

# Reliable Fuel Supply

## Pneumatic Unloading of Wood Pellets for a co-fired Power Plant

*Electrabel has increased the amount of biomass fuel at its co-fired Gelderland power plant in the Netherlands by a factor of ten. The wood pellets are delivered by barges and unloaded efficiently and dust-free by means of a mobile pneumatic unloader.*

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**Fig. 1: Wood pellets for Electrabel's Gelderland power plant are unloaded from barges with a pneumatic ship unloader.**

the amount of wood pellets supply from 8 to 75 tonnes per hour, which is a rate of up to 20 per cent of the total energy produced by this upgraded plant.

Since its operational start in 2010, this Electrabel power plant has become one of the world largest co-firing plant with wood pellets. Thanks to the excellent hinterland river and canal network in the Netherlands for bulk transport, wood pellets are transported to the power plant by barges from various locations.

Because coal-fired power plants cannot be switched on and off easily, and because of the importance of a continuous power supply, the discharge of such volume requires a 24 hours per day reliability, and, consequently, the highest quality and the most efficient operational performances of the fuel handling systems.

### Main Plant Components

The turnkey installation of the wood pellet handling plant for the project was carried out by the Belgium company Geldof Metaalconstructie. The main components of the plant include a 500 tonnes per hour mobile pneumatic barge unloader, quay belt conveyors of the same capacity, silo feeding with pipe belt conveyors and two carbon steel silos with a capacity of 5 000 cubic metres, each.

The silos are equipped with screw reclaimers delivering pellets via chain conveyors to the pellets dosing bins at 120 tonnes per hour from where they are processed for combustion. The processing facility was also part of the installation by Geldof and includes hammer mills and wood dust screens, wood dust silos, pneumatic transport/boiler injection.

Barges are unloaded pneumatically on site at the rate of 500 tonnes per hour via a mobile unit that eliminates dust emissions. According to Geldof, the complete circuit from quay to boiler uses completely closed conveyer belts, silos, hammer

Alternative and renewable sources of energy are a major concern not only due to limited resources of fossil origin but also within the context of the worldwide efforts against gas emissions. New power plants as well as some existing energy producers are upgrading their existing technologies with latest innovations in order to fulfill their legal obligations of protecting the environment while containing costs.

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The French group Suez is a major player in Europe and at worldwide level with about 200 000 workers and an annual turnover of more than USD 110 billions. Suez has been integrating this approach for many years with significant investment in engineering developments and state-of-the-art industrial installations.

Electrabel, the electricity division of the Suez group, developed a special project during the last years for its power plant in Gelderland. The plant is located near the city of Nijmegen in The Netherlands, and has a capacity of about 600 megawatts. Tractebel, its Belgian engineering affiliate, was in charge of developing this biomass and coal co-firing project by increasing

mill and buildings kept under small pressure to avoid any possibility for wood dust to escape. It is obviously unavoidable, however, that wood dust is present within the system. Therefore, secondary containment measures such as dedusting and fire and explosion protection equipment are in place.

The scope of Geldof's work for the project included design, engineering, fabrication, mounting, testing, and commissioning of the civil and mechanical construction. This also included foundation and steel construction, ferro-non ferro separation, fire and explosion protection and detection, dedusting, and other components.

Vigan Engineering, also a Belgium company, was selected to manufacture and install the pneumatic unloader for unloading the barges. The company, specialised in pneumatic and mechanical ship unloaders mainly for agribulk cargoes, looks back at 40 years of experience and more than 1150 pieces of equipment installed around the world.



Fig. 2: Pneumatic unloading of wood pellets prevents any dust from being raised.

## Pneumatic Unloading

The transport of any wood residue is usually facing the challenge of the low density of those materials. Therefore the most common process is pelletizing in order to

condense them into granules (usually about 10 to 15 millimetre length and a diameter around 5 to 6 millimetre).

Thanks to this process and with a reasonable content of humidity, the wood pellets are quite free-flowing and there-

fore allow for an easy transportation and conveying from the production facility up to its use as an input into the power co-firing with coal. During transport to the plant, those pellets can easily break with dust emission.

The use of grabs is not convenient due to several factors such as important mechanical efforts on quay structure, dust escaping into the environment, eventual spillage that can be difficult and costly to clean, and of course a low 'through the ship' efficiency when unloading small barges.

