections will first describe successful cases of pellet heating and 1 case of pellet production that we assisted outside our project countries (related with the Propellets objectives to stimulate also other markets). After this, the pilots will be described, which did not (yet) result in a concrete project.

**Successful actions**

**High efficiency hotel in winter sport area**

A new hotel hotel (Rosa degli Angeli) with a total floor surface of 2,700 m² on 6 floors, Carola a Pejo in the Province of Trento, will have solar collectors and heating with two independent pellet boilers.

The hotel will operate the whole year, including the winter, when many tourist will visit the winter sport areas nearby.

The building has excellent thermal characteristics (45 kWh/m² per year), compared to what is required for Class A in this area (70 kWh/m² per year).

The two Hargassner boilers of 100 kW have underfeed burners, which can modulate power between 30 and 100%. They will consume approximately 65 ton of pellets per year, reducing 100 ton/year of CO2 emissions, not considering the solar collectors 60 m² that are expected to produce 43,800 kWh/year.

The heat will be distributed into a network of normal radiators and low temperature floor/wall heating.

The total price of the pellets, including the transport, is 195 Euro/ton. These pellets were found on the international market, so not connected to the boiler supply. The local service is guaranteed for 24 hours/day.

**New pelletising technology implemented by Italian stove producer in Bulgaria**

Edilkamin installed the new technology, after strong support of ETA, in its own production facility in Bulgaria, but not much is yet known, because the new plant requires still set-up service. This is a problem, as the technology provider is very busy with the booming request (as mentioned).
Modular heating in a railway switchboard factory

A big factory building for construction of large switchboards (for railways) in Giussano (Province of Milano) will start the first months of 2007 with a pellet heating installation. The motivation for the pellet heating was the substitution of the old boilers that run on costly heating oil, and the concern of rising prices of fossil fuels, and its availability. These are completely substituted. The equipment has already been put in place by Mont-Ele, an engineering company that operates in energy, industrial, transportation and environmental fields. The total volume of the building is 2,500 m³. As it consists of several types of functional sectors that require autonomous heating management and times, and because good contacts with a local pellet boiler dealer were already established, which supplies max. 100 kW boilers, the total heat demand of 400 kW will be covered with four boilers of Hargassner.

The functional sectors are the following: offices, store rooms, construction rooms, various other types of spaces. The four boilers are independent, so that these sectors can be heated in a modular way, and boilers can be also switched off. The heat is mainly distributed with water: the total circulating amount is 15,000 ltr, and two buffers of 2,000 ltr can provide for peak demand and as energy storage during heat lower demand. This, too, decreases the need for larger boilers. The pellets are supplied through a contract with a foreign producer. The consumption is 25 ton/year, that are delivered once per year (allowing negotiation in spring time!) and stored in the four containers of 6 ton each, visible on the first photograph.

Low investment for large savings at home

Even if it is not a boiler system (target of Propellets), it is still an important example, which would result in a large additional saving of CO₂ in a country like Italy, were stoves are already popular. Stoves have a strong dominance in the Italian market. This is also due to the much higher price for boilers, the lack of support and the additional complications for storage and feeding of the larger quantity of pellets. The same was said at the Pellet Conference in Wels in 2004, by a USA speaker about the USA market. In spite of the small power of a stove and the focus of the project on (medium range) boilers, the stove can have a significant impact on the Italian market and the emission reduction, by considering the more than proportional potential savings. In the home of the project manager for Italy, a stove module (Pelbox of Edilkamin) was incorporated in a fireplace, at a central place, in order to heat about half of the apartment (a large space without doors or walls). The effect of the stove was a decrease of the heating time of the central heating on natural gas, to about one quarter of before, just because it is considered sufficient.
Practically, the central heating is used only for the night-zone of the apartment. It is not said that closing radiators in the night zone reaches the same results (this was already common practice in this home). The reduction of the cost in the first year (the very cold winter of 2005/6) was about 75%, from about 800 Euro to 200 Euro, with 800 kg of pellets for a price of 210 Euro. The price of the stove (2400 Euro) has in these conditions a return in 4 years, not considering the additional advantages, among which the security of supply (the gas prices were under a strong pressure because of the international developments in that winter).

