MAIN FEATURES OF NEW PELLETING SYSTEM

- No special civil works required
- Low electrical consumption
- High production rate
- Fully automatic operation
- Easy unclogging operation
- Low operating temperature: Pellets production almost at ambient temperature
- Acceptability of high humidity raw materials.

EFFECT

- Lower investment cost
- Low operation costs;
- Faster return of investment costs
- Connected to the above;
- Faster return of investment costs
- Low operation costs;
- No emissions;
- No need of cooling devices;
- Immediate bagging capability;
- Lower investment and operation costs
- Less need of drying sections;
- Lower investment and operation costs

As a result of the innovative technical features described above, the new pelleting system has a very low level of energy consumption per kg of pellet produced. Electricity is required only for operating the machines.

THE TWO PROCESSES IN COMPARISON

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>“New”</th>
<th>“Conventional”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity (%)</td>
<td>8 to 10</td>
<td>8 to 10</td>
</tr>
<tr>
<td>LHV (MJ/kg)</td>
<td>16.76 to 18.47</td>
<td>15.92 to 17.50</td>
</tr>
<tr>
<td>Ash Remainder (%)</td>
<td>0.5</td>
<td>0.5 to 2</td>
</tr>
<tr>
<td>Density (kg/cubic meter)</td>
<td>700 to 750</td>
<td>600 to 620</td>
</tr>
<tr>
<td>Energy use per kg of product (Wh)</td>
<td>70 to 100</td>
<td>120 to 200 + drying</td>
</tr>
<tr>
<td>Indicative Prod. Cost (EUR/ton)</td>
<td>30 to 50 + Resource cost</td>
<td>60 to 90 + Resource cost</td>
</tr>
</tbody>
</table>

Indicative investment costs:* Innovative pelletisers:

1) 1 t/h 380,000 EURO
2) 4 t/h 650,000 EURO
3) 5 t/h 830,000 EURO

*These figures are roughly estimated since every pelleting system has to be tailored on the customer’s needs.

LING AMERICA THEMATIC NETWORK ON BIOENERGY

Refined Bio-Fuels
Pellets and Briquettes

Characteristics, uses and recent innovative production technologies

PUBLISHED BY

LATIN AMERICA THEMATIC NETWORK

ON BIOENERGY

EUBIA

Plaza Savonarola, 10 - 50132 Florence - Italy
Tel. +39 055 5002174 - Fax +39 055 573425
eta.fi@etaflorence.it - www.etaflorence.it

ETA

Sylvensteinstr. 2 - 81369 Munich - Germany
Tel. +49 89 720 127 35 - Fax +49 89 720 127 91
wip@wip-munich.de - www.wip-munich.de

WIP

Piazza Savonarola, 10 - 50132 Florence - Italy
Tel. +39 055 5002174 - Fax +39 055 573425
euhaus@euhaus.org - www.euhaus.org

EUBIA

Rond Point Schuman, 6 - B 1040 Brussels - Belgium
Tel. +32 2 28 28 420 - Fax +32 2 2828 424
eubia@eubia.org - www.eubia.org

This publication has been realised in the framework of LAMNET, thematic network funded by the European Commission, DG Research, Programme "Confirming the international role of Community Research" (Project no. ICA4-CT-2001-10106)

Neither the publisher, nor the European Commission or any person acting on behalf of the Commission is responsible for the use which might be made of the information contained in this publication. Reproduction is authorised provided the source is acknowledged.
THE IMPORTANCE OF COMPACTATION
for a wider biomass exploitation

All ligno-cellulosic materials such as timber, straw, paper and many vegetable fibres represent a valuable energy resource. The major problem for these materials is their large volume to weight ratio, making the handling, storage and transport not only difficult but expensive.

This problem can be overcome by refining this material by drying and then compressing it at very high pressure to produce fuel briquettes or pellets. These final products will thus have a higher density (more than double) and a high heating value.

In most developed countries the use of briquettes or pellets is mainly a matter of cost, of refueling service and of the will to mitigate the environmental pollution. In a country that has limited sources of oil, gas or coal but abundance of ligno-cellulosic resources, it would seem illogical not to utilise these valuable fuel products to reduce the import of conventional fuels.

This is especially valid for developing countries where the need for renewable fuels has reached a critical point. These countries have little or no money to purchase oil with limiting consequence for the growth of their economy and industries, however a large amount of electricity and heat is required for industrial processes.

Most of these countries have abundance of biomass raw material and waste such as coconut fibre, sugar cane, cotton plants, etc... but what is needed is a refining process to transform the wastes into a usable fuel.

The briquetting and pelleting processes not only offer this opportunity but their technological level fits within these countries necessities.

The main advantages of these processes are:

- to increase the energetic value of residues for their immediate use or for further thermochemical conversion (combustion, gasification, pyrolysis, carbonisation)
- to lower the volume for storage
- to facilitate the handling, transportation and to lower its costs
- to increase the energy density to volume ratio
- to eliminate the loss of material due to fermentation

Fuel briquettes consist of peat, sawdust, chips and cutter dust. These substances are by-products from the sawmill industry and forestry practices. The material is pressed under high pressure in a briquette press.