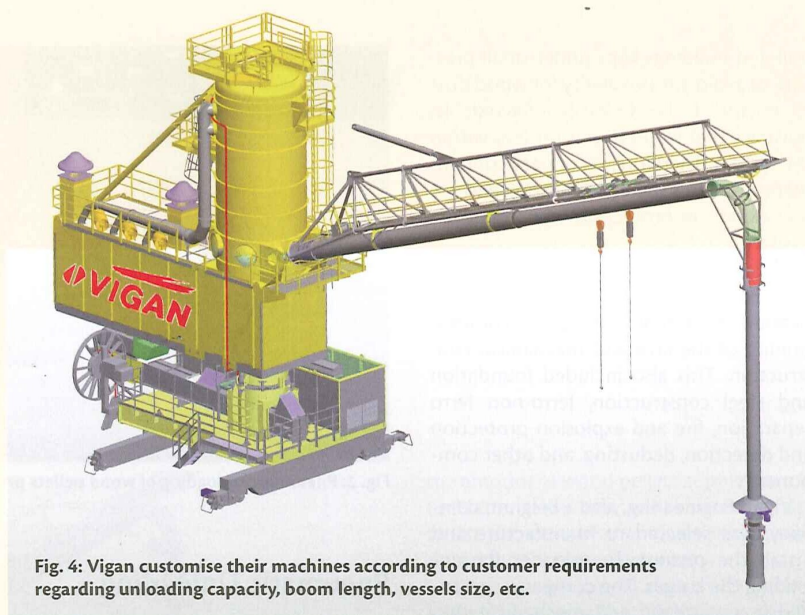
Pneumatic unloaders however are recognized as a more convenient solution for unloading barges, compared to grabs or mechanical unloaders:

- Higher unloading rate mainly during the cleaning of the hold with the intake nozzle being able to suck down to the latest product particle on the hold floor but also to reach the hidden corners.
- Safety: one operator is able to manage the whole unloading not only thanks to a remote control for all major displacements of the suction nozzle into the holds, but also by driving an auxiliary skid steer loader for speeding up even more the final cleaning.
- Environment: no dust as the whole unloading system is under negative pressure and/or totally enclosed.
- No spillage and need to clean the quay around.
- Minimum breakage by optimising the air and product speed in the pipes.
- Low weight equipment with far less mechanical efforts on the quay structure.

First pneumatic unloaders were manufactured already at the end of the 19th century but continuous technological improvements were introduced for a higher reliability, a better safety and optimum running costs.



**Fig. 3:** Three turbo blower groups provide the air flow to unload 500 tonnes of wood pellets per hour.



**Fig. 4:** Vigan customise their machines according to customer requirements regarding unloading capacity, boom length, vessels size, etc.

### Unloader Characteristics

For achieving those objectives, the Vigan NIV 600 model working in Gelderland is equipped with the latest technologies available, including, for example, three four stage turbo blowers groups with direct drive controlled by an up-to-date speed control system using frequency inverters by Schneider Electric. The direct drive is a major improvement because it reduces not only the numbers of bearings which are existing on traditional drive with belts but also the mechanical efforts on the turbine shaft.

The multi-stage turbo blowers are maximising the suction capabilities for a larger range of product characteristics to be handled with no need of any special feeding device. In combination with the speed

control system, this makes it possible to precisely optimise the energy consumption. Some Vigan customers reported power consumption figures as low as 0.6 to 0.7 kilowatt hours per tonne thanks to this new technological developments – a reason why this solution was also chosen by Electrabel. As also observed in this project, those three turbo blower groups are giving to the customer a convenient extra capacity of suction power reserve to face any unexpected event and to guarantee his daily unloading target.

Also important for the reliable operation of the pneumatic system of the unloader is an efficient filter system. This is ensured by the installation of an air jet pulse system for automatic filter cleaning. Widely known in the food and feed industry sectors for high performances and reliability, this system offers also a major safety advantage about: no running mechanical parts are in contact with the air flow that could eventually be contaminated with dust and, in this way, create the danger of dust explosion.

To further increase the reliability and safety of the unloader, special alloys against wear are used, for example, in the elbow between the vertical and horizontal suction pipes, or in the airlock components.

The use of alternative sources of energy such as biomass will certainly increase during the coming years and all the logistic aspects of these inputs require very careful approach. Electrabel receives full credit for this landmark project in green electricity production. ■



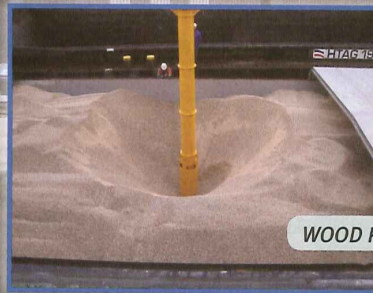
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WOOD PELLETS

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