**Complete pellet chain for 5000 ton/year, feasibility study with ManagEnergy**

The coordinator of the Italian partner ETA was sent by ManagEnergy, as sectorial expert to a local event of the Livorno ENergy Agency EALP (5 October 2007). During this event, it was noted that 10,000 ton/year of biomass (trees and shavings) end up on the landfill (see picture below). On the other side, many buildings of the Municipality (and others) are heated with oil. In the figure is a school with a low boiler room that has place for pellets on roof.

Together with the alderman of Urban Quality and the director of the EALP, a request was sent to ManagEnergy (December) to study on the feasibility of creating a pellet chain (production and utilisation), looking also for a local market: the biomass would yield about 5000 ton/year of pellets, which is too much for the municipal buildings. A letter of intent from EALP and municipality sent to the coordinator.

The request was approved in January (“MANAGENERGY” TREN-484/2005/S07.66837 SECTORAL ADVICE). The first visit already showed good possibilities to realise the pellet chain:

- the reasonable quality of the biomass and the comments of the pellet machine constructors on it;
- the interest of the (polyfunctional) landfill manager to invest in the pellet machine and to deliver pellets to the market;
- availability of the technology on the Italian market of burners and boilers for lower quality pellets, for heating but also for (small to large) industrial applications like steam production;
- User side: conditions of schools and presence of industry;

**Actions not yet realised**

**Cogeneration project with biomass supply problems**

This opportunity was discovered during the TerraFutura fair in Florence, which was a Propелlets visit. A biomass cogeneration project was organised in Calenzano by an important waste management company and the municipality. The total power (thermal + electric, so little less than the chemical input) was 3.3 MW and it was rather surprising to hear from a municipal functionary and other persons, that there was still a problem for supply of fuel: the total needed amount of biomass was not yet fully identified. It was foreseen that biomass had to be brought from larger distances than foreseen. Only a low part (10 – 25%) was fairly sure. Therefore, a logistic problem was on hand, which could neatly be solved with the pelleting technology, where ETA is involved in. Rather long discussions followed with the municipal functionary Dr. Bilenchi, and also contacts were made with the waste management company, already
a contact of ETA. However, they were for several reasons in a waiting phase with the initiative and it was not so clear what the reasons were and how quick progress would be.

Farm houses “I Fabbri” in Greve, south of Florence

Situation
A complex of rural houses consists of two dwellings and 2 buildings for service. The dwellings were till now inhabited only in summer, because they were not heated. Now it was needed by the owners, for a new family and for rent, so new heating systems had to be installed. Two pellet boilers plus radiators for the distribution of the heat were planned in two of the buildings: the “small house” and the “big house”.

The boilers were planned to be of Alessandro Termomeccanica, able to burn low value agri-pellets. Also here there was an innovative idea: to apply a very small pelletiser from a university, for 50 kg/hour, able to pelletise agricultural residues in spare time of the farmer personnel.

The main reason for the delay in the development was that the family situation didn’t develop as expected and that the situation is still as before. Also, the high price of pellets in the winter of 2006/7, and the high temperatures in this same winter did not convince the owner to go ahead.

Basic schools in municipality of Palena

Situation
Palena is a small town south of Chieti (see the blue circle on the map) with 600 families.
The Mayor asked us to advise how some buildings, actually using heating oil, could be converted into an ecological way, saving on the bill at the same time.

The municipality is at the same geographical altitude of Rome, but at about 700 m. above sea level, so much colder. Indeed, the degree-days are 2260 in a year.

