

Biomass logistics at Essent Energie's co-firing power plant

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Difficulties in handling nuclear waste and CO₂ emissions from fossil fuel sources are potential ecological problems that present opportunities for renewable energy sources. Although the case for renewable energy sources has been made for many years, adoption has historically been hindered by the relatively cheaper cost of fossil fuels. However, reduction in carbon emissions is now a high priority, resulting in the exploration of ways of reducing fossil fuel use in energy production, including the use of biomass for fuel. One such pioneering project is Biologish, Essent Energie's power plant which co-fires biomass with coal, and began operation in 2004. The power plant is located in Geertruidenberg, the Netherlands.

According to Essent managers, they have a three-year advantage over their competitors, not only in co-firing, but also in the variety and manner of their global supply and distribution of biomass. The ultimate aim is to fire two million tons of biomass, replacing up to 20% of fired coal.

Biomass

The biomass consists of:

- Wood pellets: the sawdust is pelletised to enable high density in transport;
- Palm kernel paste: palm kernels, ground into shavings;
- Citrus pellets: fibre waste from the citrus fruits processing industry;
- Dried olive pit pulp; and
- Ground cacao pods.

Other biomass products such as household organic waste (ONF) were also tested; these tests are costly in both time and money because all parts of the process, not only the firing, need to be taken into account, including the handling requirements.

The biomass comes from all over the world, and is transported by sea to Rotterdam. From Rotterdam the biomass is transported



Figure 1. The Flexiport F600.



Figure 2. Rotating feeder.



Figure 3. NEUERO blower.

in tug-pushed barges to Geertruidenberg. With an annual target of 600,000 tons of biomass to be processed, this requires 400 barges, carrying 1,500 tons each.

Different suppliers collaborated with Essent in developing technologies for this ambitious project. NEUERO Industrietechnik, GmbH is proud to be part of this project and to have been chosen to supply the first continuous biomass barge unloader in the world, the Flexiport F600.

The Flexiport F600

The Flexiport F600 continuous barge unloading system uses technology originally developed in the 1980s for non free-flowing materials for use in European feed mills, and adapted for use with biomass by Essent experts. In addition to capacity requirements (based on barge unloading time and power consumption), high technical standards for noise and dust emissions were also required.

One of the tough tasks was to design a system able to cope with the variety of products, especially with materials like wood chips and ONF that have a high percentage of dust. The totally enclosed pneumatic conveying system is an ideal solution, taking into consideration factors such as high angles at the transfer points, in order to avoid agglomeration of product.

The design of the F600 met the new ATEX dust explosion rules even before they were published, since Flexiport worked with ATEX in the definition of the new rules.

The F600 is able to work at 50% capacity with a corresponding

reduction of power consumption. This is helpful in clean-up operations or in handling extremely light materials like ONF, which has a specific weight of 150 kg/m³.

Other systems were analysed and compared. A traditional batch unloading system like crane with grab was discarded because it would need a bigger installation for the dust suppression hopper and the extra work to avoid spillage during unloading. Therefore a modern continuous unloading system was necessary. A continuous chain system has problems at cleaning and in feeding materials that are not free-flowing; the screw has a feeder, but it can jam when dealing with wood pellets, for example. The combination of a pneumatic system with a rotary feeder is the best choice, because dust is much reduced because of the suction to the pipe and minimised in an enclosed system. The plain pipe without jammed points and the belt airlock for the extraction provides the best conditions to prevent blockages or jamming in the system.

Belt airlock

The special belt airlock type was chosen because of the type of material being unidentified at continuous unloading. The range from wood chips to powder like ONF could cause blockages in traditional airlocks. The idea of the belt airlock is simple; instead of a rigid steel body, two belts seal the rotor between low pressure and atmosphere. The main advantage of this system is that the belts run at the same speed as the rotor and therefore reduce wear. **It does not eliminate at all because of the seals that close the area between belts and structure.**

TECHNICAL DETAILS OF THE F600 SYSTEM

| | |
|------------|--|
| Capacity: | 600m ³ /h |
| Ship size: | 1,500 dwt barges |
| Airlock: | Belt type |
| Nozzle: | Remote adjustable with hydraulic driven rotating feeder |
| Movements: | Traveling, slewing, boom luffing, vertical kick-in kick-out |
| Filter: | Reverse air-scavenging filter |
| Control: | Via S7 PLC and Scada system integrated to the plant |
| Auxiliary: | Auxiliary pay loader winch, auxiliary crane on top of filter |

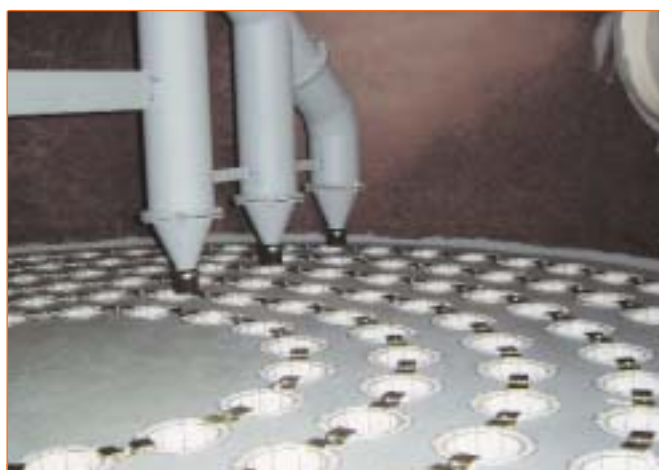


Figure 4. Reverse flow filter.



