Good practice guide and report on study visits in the W2E project
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Introduction

In the W2E project there were 5 study visits organized. Two in Sweden, one in the UK, one in Hungary and one in Romania. At the study visits the partners presented good practices in their region and this document is the record of these study visits. At the end of this document the four main good practices are explained in more detail.

Record from the study visit in Cumbria, Wednesday 5th May – Friday 7th May 2010

The following practices were presented in Cumbria:

Cumbria waste strategy – Nigel Christian (Cumbria County Council):
Brief introduction to municipal waste in Cumbria • Waste management facilities • Targets and the Landfill Allowance Trading Scheme • Cumbria Strategic Waste Partnership • Waste statistics • Future developments

National and Regional Strategy & Planning - Richard Evans (Cumbria County Council) & Krista Patrick (4nw and chair of the Regional Technical Advisory Body: Commercial and industrial wastes • Regional Waste Strategy • Minerals and Waste Development Framework • Site waste management plans.

The UK Market for Solid Recovered Fuel - Amanda Gascoyne (Shanks Waste Management)

Shanks Mechanical and Biological Treatment Plant, Dumfries Introduction to the process wh Tour of Plant – Tom Hall (Shanks, Cumbria Ltd)

Opportunity to observe recycling in Carlisle and (time permitting) visit the city centre Household Waste Recycling Centre - Mike Gardner (Carlisle City Council)

Carlisle City Council recycling strategy – Mike Gardner (Carlisle City Council) and Margaret Graham (Impact Housing): Public reaction to recycling • the challenges of providing a multi-material collection service • social benefits and key features of a not-for-profit recycling service for bulky waste.

Tour of Cockermouth Eco-Centre
Introduction – Joan Ellis (Cockermouth School)
The story of the Eco Centre
Workshop with Students – Ian Garrow (Cumbria County Council)
An opportunity to discuss with the students their perceptions of the school waste education programme and waste 2 energy.

Waste Prevention Programme overview – Martin Allman
The Waste Prevention Team • Partnering with District Councils • Service change • Behavioural change • Examples of campaigns • Prevention is better than cure • Recycling saves lives!

Energy from Waste disparity study – Annette Hill (Scott Wilson consultants)

UK renewable energy strategy and Bio-energy- University of Cumbria National School of Forestry

And this is the record of this study visit:

Cumbria Waste Strategy – Nigel Christian

Waste to Energy (W2E) concerns are a political worry rather than concerns of local people. Politicians – ‘how will the public respond to a plant in their area?’ as opposed to public ‘we do not want a plant in our area’.

Survey sent to every household in Cumbria – 17,000 responses. This was much greater than anticipated.

Q, When did you come to a new waste management strategy?
A, 2001-2002 yet there was a fear of W2E and doing something different. Delay till 2005 before we went out to European tendering for a new commercial provider. This happened due to a push from the political administration.

Cumbria County Council had no set strategy for W2E, they arrived by this solution by accident.

Over view of the mistakes made during the tendering process:
• CCC did not understand how to procure a major waste management programme and failed to educate itself during the process.
• Staff had no training. They were dealing with huge numbers which were too big to comprehend.
• CCC had difficulty pulling together a project team and had to rely on consultants.
• CCC spent too much money and relied to heavily on consultants.

Q, Why a 25 year contract? – Carol Romero
A, That is what our consultants advised us to do because it’s the standard time for capital lending.

The waste management solution in Cumbria is more down to luck than a well managed procurement process. In Cumbria we have to work within the political system.

Q, Which city is the biggest in the county?
A, Carlisle is the biggest. Barrow is slightly smaller. The West Coast also had major towns.
There was discussion about the extension of the national park including speculation as to the motivation. Is it to stop wind farms?

Q. Do residents already sort their waste when they put it on the curb side?
A. Yes it is sorted before collection. Recycling is sorted into Metals, glass, paper, card and plastics. There is also a section for Garden Waste.