One school is large: 9800 m3 or about 3300 m2, used by children from 6 to 13 years old. The total cost for the 10 m3 of heating oil per year is 12,000 € (!). The high cost is related to the delivery service to this small urban centre at a high level above sea level. The boiler of 450 kW of RIELLO is not old: 12 years. time that it is active is 1400 hours/year, because it is in Climatic Zone E, so that heating is allowed from 15 Oct until 15 April. The other school for children of 4-6 years is 4.400 m3 or about 1.400 m2. The boiler is a 200 kW model of RIELLO, consuming 4.4 m3 of heating oil per year for 6.500 €. The price is higher than for the other school. The mayor was also interested, induced by a slight scarcity of pellets on the European and Italian market, in stimulation of pellets auto-production. The municipality manages 2500 ha of forests, with mainly beach, but also oak trees. Normal cleaning of this forest can give each year 3.500 ton of fresh biomass when the wood log delivery to the citizens is subtracted, or about 2.000 ton pellets. This is equivalent to 1 ton of oil, enough for about 1000 households. In some way this case is like the Rosignano case. Indeed it was preceding in time and the difficulties with it made us look for another case, wich was found only at the end of the project.

The reason for some delay in the project was that in spite of many contacts and a good mutual understanding and goodwill, the Mayor was not able to bring the initiative to the concrete level, because of financial problems. ETA had also contacts with banks (for example the Banca Etica, a green investment bank) in order to externalise the financial
burden from the municipal budget, but the credit limits are often already covered for municipalities, so even a good return time may not guarantee the practical feasibility, as in this case.

Because of this problem, ETA talked with Iwabo (Sweden), which produces pellet burners for retrofit in existing oil boilers (as mentioned above, the two schools have quite new boilers), so that the investment can be low. Contact has been established again with the Mayor about this and a decision must still follow

**Basic schools and sport centres in municipality of Monsummano**

**Situation**

Two schools and two sport centres with heating oil boilers, each from a few to several hundreds of kW (some of which only 10 years old), spend about 1 Euro/litre, so each of these buildings had a bill between 5000 and 8000 Euro. Several initiatives were carried out to help them with the decision in favour of the fuel switch and the local functionaries showed goodwill.

In spite of the effort, the municipality never took a positive decision and was not explicit about the reasons, which has to be explained (also by other functionaries of the municipality) by fear of a new technology, a new fuel and lack of nearby examples. Nevertheless, the earlier mentioned pellet burner technology of Iwabo, Sweden will be proposed during the next months. It was already known to ETA, but now there are new and interesting models on the market, which allow also to burn agri-pellets (with a reasonable quality). The coming winter will be colder than the last one, pellets will cost less and fossil fuels more. It is known that they will work on a first draft budget in October. It might be hard to convince them, though. A few days ago, they declared to have strong doubts about the convenience of pellets, mainly because of the reasons in the first sector: wildly varying pellet prices; other operation costs; no examples nearby and the lack of support from the province. Jointly with this effort, also the municipality of Pescia was visited (vice mayor), together with the above mentioned social organisation, with the objective to find potential users. Pescia is in the same valley as Monsummano and the objective was to address all 11 municipalities in this valley, after success with Monsummano. Pescia declared to be working on an energy plan and to have in mind significant goals with sustainable development, but where not ready for initiatives before this plan had more form.

**6.5. ANALYSIS AND GAINED EXPERIENCE**

In this paragraph, the SWOT analysis for Italy (D2) is taken as the framework for the analysis.

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<th>OPPORTUNITIES</th>
<th>ANALYSIS</th>
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<td><strong>A) INPUT COST FACTOR</strong></td>
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In some condition, pellet heating systems can be very competitive in the eleven Nievole valley municipalities (Province of Pistoia), for the following reason:
- Natural gas supply does not cover the whole territory;
- Presence of old and inefficient oil systems;
- Presence of pellet producer in the territory;
- Pellets cost less than natural gas;
- Heating systems sellers provide also pellets (Security of Supply).
- The Italian pellet market is the strongest in Southern Europe, the number of stove sales is expected to double this year.

