



Twence achieves maximum energy recovery by supplying steam to AkzoNobel in Hengelo for use in salt production (photo: Twence)

R1 STATUS DRIVES UP ENERGY EFFICIENCY

Transformation into energy factories

It is no coincidence that we no longer refer to MSWIs, but to waste-to-energy (WtE) plants. For many years the waste sector has been investing in increasing energy efficiency – and with success. One of the motives for making these investments is obtaining the European R1 status. The decisions on awarding this coveted status in the Netherlands will be made this autumn. WtE plants are not given this status lightly; it represents a major achievement.

BY MARIEKE VOS

In 2005 the waste incinerators decided to further increase the energy efficiency of their facilities. One of the reasons for this was to obtain R1 status (recovery operation), under the EU Waste Framework Directive (see text box). R1 status lifts WtE plants a step up the waste hierarchy from disposal to recovery. Moreover, it permits them to incinerate foreign waste and is proof that they add value by supplying sustainable energy. The investments have borne fruit. 'Since 2005 our energy efficiency has improved by leaps and bounds,' says *Hugo Middelkamp*, projects manager at Twence. Improving the efficiency of facilities is part of a trend that goes back further. Under national agreements with the sector – the VERBA Covenant – efficiency had already risen by 23 per cent between 1999 and 2001. The European R1 status was the next incentive. 'Without this status you don't really count as a waste-to-energy plant in the Netherlands,' explains *Dick Spanjaard* of Attero. *Jan Peter Born*, director of processing at HVC, explains: 'A waste company with the old D10 status (Disposal operation – Incineration on land) now has some explaining to do, not only to society as a whole, but also to its shareholders and customers in particular. Our shareholders demand it.'

NEW TECHNOLOGY

The average temperature in a waste-to-energy plant's combustion chamber is 800–1000 degrees. This is hot enough to generate electricity, as long as the plant is designed to do so. All plants that generate electricity have more or less the same design: the incineration chamber is lined

with water pipes and the heat converts the water into high pressure steam. If this steam is fed through a turbine, it generates electricity. The steam can also be used directly to heat greenhouses, in district heating schemes or by industry.

During the 1980s and 1990s attention was directed mainly at minimising harmful emissions. Many older plants were therefore not designed primarily to achieve the highest possible energetic efficiency. In recent years the performance of many WtE plants has been reviewed. Some have been replaced; others have been renovated and retrofitted. HVC decided to replace their plant in Dordrecht. It consisted of four old units, two of which did not generate electricity. These two have now been replaced with a single new facility of considerably larger capacity that *does* generate electricity. This has increased the amount of electricity generated by HVC's plant from 9 to 32 megawatts – enough to supply 76,000 households. Retrofitting is also an option. At the moment Attero is retrofitting its WtE plant in Wijster with a more energy-efficient flue gas treatment system. In the current system the flue gases are heated before being filtered to remove the sulphur dioxide. 'A terrible waste,' says Spanjaard, 'because these gases are hot enough earlier in the process. With the new technology we remove the sulphur dioxide earlier on. This is more efficient and will save us more than 6 million cubic metres of natural gas each year.' HVC is making use of a similar technology. One of the units in their WtE plant in Alkmaar has already been retrofitted. The other will be converted before 2012. The HVC plant in Dordrecht already uses this technology.

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Another way to increase the efficiency of existing facilities is to improve the internal processes. As an example, Spanjaard mentions cleaning the air-cooled condenser, which condenses the steam so that the water can be used again. 'If the equipment is dirty it takes more energy to make the process work properly.'

EIGHTY PER CENT

A WtE plant that generates electricity using state-of-the-art technology can achieve an efficiency of 30 per cent at most. This is lower than the 46 per cent achieved by a modern coal-fired power plant and the 35 per cent by a nuclear power plant. However, if a WtE plant also recovers heat in the form of steam, its energy efficiency is increased considerably. For its new incineration line, which came into operation in 2009, Twence wanted to achieve 'maximum energy recovery', states Hugo Middelkamp. This goal appears to have been reached. Since last January Twence has been supplying steam to AkzoNobel in Hengelo for use in its salt production plant. This saves AkzoNobel 40 million cubic metres of natural gas each year, equivalent to 72,000 tonnes CO₂. Twence also supplies the RWE power plant in Enschede »

