Pushing Forward With Bioenergy

With the ever-increasing demand for renewable bio-energies in various strategic markets in Asia, some market leaders have stepped up their efforts to propelling the technological development in this field. The recent project of a new wood pellet plant constructed by a Spanish company in Malaysia has further strengthened this initiative. By Ignacio Aranguren, Project Engineer, Prodesa

The potential capacity of the Asian continent as a pellet consumer and producer has been confirmed as it was expected years ago. The leading companies in the field of bio-energies are focusing their efforts to enter to this market.

There are several factors explaining this 'boom' of the biomass market in Asia: firstly, the expected industrial development of the area is producing the noticeable increase in its electrical consumption.

The existence of vast tropical forestry areas also explains the biomass sector development, although it is important to remark that if a long-term energetic model wants to be implemented these resources must be managed in a rational and sustainable way.

Three of the biggest economies in the area, Japan, South Korea and China are nowadays the expected references in the sector. Governments of these countries are moving towards renewable energies and specifically towards Bioenergy. Big electrical power plants are now being redesigned and modified in order to be fuelled with wood pellets together with coal.

The efforts of these countries to meet their targets for
energy conversion and policies promoting renewable energies point to a significant growth in the demand of pellets in the short and medium term.

First important pellet tenders are starting to be launched and purchased by the power plants in these countries, and if optimistic expectations continue been confirmed in the following years, business will reward the players who started in it from the beginning.

It is estimated that Vietnam exported around 750,000 tonnes during 2014, most of them to South Korea, which estimated that its pellet consumption increased from 400,000 tonnes during 2013 to 1,800,000 tonnes in 2014.

A Southeast Asiatic project was started last year. The project is located in Sarawak, the Malaysian island of Borneo. It is a 120,000 tonne/year pellet plant, which uses several and diverse biomass residues from the region as raw material.

Cellmark AB, a Swedish multidisciplinary company with its main activity trading of different products; Sarawak Timber Industries Corp, an important local timber organisation in the region; and Derasas Jaya SBD a Malaysian machinery trading company are three main actors involved in the investment of the plant, which have created a joint venture for it. The resulting pellet installation has been named Green Pellet Sarawak (GPS).

In the design of the plant, the customer was consulted to find the best approach of it with the manufacturing of the main equipment in Europe and some equipment in local workshops. The plant consists in the following lines:

Wood Yard

The raw material is one of the main and key pillars of a pellet plant. Managing this issue with success or not, will involve consequently the success or not of the pellet plants.

- Long-term raw material provision for the plant must be ensured; Supplies and prices must always be fixed, accorded and guaranteed for long periods with enough time.

- Short-term raw material provision for the plant must also be ensured. Enough storage space in the pellet plant wood yards, and optimal logistics for its transportation and handling need to be planned during the design of the pellet plant.

In this case, the plant receives a great variety of raw material for its pellets, such as logs, veneer, plywood cut, log off cuts, and log ends.

The project includes several types of equipment to process and treat different kinds of raw material and achieves the required particle size in order to obtain an optimal performance during the drying and pelletising processes. Two independent lines, each of them with a chipper and screen, will reduce the particle size of the different raw materials below 15mm.

Drying Island

The drying island is the ‘heart’ of the plant and the key to achieve the required pellet quality and production objectives. Three different options were presented for this purpose: an indirect high temperature dryer; a drum dryer, a direct high temperature dryer; and a belt dryer, an indirect low temperature dryer.

In case of the plant, finally a low temperature belt dryer was chosen. The belt dryer will use hot water at 105 deg C provided by a hot water boiler. With the hot water we generate hot air, needed for the drying process.

The belt dryer was manufactured under the Swiss Combi license. It is a 157 sq m dryer with a two-layer recirculation system for the semi-dried product which ensures an optimal drying, with a constant moisture level at the outlet and guarantees very low thermal and electrical consumptions.

During the drying process the raw material features will change and it is necessary to work gently with the wood in order to keep the proper conditions to ensure the best pellet quality.

Moisture, colour and chemical parameters of raw material are related to the drying process, also to comply with the requirements about pellet quality (mechanical durability, size,
finest, moisture, LHV) means to control properly the drying process, thus the better the drying system is, the better is the pellet.

