

Rofire: The perfect secondary fuel from recycled paper industry refuse

Novem, The Netherlands

Summary

A Dutch paper mill in the Netherlands has commissioned a new unit to make solid fuel pellets out of reject material. The mill recently changed its dried paper sludge manufacturing process. The recycled paper is separated into organic and small inorganic fractions. The organic fraction is separated into dried paper sludge and “combustibles” such as fabric fibre, plastics, wood and rope fibre. In a new production unit, the mill processes this combustible fraction into solid fuel pellets using a multistage process. The company markets the pellets as solid organic fuel under the trade name of ROFIRE.

End-user area	Target Audience	Technical
<input type="checkbox"/> New buildings	<input type="checkbox"/> Citizens	<input type="checkbox"/> Energy efficiency
<input type="checkbox"/> Refurbishment of buildings	<input type="checkbox"/> Households	<input type="checkbox"/> Heating
<input type="checkbox"/> Transport and mobility	<input type="checkbox"/> Property owners	<input type="checkbox"/> Cooling
<input type="checkbox"/> Financial instruments	<input type="checkbox"/> Schools and universities	<input type="checkbox"/> Appliances
<input checked="" type="checkbox"/> Industry	<input type="checkbox"/> Decision makers	<input type="checkbox"/> Lighting
<input type="checkbox"/> Legal initiatives (municipal regulations, directives, etc)	<input type="checkbox"/> Local and regional authorities	<input type="checkbox"/> CHP
<input type="checkbox"/> Planning issues	<input type="checkbox"/> Transport companies	<input type="checkbox"/> District Heating
<input type="checkbox"/> Sustainable communities	<input type="checkbox"/> Utilities	<input type="checkbox"/> Solar energy
<input type="checkbox"/> User behaviour	<input type="checkbox"/> ESCOs	<input checked="" type="checkbox"/> Biomass
<input type="checkbox"/> Education	<input type="checkbox"/> Architects and engineers	<input type="checkbox"/> Wind
<input type="checkbox"/> Other	<input type="checkbox"/> Financial institutions	<input type="checkbox"/> Geothermal
	<input checked="" type="checkbox"/> Other	<input type="checkbox"/> Hydro power
		<input checked="" type="checkbox"/> Other

Context

In the Netherlands, the use of renewable energy sources is supported by local and national authorities. The driving force behind this attitude is concern for the environment, particularly the greenhouse effect. With financial support programmes and fiscal advantages, as well as restrictive regulations, the government stimulates companies and private individuals to use 'green' energy.

In 1996, these considerations prompted Kappa Roermond Papier to study the possibilities of making a solid fuel out of the combustible fraction of the waste paper rejects. These studies resulted in the specification of a new type of fuel. A feasibility study demonstrated the technical and economical possibility to produce a solid fuel from paper refuse. Therefore, in 1999, Kappa Roermond commissioned the construction of a new production facility for pelletised secondary fuel.

Kappa Roermond Papier, a paper mill in the Dutch city of Roermond, manufactures 470,000 tonnes/year of cardboard for the packaging industry.

Objectives

One of the raw materials is recycled paper, about 446,000 tonnes of which are annually processed by the company. The production process produces about 30,000 tonnes of rejects, about 99 % of which consists of combustible components like fabric and rope fibre, plastic fragments and wood shreds.

Process

The ROFIRE production unit processes the combustible fraction into solid fuel pellets, in a multistage process. First, the mass is dehydrated in three screw compactors. The compressed mass, at a dry content of over 60 %, is transported to the ROFIRE unit.

A flip-flow sieve separates the larger particles (> 30 mm), which are cut into smaller fragments in a shredder underneath. The sieve also loosens the compact mass, which allows magnetic removal of remaining iron particles.

After re-mixing of the shredded particles, the organic mass dries in a rotating drum drier, where the dry content is increased to 93 %. While the heaviest particles remain behind in the drier, the light fraction is transported by the drying air and reclaimed in a separator and two cyclones. About 66 % of the drying air returns to the drier.

Finally, the product, still at high temperature, passes a pelletiser. The pellets are cooled in a counterflow air cooler where they are cooled to 5 °C above outside air temperature. The drying air from the drum drier and the counterflow drier is discharged through a gas scrubber, where dust and odour are removed.

The pellets are sold as solid organic fuel under the trade name of ROFIRE®. ROFIRE® constitutes a solid fuel with a calorific value of the pellets of 23.7 GJ/tonne. It can be used as fuel in processes with a combustion temperature in excess of 800 °C. Combustion below this temperature could result in the formation of noxious emissions. In blast furnaces, cement kilns and lime kilns, ROFIRE is a good fuel in addition to coal, oil or gas.

The project could be replicated in any recycled paper processing plant.

Financial resources and partners

The total investment was € 6,580,000. Under one of its stimulation programmes, the government awarded a € 1,134,450 grant.

Results

Since its completion in early 2000, the unit has produced 16000 tonnes of ROFIRE® per annum. Production of this amount requires 30,000 tonnes/year of solid waste. Using paper production refuse to make solid fuel is highly innovative. The calorific value of the pellets is about 23.7 GJ/tonne, so the annual production of 16,000 tonnes represents 380,000 GJ, equivalent to about 9,000 tonnes of coal or 12 million m³ of Dutch natural gas.

Using ROFIRE as fuel does not reduce the CO₂-emissions of a combustion process. It does, however, abate national CO₂-emissions, since the waste used to produce ROFIRE, would otherwise have been burned separately. The actual size of the CO₂ reductions of course depends on the fuel

replaced by Rofire. Replacing other solid fuels like coal results in a CO₂-reduction of 37,000 tonnes/year. Furthermore, the project avoids the disposal of 25,000 tonnes/year of waste.

The pellets are sold at € 0.6/GJ (€ 14/tonne) so the annual turnover is € 228,000. Considering reductions in waste disposal costs, the payback period is about 4 years.

Lessons learned and repeatability

The project could be replicated in any recycled paper processing plant.

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