The pellets production

Generally, the production process of pellets has three basic stages:

1. Storing and pre-treatment of raw materials
2. Drying the raw materials (at approximately 18-19% moisture content);
3. The pellet processing

The production process follows these steps:

1. Loose raw materials, after grinding to convenient size, are fed into pelleting cavity
2. Rotation of die and roller pressure forces materials through die, compressing them into pellets
3. Adjustable knives cut pellets to desired length

With traditional pelleting systems, after one century of development and most widely used today, the raw materials are fed into the inside of the die and pellets are extruded to the exterior of the die, with the end product of pellets at an average temperature (effect of high pressure) between 100 and 120 °C. Another step of cooling the pellets has to be carried out before the pellets can be packaged.

Average production costs: 60 - 90 EURO/ton of pellets

THE TRADITIONAL TECHNOLOGY

1- Storing and pre-treatment of the raw material.
2- Drying the raw material
3- Actual pellet production process
4- Pellet cooling
5- Pellet storing

Pellets extruded to the outside of the die

THE INNOVATIVE TECHNOLOGY

1- Storing and pre-treatment of the raw material.
2- Drying the raw material
3- Actual pellet production process
4- Pellet cooling
5- Pellet storing

Pellets extruded to the inside of the die

The new process is extremely versatile:
- Only limited energy consumption is required, as no drying or cooling is necessary.
- The patented process permits high productivity and high pellet quality.
- Humidity content of 35% in the starting material does not represent a problem.
- It can process material with variable size granules.
- Product stability, homogeneity and density are guaranteed.

Only 50-100 Wh energy consumption is needed for processing one kg of material with a humidity range of 15 to 35%. This represents drastic production costs savings when compared to the conventional process.
The presented easy-to-operate pelleting system is innovative in the sense that moist raw materials (up to 35%) can be processed at low temperature (mechanically) carrying out simultaneous drying and compactation. Also the last step of cooling is unnecessary.

With this system, the raw materials enter from the outside of the die and pellets are produced inside. The temperature of pellets only increases to 10-15 °C and the maximum operating temperature of the dies is in the range of 55-60 °C. At such a relatively low operating temperature for the dies, there is no emission of smoke/smokes and/or vapours VOC and no cooling device is required.

Another advantage of this system is that it is able to pick up raw materials with a humidity of up to 35% without any further special operation and hence the drying step can be avoided in most cases, with great operating costs and initial investment savings. For humidity content above 35% the biomass can be equally processed carrying out two complete operations.

The pelleting mill is the core of the system. It is extremely versatile as it may process various types of loose materials, such as dehydrated biologic sludge by-product of water treatment plants, biologic or chemical fertilisers, pulps and slag from industrial processes, fodder, cereals, chaffs, husks, straw and stalks, growing waste, organic fraction of municipal or industrial solid waste, compost, paper and cardboard, fabric wastes, wood chips and sawdust, forestry residues, plastic materials, chemical products suitable for pelletization, etc.

The pelleting machine consists of one or two dies for producing pellets with diameters ranging from 6 to 16 mm and an external cylindrical shaped surface, with drawing ports placed in maximum pressure areas. The diameters and the quantity of the ports are function of the raw material and the desired size of the pellets. The operation of all possible configurations is totally automatic and is monitored by a microprocessor PLC-equipped switchboard. The microprocessor PLC can automatically adjust the system operating parameters to the characteristics of the raw material. Possible clogging can be easily removed by a simple reversed rotation of the dies, without any disassembling or other operations.

**Average Characteristics**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Pellets</th>
<th>Briquettes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat value</td>
<td>16.92 - 17.64 MJ/kg</td>
<td>16.92 - 17.64 MJ/kg</td>
</tr>
<tr>
<td>Density</td>
<td>650 - 700 kg/m³</td>
<td>650 - 700 kg/m³</td>
</tr>
<tr>
<td>Diameter</td>
<td>6 - 16 mm</td>
<td>6 - 16 mm</td>
</tr>
</tbody>
</table>

**Utilisation**

- Pellets are suitable for small burners (e.g. domestic stoves)
- It is possible to consider pellets similar to a liquid fuel in terms of alimentation of the burners (high automation is possible)
- Due to their bigger size and higher combustion temperatures, briquettes are not suitable to be used as a fuel in boilers smaller than 500 kW.

**Volumetric Energy Content**

- oil 1 m³ = solid wood 6 m³
- wood chips 18 m³ = wood pellets 3 m³

---

**DATA PROVIDED BY**

EUBIA

Published by ETA - Florence and WIP-Munich in the framework of LAMNET Thematic Network funded by the European Commission, DG Research, Programme "Confirming the international role of Community Research" (Project no. IC4A-CT-2001-10106).

The activities of LAMNET include the analysis of available bioenergy technologies and systems as well as the development and implementation of policy options for the promotion and deployment of bioenergy.

Should you wish to receive more information on this Thematic Network, please contact the project coordinator:

Dr. Rainer Janssen, WIP-Munich, tel. +49 89 720 127 43 - fax +49 89 720 127 91 -
E-mail: rainer.janssen@wip-munich.de