- The experience is that in the first steps only situations with oil heating should be addressed, because of the higher cost of the fuel. Even then, non technical barriers are very dominant. So, in the case of natural gas, were the price difference with pellets (as fuel) is already much smaller, the changes in the pellet price created very large changes in the pay back time. The other price difference between gas and pellets (that of the investment) is the price for the boiler: Italy has been for many years a strong natural gas economy, and this is evident from the large number of technology providers for equipment and the low price for good gas boilers.
- Agri-pellets will be a decisive step towards still better competitiveness, but this needs market efforts to introduce a new technology, not only for the production, but also for the burning of those pellets.
- The cost of pellet heating systems is still too high and very few Italian products are on the market. Part of the investment is the cost of auxiliary systems (storage and feeding). Storage and feeding can imply large costs for adaptation of a not adequate building (as in the project Biohousing of EIE is studied). Only the very recent National Financial Law gave a strong input for investments, about which another paragraph will give more information. In comparison, the simple stove with their own storage and manual feeding with small bags are not only cheap, but also the total investment is much quicker to understand. Moreover, as in the pilot case study has been noted, a single stove can replace sometimes a large share of a central heating system, and decrease the running hours of this latter.

After all, the cost factor, together with the simple approach of stove installation, explains still the strong market of the stoves in Italy, and the weak position of pellet boilers, which have a very strong competitor in the excellent Italian gas technology. Long term price stabilisation of pellets, investment support for boilers and pressure on natural gas supply are necessary to change this.

The opportunity of agri-pellets is very important for Mediterranean countries, where wood is scarce and agricultural residues are abundant (and a burden on society).

B) TECHNOLOGICAL FACTORS
Quality of heat provided by pellets systems is good, and heat is instantaneous; Pellet heating is now a modern technology, offering all the comfort that users know already from fossil fuel heating (continuous operation, automatic temperature and distant control, feeding of fuel), and the clean exhaust gases make it easy to get authorisation; A new pelleting technology is available, which can use different types of biomass, including low cost residues, without any additive. This technology enables mobile, and therefore very local pelleting. That will make biomass collection much easier;

As mentioned above, with the cost factors, the technology of pellet heating systems is mature, but different than that of natural gas. Pellet heating needs a storage and a feeding system. Only with stoves, this is no issues, because everything is enclosed in a single device. For boilers, storage and feeding may need space, which is often unavailable in Italian houses, where prices of a square meter are rather high. Also, many Italians live in flats, which don’t allow the flexibility in finding solutions like in other countries where more families have a garden, like Austria. In addition, the extra systems for pellet heating need sometimes a lot of research and management to find the optimal solution, which are a significant technical/psychological barrier for Italians. The new pelleting technology is available, but under control of a small enterprise that is now very busy to process the many requests for information and for orders. Moreover, it is difficult to introduce the technology into a market of pellet producers, which are willing to produce only normal wood pellets, and will not invest in a technology that has innovative characteristics. Also the user side needs new technology for the application of agri-pellets. This technology is available (as we are always keen on it, also on the several travels for the Propellets projects), also for rather small boilers and even for pellet burners. In conclusion, also technological factors make introduction of pellet boilers difficult in a market, which made its choice long ago for stoves. In spite of this conclusion and that for the cost factor (above), the pellet boiler will have a good chance, but it needs time, financial support and considerable legal/social pressure (like more awareness of environmental urgency and of a menace for short supply of natural gas, as two winters ago).

