

Memo: **Report¹ on bus ticket no. 15**

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LARGE SCALE PHYSICAL PRE-TREATMENT OF BIOMASS AT A CENTRAL YARD

Definition of the problem

In the very near future The Netherlands will need huge amounts of biomass for co-combustion in existing coal plants. Furthermore, there will be substantial extra demand for biomass for liquid and gaseous biofuels, most of which will be imported. To be able to handle these large amounts of biomass central yards could be needed, where handling, blending and pre-treatment can be optimized to achieve the desired fuel mix. In the coal industry this is already common practice; for the emerging biomass industry it will be useful too.

Questions

1. Which locations will be most suitable to establish central biomass yards in The Netherlands?
2. Which pre-treatment technologies need to be included? (see BUS-ticket 16 as well)
3. Which scale is the most feasible? What will be the approximate investment costs involved?
4. Which parties are willing to set up a joint venture to establish such a central biomass yard?

1. Approach

By a quick scan, consisting of interviews and E-mail consultation with experts, an attempt was made to answer the above questions. The following experts have been contacted:

- Wijnand Schonewille, Port of Rotterdam, bulk terminal
- Peter-Paul Schouwenberg, Essent renewables - Amer power plant
- Henk Kwast, Bruins en Kwast, collection of fresh wood and used wood
- Houtbank/Tetteroo - collection and export of used wood
- Michel Leermaker, SITA - collection of used wood
- Cor Siero, Ecochip - collection of wood residues
- Toon Beeks, Biomassa Stroomlijn BV - collection of prunings)
- Rob van Rij, E.ON power plant at the Maasvlakte, in which biomass pellets from a nearby Biomass Pellet factory are co-combusted
- Jaap Koppejan, TNO-MEP - pretreatment for co-combustion
- Silvan de Boer, Eneco
- Toon van Tienen, NUON

2. Results

2.1 Port of Rotterdam. The experts from the port of Rotterdam suggest the following logistic chain:

- Wood pellets pressed on-site at the wood processing industry in exporting countries (e.g. Russian Federation) with good connection to a sea port with bulk export facilities (e.g. Archangelsk).
- Transport by self loading bulk carriers to a bulk terminal yard on the 'Maasvlakte', where the wood pellets can be mixed and blended with coal.
- Inland transportation by means of river barges, using the services of 'Regionale Overslag Centra' or 'Binnenvaart Service Centra'. Most biomass power plants and co-combustion plants are located at accessible waterways with a minimum depth of 4 m.

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- The ready-to-use fuel mixture can be unloaded and stored at the plant by using conventional equipment (such as elevators and silos).

2.2 Amer 8 power plant of Essent. Favourable site with discharging quay, water depth of 4 m, coal-bunker for 120 ktons of coal close to the plant, four biomass-silos 5 ktons each, which allow direct blending (mixing) in combination with the use of hammermills for particle size reduction. In 2004 some 1.2 million tons of biomass will be used at Amer 8, of which 31% will come from the USA, 27% from Europe, 21% from Asia and 18% from Africa. The imported biomass consists of wood pellets, wood chips, palm kernel expeller residues, citrus pulp, cocoa hulls, corn pellets, olive kernel pulp, paper sludge, vegetable oils.

2.3 Contractor Bruins en Kwast and energy company Cogas will jointly build a small bio CHP-plant in Goor in 2004. This is an example in which a forestry contractor has become an energy producer. The power plant will be fueled both by A-quality wood and B-quality wood, totalling 17 ktons per annum. Apart from the supply of warm water to the neighboring industry the CHP plant will produce 12 million kWh of green electricity, to be consumed by 4000 households in Goor. Bruins en Kwast is responsible for the biomass supply. In addition to their forestry contracting work and waste management they run a composting yard, which enables them to sort out and prepare the collected biomass for different markets. Bruins and Kwast considers the coal bulk terminal on the 'Maasvlakte' very suitable for large scale imports of biomass, especially in connection with the 'Betuwelijn'. A biomass transfer yard could also be located at 'Moerdijk' and in Delzijl. It is important that the yard has sufficient buffer storage capacity: at least 10,000 m³ for short term deliveries. An important factor for the choice of the biomass yard location is logistics, which should be excellent. Bruins and Kwast is certainly interested to participate in a joint venture.