Strategy Drivers – Nigel discussed the perverse outcomes of the legislative system in the UK.
• There is a strong target focus. CCC set a lower target than they could achieve for landfill reduction to ensure that they did not occur penalties. Penalties are a disincentive to honest target setting.
• Projections are made by CCC based on satisfying auditors.

Q. What is the total price for people bringing waste to Landfill?
A. There is a landfill tax of £40 per tonne and then additional cost at the landfill site. The overall cost per tonne is £72.

CCC did not move fast enough to get the Shanks treatment capacity online and now they are facing financial penalties due to still sending to much waste to landfill.

Waste reduction has saved the council 20 million in capital expenditure. Due to the focus on waste reduction, they have only had to build two waste treatment plants rather than three.

Q. Who decided that County Council’s are responsible for waste?
A. Central government. In the 1974 Local Government reorganisation waste disposal was designated as a strategic function. Now many believe that the split in function is not a good one and Cumbria is working towards the creation of a joint waste authority.

Q. Is this the same all over England?
A. In some parts it is the same but in other areas we have unitary authorities, which are responsible for both collection and disposal.

Q. Why is a nuclear power plant an opportunity?
A. West Cumbria has been home to nuclear generation for 60 years, yet there is now the need to decommission the old plant. Many jobs have been linked to West Cumbrian nuclear generation. CCC is exploring new opportunities with the people who run the current nuclear power plant but also national government. National government are pushing for a better mix of energy, due to concerns about climate change and energy security. Sellafield has been identified as a potential new site for a nuclear power plant.

Q. How do you mix high levels of protected area with nuclear power?
A. This is very difficult. The plant is outside the national park but will need grid connections which will run through the park. Also the plant is still visible from park, this needs to be taken into account during the design of this plant.

Q. What is the percentage of protected area?
A. About 50% - taking into account the national parks and areas of Special Scientific Interest.
Q. Does recycling, compost or landfill provide more benefits for Cumbria economically?
A. 2-3 years ago an external company looked at the overall economic benefit recycling brings to Cumbria. Despite there being no recycling processing facilities in Cumbria, the overall economic benefit to the county is still 6 million. Composting is carried out in the County and is either sold or used on farmland in Cumbria. The County Council has never calculated the exact value of composting. Landfill also has economic value by creating gas which is turned into electricity. Only now is CCC beginning to view waste as a resource to us. This question is central to any future policy developments.

**Cumbria’s Wider Sustainable Waste Management Strategy – Richard Evans**

Cumbria is the third county in the country to reach a sustainable waste management strategy.

Public meetings – people are opposed to W2E, they connect it to incineration. They have been ten rounds of public participation and 30 public meetings in total.

Q. What involvement do you have from the commercial / industrial sector?
A. CCC have found it difficult to get them engaged. But representatives from this sector are on the regional technical advisory body therefore the Council has involvement by proxy through these other organisations.

Q. Surely commercial / industrial interests as well as public have to be included in the process not just public?
A. While we refer to the ‘public’ we also include commercial and industrial organisations in our considerations.

**Regional Strategy and Planning – Krista Patrick**

Aim at regional level is to prevent waste.

Survey of commercial / industrial waste – how much do we have? What are the opportunities for recycling and recovery? 7 million tonnes produced in North West.

Q. Do we know what the composition of waste being land filled is?
A. Non metallic waste is the most popular waste stream followed by mixed waste. We have high recycling levels but if we did further separation we could push the figure higher.

Q. What is your role? Is it advisory or do your policies have to be implemented on a regional level?
A. The policies contained in our plans, set the framework for each of the sub regions to put more detail into their sustainable waste management strategies. We set targets for each sub region, how much waste it should have and how it should be dealt with. Sub regions have to develop how they will achieve this.

Nigel interjects to tell the group that as yet there is no penalty if the sub regions do not deliver. The situation may change with the election.

**Solid Recoverable Fuels – A sustainable option for the UK – Tom Hall**
The difference between Public Private Partnership (PPP) and Private Finance Initiative (PFI) was explained. With the Shanks contract Cumbria’s route was PPP, this means that eventually Cumbria will own the plants.