C) SOCIO-ECONOMIC FACTORS

Pellets can be made from local resources that reduce the energetic dependency; The creation of local pellet markets allow to stimulate new local activities;

Environmental urgency increased much in Italy, and as a result, national support became more consistent. It is expected that also the decisions of single families will be (slowly) influenced by the awareness that each contribution to the mitigation of climate effects will be welcome. The opportunity of agri-pellets is, also as social factor, very important for Mediterranean countries, where wood is scarce and agricultural residues are abundant: they are now a burden on society (cost of elimination) but in the future they can provide income to the agricultural sector that is going through hard times.
There has been a constant effort from our side to point farmers and producers to the new technology, but the production capacity of it is developing slowly because of the very busy technology provider. Also demonstration is sometimes difficult to organise. However (as mentioned in 6.4. Pilot projects), a pellet production plant with this technology was recently set up by one of the most important Italian stove producers (Edilkamin), which is now in the set up phase. In conclusion, there are quite some socio-economic factors that are promising a good progress towards a better market for larger pellet heating systems (besides stoves), but partly beyond the Propellets period (because of late financial support, only recent environmental alarmism in the media, and a late development of the agri-pellets technology).

### THREATS

<table>
<thead>
<tr>
<th>A) INPUT COST FACTOR</th>
<th>B) TECHNOLOGICAL FACTORS</th>
<th>C) SOCIO-ECONOMIC FACTORS</th>
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<tbody>
<tr>
<td>- Natural gas high-efficiency boilers decrease specific cost of (fossil) energy;</td>
<td>- Feeding technology is much better than with wood logs or chips, but still more difficult/expensive than oil/gas;</td>
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<td>- The prices of natural gas boilers is definitely lower than that of pellet boilers;</td>
<td>- Heating systems have sometimes problems with certain qualities of pellets with attractive prices;</td>
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<td>- Pellet prices are sometimes exceptionally high at local stores;</td>
<td>- Houses are not yet designed in an optimal way for pellet utilisation. Two examples: no storage room near the boiler/stove; collector of central heating system far away from living room so that hydro-stoves are not easy to connect.</td>
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<tr>
<td>- These factors have been discussed at the “opportunities” for the INPUT COST FACTOR.</td>
<td>- As said before, feeding technology (but also storage has to be mentioned) show to be e refraining factor, not only in comparison with oil, but especially with gas (which has direct delivery and extremely simple and compact feeding technology);</td>
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<td>- Heating systems seem to have already better capability to use lower quality pellets, but this limits the choice to a few technology providers;</td>
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<td>- As mentioned above, this factor not only makes pellet boilers impossible in some cases and expensive in other cases, but it refrains also potential users from trying it.</td>
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The current economic recession refrain potential users from the investments in pellet technology, even if life time cost is lower. It was already known from the beginning that our main target group (municipalities) has strong limits with budget. We had the experience that not only investments are difficult for them to approve, but even loans are difficult to obtain (because of credit limits and very cautious behaviour of banks to give credit), also if these loans can be paid back quickly. External financial management seems to be the only solution in these cases. However, for other reasons, they were the most interesting and voluminous target group for Work Package 3 of Propellets.

### STRENGTHS

<table>
<thead>
<tr>
<th>A) INPUT COST FACTOR</th>
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<tr>
<td>The price of gas is connected with fossil fuels: the petrol price is continually increasing</td>
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<tr>
<td>The increasing of pellet market lower the prices of pellet</td>
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</table>

### B) TECHNOLOGICAL FACTORS

- The experience after the writing of this SWOT is indeed that the price of gas is indeed continually increasing. In addition, an effect of one way price change (that means, a global increase in price will lead to an increase for the final user, but not so for a global decrease) is also in some extent true for gas.
- Italy imported much (about 50,000 tons/winter) from outside Italy. Transport costs are not in proportion to distance, so in many case one can calculate an additional price of 50-100 Euro/ton for pellets from far. This is a clear signal for a low cost product: produce it locally.
- After the very short supply during the very cold winter of 2005/6, many new producers came on the market. These produced too much pellets for the very mild winter of the successive year, but this “thermal donation” of nature was followed very late by the pellet price.
- The visit to the Pellet Conference, 2007 in Wels revealed that also the Austrian market had in and after the cold winter a blow of pellet prices from 200 to 260 Euro/ton, which were partly due (according to some on the event) to the strong demand from Italy.