2.4 Collection and recycling of B-quality wood for the particleboard industry.

The Wood Distribution Europe company (Houtbank/Tetteroo) is one of the largest used wood traders in The Netherlands. The transfer capacity of their wood yard in Roosendaal is 250 ktons annually (B-quality wood) and in their Moerdijk yard some 130 ktons/a of A-quality wood. They do not collect the used wood themselves, but they are supplied by some 250 companies, which collect, transport and sort out the wood from municipal service yards, wood waste from the packaging industry and lumber yards. Most of the used wood is exported to Italy (250 ktons of B-quality wood) using railway lorries, where it serves as a feedstock to the local particleboard industry. A smaller portion (120 ktons of A-quality wood) is supplied directly to the Presswood company in Ermelo, The Netherlands, which produces base elements for pallets. About 10 ktons/a of A-quality wood is supplied to the board industry in Belgium. At the Roosendaal yard, each week a 36 lorries train with 5 ktons of used wood departs to Italy.

Their logistic supply chain is as follows:

1. Collection of used wood in containers
2. Sorting out
3. Washing
4. Breaking / size reduction and loading
5. Transport by train or ship
6. Further particle size reduction
7. Removing of metal parts by air sieving (ferro and non-ferro)
8. Crushing and pulverising
9. Pressing into eco-particleboard and finishing
10. Furniture production (IKEA-style)

2.5 Collection of prunings by Biomassa Stroomlijn BV, to supply the biomass plant in Cuijk

Biomassa Stroomlijn BV collects containers with prunings from gardens and landscape maintenance and the management of small woodlands in addition to trees felled due to road and railway construction work. In total some 150 ktons/annum is being collected and chipped, of which 100 ktons is being

supplied to the power plant in Cuijk. It is a daughter company of a large Dutch transport company active in waste management (Van Gansewinkel group). With an annual production of 60 million tons, the Dutch waste market is a multi-billion euro industry. The waste sector is dominated by major players such as Sita, Essent Milieu, AVR, Van Gansewinkel Group and Shanks². At present about 40 waste sorting installations are in operation in The Netherlands. Van Gansewinkel has business relations with about 300 small producers/suppliers of biomass. They take care of logistics and quality control (eg by means of pre-treatment and blending). Biomass Stroomlijn has several yards where the collected materials are sorted out, chipped, mixed and stored. However, legislation/permits for storage are very difficult to obtain and this is a limiting factor for the expansion of biomass business.

At the municipality level they have introduced a concept of a cost-effective, small-scale chipping-chain, which consists of

- (1) pruning manually
- (2) extraction of branches by means of a tractor with a crane
- (3) mobile chipper combined with a trailer
- (4) temporary storage on site
- (5) container loading and hauling
- (6) unloading at the power plant.

In this way, the collection of chipped biomass from prunings and landscape plantings costs about 54 euro per ton, which is relatively cheap, compared with composting (64 euro/ton). The total supply of biomass to the power plant in Cuijk totals 250 ktons of wood chips, which requires about 10,000 trips by container lorries, on each of which 25 tons of wood chips is loaded. Hence, the collection of biomass is mainly a matter of optimizing logistics. In this respect, a number of decentralized wood yards are to be preferred, allowing greater flexibility.

2.6 SITA

SITA has about 40 bulk transfer yards in The Netherlands for the collection and pre-treatment of various waste streams. They are active in a broad spectrum of waste management, ranging from used wood to domestic waste and frying fat. The woody fraction they collect, totals about 80 ktons/annum, most of which is being exported to the particleboard industry in Belgium and Germany and partly to renewable energy companies in Germany (especially since there is no outlet to the power plant of Electrabel in Nijmegen, for the time being). The role of biomass yards should be considered for the whole supply chain. What happens before and after the biomass enters the gate of the yard is equally important, especially in terms of environmental impacts and risk reduction. Locations on the waterfront are to be preferred: the less handling needed, the better (each time biomass is picked up for an extra handling, it costs about 15-20 euro per ton). The demand side of the market largely determines how big the yard should be. The bio-energy market has just started to develop, but other outlets for organic wastes, such as composting and anaerobic digestion are already much more common. Woody biomass is relatively easy to handle and the technologies needed are well known. Technology should match the different types of biomass, but legislation (within EU-25) has an important impact too.

The investment costs to establish a biomass yard with the required safety measures (such as a sprinkler installation) with an annual turnover of 100-150 ktons of biomass and waste is in the order of 7.5 million euro. This includes a 7500 m² intake and sorting area indoors, divided into several compartments, and with the necessary equipment for handling, sieving, breaking, etc. Because biomass and waste streams often are heterogeneous, a relative large floor surface is needed. Frequently, this is a limiting factor for upsizing. However, the handling of large volumes of imported biomass (e.g 1 million tons/a), is much easier to organize, because the necessary product quality has to be established in the country of origin. SITA's largest waste partition and transfer yard has a capacity of 250 ktons of waste/a. It is located in the 'Waalhaven' in Rotterdam, accessible both for sea bulk carriers and for river barges and tug pushed lighters. On this site, they have still some room available (8000 m²) for

² http://www.aoo.nl/images1/aoo_nl/bestanden/AOO2000-00b.PDF

extra bulk storage and handling. SITA is willing to consider participation in a future joint venture to establish and run a central biomass yard.