The wet material (1) is dosed into the feeding screw (2), from where it is evenly distributed onto the belt. The product input into the dryer is controlled by the torque of the feeding screw (2) to maintain an even filling in the screw.

The product layer is transported through the dryer on the belt before being discharged into the first discharge screw (3). Via an additional screw conveyor, this product is recycled to the second feeding screw (4) where the second layer is placed onto the first. After passing through part of the dryer a second time, the now dried product is discharged (5) for further processing. By working with a two layer system, maximal saturation of the exhaust gas and therefore maximal energy efficiency is reached. The moisture content at the discharge is measured and controls the through put of product by adjusting the belt speed.

The extractor fan (7) is drawing ambient air through the heat exchanger (8) where the air is heated up before passing through the product layers and belt. While passing through the product, the material is dried.

The air is leaving the dryer almost saturated at the stack. The fan capacity is controlled via a frequency converter according to the energy available at the heat exchanger. To secure a clean belt for optimal operation, a cleaning brush (8) as well as a belt cleaning system (9) is installed.

The belt dryers which is also installed in different countries in the world have the following benefits:

- Low energy consumption
- Low level of emissions
- Lower risks of fire in the dryer
- Use of low temperature energy
- Careful drying for optimal product quality
- Automated operation
- Modular design which allows a future enlargement of the dryer

The hot water boiler installed in the pellet plant supplies the most of the thermal energy required in the dryer. It is a biomass boiler with a mobile grate, which can use chips, bark or other biomass residues as fuel.
In order to have a correct drying process, a continuous and stable flow of hot water must reach the dryer. Some extra thermal energy is also supplied by an already existing in the installation thermal oil boiler. The thermal generation system was optimised to maximise the recovery of existing thermal energy in the area.

**Dry Product Intermediate Storage**

The drying process reduces moisture content to eight to 10 percent and the woodchips are then transported to a dry product storage by several chain conveyors.

The intermediate storage allows the system to have autonomy between the dryer and the milling and pelleting line for a correct performance of the plant. But on the top of that, it is advisable to have this storage, in order to get very homogeneous moisture content in the product and therefore a stable pelleting process and high pellets quality.

**Dry Product Milling Line**

One big dry product hammer mill has been installed in order to reduce the size of the dry product before it is pelleted. This stage is especially important when producing industrial pellets for co-combustion in power plants.

In this kind of power plants pellets are pulverized before being burned and so the size of this powder must meet with requirements of the customer. Usually, power plants are very exigent with these parameters, and only a correct design of this line will allow us to accomplish it.

**Pelletising**

Three pellet mills with 355 kW each, will produce 120,000 pellet tonnes per year. Produced pellets will meet all the required quality standards in order to be sold as industrial pellets for co-combustion, but in case the customer wants to, the plant is also prepared to produce pellets which will meet the domestic European ENPLUS requirements.

The pelleting line includes a small dynamic silo, in this way the homogenisation of the product continues being improved, and we add a small buffer in the line, in order to control flow peaks.

Once the pellet is produced, the temperature in the product is around 90 deg C, thus a cooler system is required to achieve the quality and to comply with the pellets specifications. The cooler system is equipped with a cyclone for reducing the dust emission to the atmosphere and to recover the very small size particles into the product flow.

After the cooler, a vibratory screen sieves the product for taking out from the line fines and broken pellets which not comply with specifications. These, will also be reprocessed.

**Pellets Storage**

One big silo will be used as a storage for the produced pellets. Most of pellets will be sold in big bags, so there is an automatic big bag station installed for this purpose.

The Malaysian plant is expected to be completed at the end of September when the plant will be producing its nominal capacity.

Due to the specific requirements in the operation and maintenance in pellet plants, technicians will stay on site during the first two years: one plant manager and one production manager, both highly experienced, will supervise all the tasks and labours of the workers, and at the same time will continue training them.

It is usually said that it takes between one and two years for pellet plants to reach their maximal capacity. This is because of the period that it takes for local managers and workers to obtain the required operating and maintenance ‘know how’.

With the help of the supervisors, the plant will produce 100 percent of its production capacity from the beginning, and after two years, these supervisors will leave the installation, local managers and workers will have no problems on obtaining the design pellet plant capacity after two years of continuous training.