In conclusion, the foreseen stability of the pellet prices in comparison with varying prices of fossil fuels (much asserted by pellet market actors), came out only partially. It seems however, that the market answered with an improvement of supply flexibility (production capacity in more countries and better transport). However, the best solution for a stable price seems to make better use of more local (less distant) resources. This means, at least for Mediterranean countries (low wood resources) that technology (pelletisers and boilers) should shift to agri-pellets.
The recent automatism of pellet boiler allow to bring near the easiness of methane system.

This is still a valid argument in the market of today, and pellet systems are surely more convenient than other types of solid biomass but the auxiliary systems that are needed for boilers (not for stoves) make it more difficult that fossil fuel systems, especially natural gas technology is still much easier to install.

C) SOCIO-ECONOMIC FACTORS

Heating costs are an increasing burden on the population, including the lower incomes. This factor is increased by the dependent position of Italy on the international market (Security of Supply). Pellet heating can lower the risk of short supply and have a positive impact on the price. This in turn has a positive impact on social welfare.

Our conclusions in this phase of Propellets is that this is still true: in spite of the unexpected variations of the pellet price, the fossil fuel prices are expected to behave worse, most of all because of the steady grow (while the pellet price returns even below past values).

As a point of Strength of agri-pellets for socio economic factors we found two factors: the local origin of the input resources for pelletising, which will turn a cost into a revenue for local agriculture, and the positive impact on the cost for the population and municipalities (with a weak budget), provided that they will have technology to burn agri-pellets. This technology is becoming more and more available.

WEAKNESSES

A) INPUT COST FACTOR

Information about cost of pellets is not clear. There are many local variables that don’t allow to have a uniform price, like for fossil fuels: this problem refrains users (public or private) to choose for pellets.

There is strong competition between pellets and other formats of solid biomass.

Comparison between costs for biomass and fossil fuels (per litre equivalent of heating oil)

The statement about clearness on pellet cost can only be confirmed: The succession of a cold and warm winter in the period of Propellets showed the influence of climate on a fragile market like that of pellets. Our conclusion for Italy (and all other countries with scarce wood resources) is a confirmation of our recommendation: switch to the resources that you have in abundance and you will be rewarded with stable prices.

Our impression on the competition between pellets and other solid biomass is that on large scale, pellets will be able to grow, because of the logistic problems. The use of chips and logs is an old tradition and will stay as it was, or grow slightly. The huge potential availability of agri-pellets will be able to support a very quickly growing market.
### B) TECHNOLOGICAL FACTORS

- New technologies are often developed by small medium enterprises; they are not so strong to permit the penetration of new technology in the market.
- This is still true. Moreover, in Italy their would be needed two innovations: the first to use more pellet boilers and not only stoves, and here the Italian technology provider are not much. Second, the need for agri-pellet boilers in order to have a more tranquil prospect for Security of Supply. Here a few Italian enterprises have a good history: the traditional need for an agricultural country to burn agricultural residues (including for example humid olive waste) led to the presence of some enterprises that now present the possibility to burn agri-pellets. It is still difficult for them to enter into the real market for larger heating systems and probably the installer sector should be convinced.
- The Ecotre pelletising technology was originally also Italian (Calenzano, next to Florence). It was so difficult for them to get a market that they had to be bought by another EU company (Slovakia).

### C) SOCIO-ECONOMIC FACTORS

The unquestionables socioeconomic benefits find an internal limitation: the cultural barriers.
The scepticism born by disinformation and by difficulty to change inefficient behaviour.

- The cultural barriers were already mentioned above: the cumbersome process of choosing a technology, to decide for changes in the structure of the building for storage and feeding, and the unsure supply of the winter 2005/6 make decisions very slow.