Figure 5. Essent Gertruidenberg power plant.

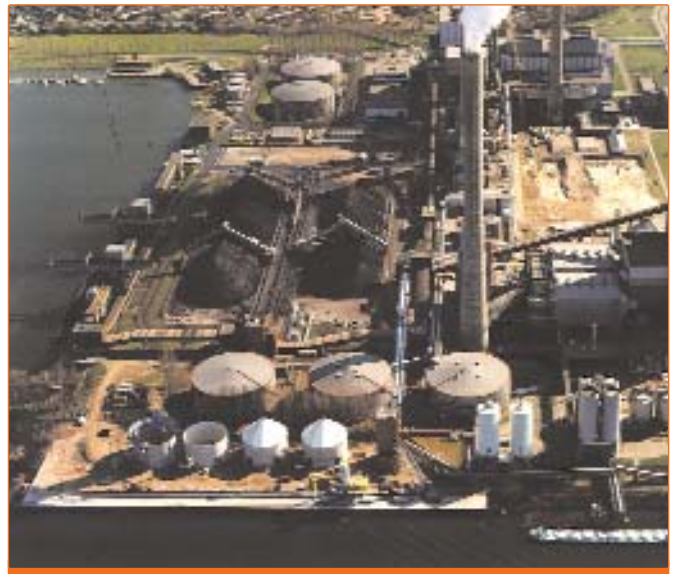


Figure 6. Essent Project Biologisch under construction.

Nozzle with feeder

The rotating feeder introduces the material into the conveying pipe. The speed is adjustable with the hydraulic drive. The intake air can be remotely adjusted to the best air/product ratio.

Pipe-filter intake

The pipe design contemplates no telescopic movement, since the different materials like wood chips could block the movement. The use of flexible cones was discarded for this same reason. The use of cylindrical joints at vertical kick in/out and the filter intake allow tidiness and avoid product deposition.

Blowers

Four NEUERO blowers with special characteristics are installed in the machinery house. The operation level of the frequency inverter air control system can be set by the operator at the touch panel, in percentage value. This helps to reduce the air depending on the type of product being unloaded. For the clean-up operation, the use of only two blowers is possible by shooting off the second stage of each set. This is also valuable in unloading very low density materials. The pneumatic system is a volumetric one limited by the airlock volume, therefore light density materials can easily cause overflow of material.

The drive motors are also equipped with automatic belt tension (ATB). This simple but efficient design enables constant belt tension with no need to re-tension. An automatic greasing system completes the package, with PLC alarm for grease replacement and/or blockage of the grease pipe.

Filter

The filter was designed to be oversized because products like ONF are almost completely composed of very light dust.

Working with normal products, like wood pellets, the filter loss is extremely low. The filter is cleaned by reversed air flow generated by turbo blowers. The advantages of this are:

- This counter flow principle produces less shock loading of the bags and eliminates the possibility of condensed moisture and oil contamination, very often produced in high pressure reverse pulse type filters. This results in increased bag life;
- Lower maintenance costs, since there is no air compressor, air dryer, solenoid valves, air tank, timer and piping;
- Less of a loss at conveying, due to not using outside air; and
- Efficient in hot and cold climates – no solenoid valves to freeze in winter.

Electric controls

Power for the unloader is taken from a medium voltage motorised cable drum. The 10.5 kV cable contains a fibre-optic cable for the communication and control. The control panels were designed to Essent's high standards. A Scada system via bus communication with fibre-optics to the power plant's central control provides all F600 unloader data and allows capacity and power consumption to be controlled.

Upgrade

At the end of 2004, Essent ordered a system upgrade. The capacity will increase by 30% for heavier products like wood pellets. The cost is relatively low because only new electric motors and other minor changes are necessary. The upgrade is scheduled for completion in February 2005.

ABOUT THE AUTHOR / COMPANY

Tomas Kisslinger (46) has twenty years experience in bulk handling, specifically in grain related areas. Since 1992 he has been Managing Director of NEUERO Industrietechnik.

NEUERO is manufacturer of mobile pneumatic conveyors, grain vacs and ship unloader/loader for transport of bulk grain, meals, plastics and alumina for example.

NEUERO started in pneumatic grain conveying over 80 years ago with the manufacture of small agricultural

machines. Since then the company has delivered equipment in the 20 t/h to 2000 t/h range to many installations around the world. NEUERO has two companies with sales, engineering, manufacturing and service facilities in Germany and in the US.

New developments are the biomass unloader shown in this article, alumina pneumatic ship unloaders to China under construction and a new development of a mechanical continuous ship unloader with 1,200 t/h capacity.

ENQUIRIES

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