The Shanks plant in Dumfries (which the group subsequently visited) is a similar scale to the Cumbrian plant. Like the Dumfries plant it only takes local authority waste.

Tom Hall explained the process within the plant and then passed round examples of the products that you have left over after treatment. This included a sample of Solid Recovered Fuel (SRF). It was noted that this does not have a strong smell.

Shanks have international links to Sweden and Holland. The plants are made in Italy.

Q, Martin asked for further explanations about grades.
A, When you put a fuel into a burner it needs to be a uniform composition because otherwise it gets to hot. If it gets to hot it will burn its way through the burner, therefore you need to control moisture content and other variables to prevent these hotspots.

The UK provides 4% of the SRF production in Europe. This is much smaller than Germany which has 47%. Sweden is in 3rd place and Italy 4th – both ahead of the UK. Overall SRF is a developing market European wide.

In the UK SRF comes from Municipal Solid Waste (MSW) vs. Europe where it’s a mix of MSW and Commercial & Industrial (C&I) waste.

Q: In the UK Shanks has developed its waste treatments only for MSW whereas in Europe they deal with MSW and C&I. What is the barrier in the UK which stops them dealing with C&I waste?
A, Before building a plant, Shanks need a viable commercial contract. A plant in Cumbria costs 20 million and therefore you need to be able to guarantee that you will fill it with waste. However Shanks are moving to expand their operation in C&I waste in the UK. They are currently building a plant in Cumbernauld, which will deal with supermarket waste.

The different market context between the UK and continental Europe was noted.

Q: Do you think the market will change? Do you think in the future that people will pay us for SRF rather than CCC pay £20 per tonne for its disposal?
A: SRF is classified as waste by central government. Central government are not willing to call it a fuel. Maybe if people start to see it as a fuel things will change. However it is important to remember that paying £20 per tonne versus £100 to landfill is still a significant saving.

Q: How will CCC benefit from this contract?
A: There is a shared risk and financial benefits built into the contract. In the early years Shanks have all the risk to find the market yet are the primary financial beneficiary. From 2018 CCC will benefit more from the arrangement financially as the market develops for people to pay for SRF. Yet there is immediate benefit from the plants coming online in avoiding landfill and LATTs charges.
Q: Do you feel it is a good strategy to build plant without an off taker prepared to pay for the SRF produced?
A: (Shanks) This is a good question. Cumbria is the last contract we will sign without a guaranteed off taker.
A: (Cumbria County Council) Procurement of the contract was driven by the potential for significant LATTs fines, rather than the potential emerging market opportunities for fuel. This was short sighted, it was a policy decision based on looking at the next days rather than ahead. The key lesson is to anticipate and understand the future direction of regional and national government thinking.

Q: Have you considered thermal valourisation?
A: We have gone out to 8 different technology partners. We are exploring this with partners at CCC.

**Carlisle City Council’s Recycling Revolution – Mike Gardner**

Carlisle City Council are working with CCC through the Cumbria Strategic Waste Partnership (CSWP). The CSWP have set a target to recycle 50%. This connects to national pressure and central governments recycling target of 50% by 2015. Politically recycling is very popular – a vote winner. The clear message from the public consultation is that we want you to recycle.

The focus on recycling comes from the waste hierarchy – reduce, recycle, treat, dump.

Q, How did we achieve this target?
A, Previously the recycling box scheme was ‘opt in’. The council adopted a new approach: carrot and stick. You have to compel people to recycle but also have to give people the tools to be able to do it.
Stick: only empty bins every two weeks. This was hugely unpopular and made the national news. Carlisle City was labelled the ‘bin police’, and this became a ‘hot topic’ throughout the city. The public were afraid that they were going to fined. While inaccurate these scare stories encouraged people to recycle.
Carrot: Green boxes. The council also collect garden waste (but not food waste). The collection of garden waste is very popular and helps underpin the recycling scheme.
Lesson learned: If you want the message to sink in you need to keep it simple e.g. waste in the garden yes, food waste in the kitchen no.