Some boilers that can burn agri-pellets are:

- **Oekofen**, which had also dissemination about Miscanthus pellets on the exhibition of Wels, 2007.
- **Reka** from Austria (exhibition of Wels, 2007).
6.6. CONCLUSIONS AND RECOMMENDATIONS

Introduction

The conclusions till so far are that Italy is a country with a good pellet experience, but in a somewhat other direction (stoves) than medium heating systems with boilers. This is most of all due to the certainty that many people have about the role of pellets: in the living room. This is also the case in the USA, where boilers have also much difficulty to get a market. Also, the strong position of natural gas suppliers and the excellent technology providers in Italy make it difficult to see pellets in another role then stove fuel, where a “real” woodfire is obtained with relatively little effort and organised in one or two days after the decision (just buy the object and find the hole it the wall).

Another conclusion is that the succession of two very extreme winters (cold → mild) played a bad trick to us, trying to convince potential users: the first winter convinced them that the pellets are unavailable and/or expensive, the second, warm winter removed the question of heating from their interest.

Of course, pellets are not only an economic issue: also environmental drivers exist for the need to stimulate them. As these are a question that concerns the community, there should be support from the public authorities. Recently this has been implemented with the Financial Law, allowing detracting 55% of the expenses for energy efficiency in buildings from the income tax in three years. It is expected that this new law, which substantially change the economical conditions for pellet heating, will make the chances for the Propellets objectives much better, though rather late.

Another factor for the convenience of pellet heating is the fuel price. Natural gas is not so expensive as heating oil and LPG. These liquid fuels have a niche market, where the gas grid does not arrive. That is not in many places. Therefore, a new type of pellet should come into the market, which has a much lower price, but not a much lower heating value and without too much technical and environmental problems.

This could be the agri-pellet, made from the abundant resources that are available in Mediterranean countries (low wood resources). This will also give the advantage of secure supply, which was shown to be a problem in Italy.

The fact is: the continued operation of a central heating system is usually much more important than that of a pellet stove, which is often considered as additional heating and/or a nice looking luxury. Therefore, Italy and other short-of-forest countries should absolutely rely more on the agricultural residues. Transforming these into pellets will make it a modern fuel, adequate to compete with fossil fuels in standard situations that we find in schools, hotels, offices, living quarters and industry.

We promote now a new pelletiser technology with the following two advantages:

1) No thermal pre-drying needed, because this is done by very high mechanical pressure, so it requires much less energy and space to produce pellets;
2) Mixing of several types of biomass is possible (60 types were tested among wood and non wood, without binding materials), so it is possible to “compose” pellets that respond exactly to some required standard of quality.
So, it is a suitable technology to offer pellets of lower quality to the market of large users, preserving wood pellets for stoves. As said before, boiler and burner technology is developing towards these agri-pellets.

The conclusion with this direction is that we direct our efforts directly towards the agri-pellet opportunities, if possible (and not contested by potential users) also within Propellets, because we believe that the medium scale pellet boilers in Italy will have, sooner or later, too much difficulty with the supply of pure wood pellets. This is based on the quantity of fuel, which a consistent number of such boilers in Italy would need. Moreover, the user of a pellet boiler will be much more critical to Security of Supply than a stove user (see the critics of Monsummano). Finally, it will have a positive impact on local farmers, which will have a supplemental income, and it is not impossible that they will find an agreement with the users (see municipality of Palena).