2.7 TNO/MEP on large scale imports and pre-treatment of biomass

When considering new initiatives, e.g for liquid and gaseous biofuels, a central biomass yard in the vicinity of the sea port of Delfzijl would be the most obvious choice, because Groningen is very busy creating an 'Energy valley'. However, you would still need facilities for biomass transfer to existing coal plants. With respect to stock buffering the need for mixing/blending, drying and size reduction will depend on the subsequent conversion technology. I guess the larger the facility the more cost efficient, so the size will be determined by the processing plant(s) that obtain the materials. Large scale (500-1000 kton/y) would be likely. I am not sure, which parties are willing to set up a joint venture to establish such a biomass yard, but I guess the established companies involved in blending coal could do the job as far as the use in coal power plants is concerned. Additional know-how will need to be incorporated for particular processes, such as drying, size reduction, etc.

2.8 Eneco energy

At this moment ENECO focuses on relatively small-scale stand alone CHP-plants which will run mostly on local feedstock and of which the produced heat can be sold locally. ENECO has no co-combustion facilities yet. Thus, large scale imports of biomass is not yet an issue. However, large scale biomass yards, once established, may supply stand alone biomass plants too, in which case decentralised yards would be preferred. The necessary pre-treatment on the yard will depend on the type of conversion plant and the technology applied. ENECO is opting for solid and proven technologies with modest biomass specifications, which do not require a lot of mixing and blending. The question raised about forming a joint venture will be discussed in ENECO's management team.

3. Conclusions

- 1) This quick scan has yielded some interesting information about the way in which biomass is collected and handled in The Netherlands at present.
- 2) However, the questions raised proved to be a little bit too specific and too detailed. The experts interviewed had some difficulties in answering them properly.
- 3) Biomass handling and pre-treatment and waste management and recycling often go hand in hand, needing the same kind of logistics.
- 4) The waste sector is dominated by a few large players and further mergers and up-scaling is to be expected³. Combining different activities by horizontal integration is a strategy often deployed to face the increasing competition and to maintain a leading market position.
- 5) If new biomass yards are to be established in The Netherlands in the very near future to handle large quantities of imported biomass, it seems a good idea to make use of the existing experiences and know-how of the waste and recycling sector and to cooperate closely (e.g form a joint venture) with one or more of the leading firms.
- 6) Two large biomass yard located at the Maasvlakte and Delfzijl for large scale imports of clean biomass and a number of smaller yards in conjunction with existing waste recycling and composting yards will enable a flexible supply of feedstock which is tailor made to the quality requirements of the bioenergy producers.
- 7) Pre-treatment of clean biomass will consist of particle size reduction, homogenization, blending and quality control and management. These measures require standard technologies which can best be outsourced to the fuel suppliers. Usually biomass is not dried prior to energy conversion. However, pelletising biomass and waste could be an interesting (but rather expensive) option for some end-users (i.e private consumers).
- 8) Pre-treatment of used wood and other organic waste products from the agro-food industry may need additional steps of sorting, sieving, removing of unwanted materials and, in some cases, pulverizing.

³ BVOR (Branche Vereniging Organische Reststoffen)

4. Follow up?

A number of questions still remain unanswered:

- How many biomass yards will effectively be needed by 2010?
- What are the investment costs involved? (we didn't get much information on this point)
- How to overcome the difficulties with legislation and (environmental) permits? How serious are these barriers to the large scale deployment of biomass?
- What are the exact pre-treatment steps (in conjunction with BUS-ticket no 16)?

Recommendations

1. Organize an in-depth workshop with an group of experts / captains of industry to assess the viability of large-scale biomass yards in The Netherlands in greater detail; to formulate a joint vision coupled to a number of recommendations in the form of a concrete action plan; and to bring potential business partners together. Both the BUS and Novem may be approached to facilitate such a meeting.
2. Vision and action plan will be discussed with the participants of the ongoing 'Transition on Biomass' and the outcome of the discussions may be presented to the Dutch authorities, e.g to the Secretary of State of the Ministry of Economic Affairs.