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WASTE FRAMEWORK DIRECTIVE AND R1 STATUS

Waste-to-energy plants can obtain R1 status (Recovery – Use principally as a fuel or other means to generate energy) if they achieve a certain level of energy efficiency calculated according to a formula set down in Annex II to the Waste Framework Directive. In June 2011 the EC Guidelines on the R1 Energy Efficiency Formula were published, providing practical guidance on applying the formula. In the Netherlands the Guidelines are being used for the interim revision of the National Waste Management Plan 2009–2011. In anticipation of the publication of the EC Guidelines, the Dutch government provisionally awarded R1 status to nine WtE plants. Later this year Agency NL will determine which WtE plants will obtain or keep their R1 status. It is expected that all the WtE plants will obtain this status.



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with hot water for use in the city's district heating network. For HVC, too, 'the efficiency jackpot is obtained by supplying steam,' according to Born. At the end of March, HVC began laying a heat mains in Dordrecht, which is expected to be operational by the end of 2013. In Alkmaar, HVC is working on a similar project. Its power plant already provides steam to heat the adjacent business park and the pitch of AZ Alkmaar football club. The first apartment complexes are now being connected to the heating network.

If a WtE plant supplies only steam and no electricity, its energy efficiency can rise to as much as 80 per cent, says *John Vernooij*, director of Omrin. Omrin has built a new 'residual waste power plant' (Reststoffen Energie Centrale – REC) in Harlingen because there is a major energy consumer nearby that requires about as much energy

as the facility can produce. The REC came on stream at the end of March 2011 and delivers steam to Frisia Zout. This company pumps up brine from underground salt deposits and evaporates it, a process that requires a considerable amount of heat. Now that Omrin supplies Frisia with steam the company no longer needs any natural gas, a saving of 75 million cubic metres per year. 'We are geared totally to supplying steam because that delivers the greatest efficiency gains,' explains Vernooij. Omrin's motive is sustainability: 'This is important to all our shareholders, the municipalities in the province of Friesland in the north of the Netherlands. This year our REC accounted for a third of the total CO₂ reduction target for the whole of Friesland.'

PARTNERS WANTED

To make use of the steam, WtE plants depend on having customers in the vicinity. Omrin was able to find the most suitable location for its REC, but most companies are tied to existing sites. They therefore need to find neighbours who want to buy steam, such as Twence did with AkzoNobel. If they have no big industrial neighbours, another option is to open negotiations with companies looking to locate in the area. Attero, for example, is cooperating with the provincial council to find suitable partners. The first has already been found:

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animal feed producer Noblesse is building a factory in Wijster and will be buying heat from Attero. 'We hope more will follow,' says Spanjaard.

Improving internal processes, fitting more efficient flue gas cleaning facilities and supplying steam and hot water to partners in the surrounding area are the main ways of increasing the energy efficiency of WtE plants. The interviewees expect that further progress will be made on these fronts in the coming years. Obtaining and retaining R1 status is certainly an incentive. ☺

SITA'S REENERGY WASTE-TO-ENERGY PLANT OPENED

On 12 October Herman van Rompuy, President of the European Council, opened the SITA ReEnergy waste-to-energy plant in Roosendaal. The plant is one of the most modern waste-to-energy plants in Europe. With a capacity of 291 kilotonnes per year, the plant can process municipal and commercial wastes and generate 275,000 MWh of electricity, enough electricity to supply 70,000 households. ReEnergy also delivers heat to greenhouses in the area around the plant, which avoids the use of about 3.5 million m³ of natural gas. The waste-to-energy plant represents an investment of €200 million. Van Rompuy: 'This plant represents a courageous investment into which a great deal of hard work has been put for a number of years. This project is a successful example of the so-called "green economy". Green growth is one of the core pillars in the EU 2020 Strategy. Economics and ecology are not opposites, but rather each can enhance the other. A precondition for green growth is that we have to use natural resources and raw materials more efficiently. Waste is a potential source of energy and new material. In Europe, we must make great efforts in this area, not least because we depend very strongly on imports for our raw materials. Recycling and burning residual products and energy recuperation all have a role to play. So the fact that, in this project, almost one-third of the original energy contained in the waste is reclaimed in the form of electricity is a good example of resource-efficiency.'