Conclusions and recommendations:
- Our conclusion for Italy (and all other countries with scarce wood resources) is a confirmation of our recommendation: switch to the resources that you have in abundance and you will be rewarded with stable prices. We sustain that suitable medium size boilers do exist and can be developed further, which will burn agri-pellets without technical damage and very limited harm to the environment (less then many other ways that agricultural residues are treated nowadays). Technology must be found and developed for burning agri-pellets in medium pellet boilers. Research is needed for sustainable combustion of agri-pellets and standards to guarantee constant and known quality for several distinct classes of lower quality pellets.
- Socio economic impact on population and farmers must be analysed. The reduction of logistics, resulting from pelletising agricultural residues can be studied, compared to large quantities of wood pellets that must be transported nowadays. Probably, the lower price of local agri-pellets, compared to imported wood pellets, would automatically attract users of pellet boilers, therefore avoiding transport of huge quantities of pellets that will be necessary in the near future. The very large quantities of agricultural residues, as studied under the EC supported project Pellets for Europe, represent a resource that is enough not only for pellet heating as intended in Propellets, but also for small and large industrial users: technology to make ot air, water or steam with (agri-)pellets is already available. This will leave pure wood pellets for users that can not use lower quality pellets.
- If medium and large pellet boilers continue to rely on only pure wood pellets, this will hinder the progress of biomass heating in the same way as the photovoltaic industry was held back in its growth when it was relying on scrap from the semiconductor industry. In the same way as they are now producing solar grade silicium (less pure than the electronic scrap) to feed the solar boom, also the biomass sector must be able to make pellets from the huge agricultural residues, at least in countries where these are much more abundant than wood. In EU27 there is about 200 million dry tons / year of these residues. Pellets from local residues will surely result in stabler prices, therefore eliminating one of the most important barriers against pellet heating in Italy and many other countries (in Finland, heat pumps seem to be preferred now, because of this instable pellet prices).
- Also a lot of work for convincing and set up of production of supply chains are necessary. Society must be able to use agricultural residues that are not always
available in a concentrated way, so collection of biomass and *early* pelletising also with rather small pelletisers is also a new challenge, which will avoid transportation of voluminous and humid biomass.

- It is still difficult for small enterprises to enter into the market for larger heating systems and the installer and building sector should be convinced. Otherwise it remains only a market push, and not a pull. There are already EC project running with focus on the building sector (Biohousing, where ETA is partner).

- Feasibility Studies for the total costs in the whole chain of agri-pellets: the avoided cost of waste disposal but on the other hand the waste collection cost if you want to pelletise it. The price that can be asked for a lower quality product. The additional costs for a different boiler. The environmental damage from burning less pure pellets, compared with the harm if the agricultural residues is treated in another way (or left, or burnt in the field).

- Dissemination has to continue and addressed to several sectors. A combination of articles and workshops should concentrate on several sectors, be held in their specialist events and be more frequent that was done under Propellets: so several presentations for installers of heating equipment in meetings that they are organising, the same for municipalities, which have also their associations and their own events. Other sectors that are well organised in associations, have their meetings and are potential users of pellet heating: building companies, hotels, hospitals, etc. Presentations can also be organised for corporate meetings, for example for supermarkets, offices, etc.

- The technology of exchange the oil burner of a boiler with a (agri-)pellet burner, should and will be analysed and promoted more in Italy. It will lower the cost for the conversion: not a new boiler but only a new burner is necessary.

- Financial issues: support remains an important success factor for the progress of pellet heating, if low cost technologies based on natural gas remain still available on a nation wide scale. Financial recommendations:

  - A study how much support would be needed to make it competitive in one or another market.
  - Involving the financial sector:
    - Banks and shop linked credit institutes (like those that can be activated during purchase of domestic appliances, cars, and the like) should be linked better to purchase of pellet boilers.
    - the ESCO approach seems the only method to finance projects in situations where credit is difficult to obtain.
    - research the opportunities to get easier guarantees for loans, looking for initiatives of guarantee funds (like “Fidi Toscana” of the Region of Toscany) for several types of socially and environmentally important loans with amounts that are absolutely sufficient for any pellet heating system.
    - Using the driving force of large, Kyoto restricted emitters: ETS installations with emission allowances (so very large installation above 20 MW thermal power) will be interested in a fuel switch towards agri-pellets in order to avoid the 100 Euro/ton penalty. This will mobilise the investors (financer!) and can create the market for agri-pellets in a few years (next year they already have to comply) and make it a commodity (and also creating a standard). If the medium boiler providers will adapt to this, then they will have plenty supply of fuel at low cost.