Cumbria County Council pays Carlisle City Council for the amount that they recycle.

In recent years less waste for recycling is being collected. Reasons for this include:
• Changes by manufacturers including less materials in packaging e.g. wine bottles contain 25% less glass. There have been significant advances in product design.
• Changes in consumption e.g. people reading papers online rather than buying them.
• Changes in how people think about waste due to the success of waste education.
Currently Carlisle City Council has now reached a recycling rate of 48% which is almost the target.

Q: What happened between the years 2006 and 2007 where recycling rates jumped by 13%?
A: Initially there was only a pilot scheme with boxes distributed to 25% of households. Then it was extended across the city but remained an opt in scheme. In 2007/08 people were forced to use the boxes by making the bin collections less frequent. This ‘stick’ enabled the Council to break through the glass ceiling on recycling levels.

Lesson learnt: In order to make an impact you have to make a ‘big noise’. People are busy and have a lot of things competing for their attention. To make headway you have to be heard above the din.

Q. Apart from the limited rubbish collections are there any other incentives to encourage recycling, e.g. fines?
A: We have never fined people for too much waste but if they persistently break the rules of waste collection e.g. the day you put the rubbish out, then they may consider issuing fines. The recycling rates are high for the following combination of reasons:
• Recycling has become 2nd nature for people.
• Recycling gives people the feel good factor, the public recycle because ‘it’s the right thing to do’.
• There is peer pressure to recycle, the sense ‘everyone else is doing it’.
• High profile national cases where local authorities have fined people for rubbish violations have hit the national news. The public pick up on this and believe that Cumbria may also fine people.
• There have been huge national and local education campaigns – supported by the Waste and Recycling Action programme. Programmes such as these have provided a large quantity of financial support. In Cumbria we have taken the national campaigns and localised them. Martin’s team spend their time on community engagement on waste reduction / recycling issues (especially in schools).

Q. Is it possible to have a higher target for recycling by including food waste?
A, Interesting question, in the UK we are criticised for having a target driven culture. Targets are good as they give people something to work for, but they have a danger of becoming an end to themselves. Other authorities are currently recycling 60% but for Cumbria to achieve that we will have to recycle food waste. This will involve a change to the strategy and will therefore need the backing of the CSWP to do this. Carlisle City Council will not do this unilaterally, we need to do this together. Currently the waste partnership is having this discussion. Where do we go from here? We have met our targets what is next?

Q: Do you know how much recyclable waste goes into the regular bins?
A: No, a few years ago we commissioned a study looking at the contents of the bins. My guess would be 80% participation in the recycling scheme across the city. So the remaining 20% of households do not recycle much. However not all recyclable material within the 80% of households who participate ends up being recycled. So overall quite a lot of recyclable waste is ending up in the waste stream.

Q: Can you provide a financial breakdown of expenditure on collections and income streams?
A: The majority of our income is subsidy from Cumbria County Council which is linked to percentage recycled within the city. It is difficult to quantify the exact amount of the subsidy, as some of the collection is contracted out, but it is roughly 90% of the cost.

The net cost for the council of collection is £55 per household per year (that includes refuse and recycling collection). We collect 476kg / per household / per year. While collection is expensive, recycling ensures that there is less waste to treat and therefore saves money. This is partly paid for by council tax. Council tax is a fee for all services and individuals are not charged separately for rubbish collection. There have been debates about putting micro chips in peoples’ bins to introduce a system of ‘pay as you throw’. This system is used in Sweden. This idea is hugely unpopular because people in the UK already feel like they are an over watched by a ‘big brother’ nation state. Nigel pointed out the practical problems with chips interfering with the transfer of waste to landfill.

This situation could change with a new government. The Conservatives are promoting incentive payments for recycling. This would involve putting a micro chip in the green box and providing money back if you recycle.

To any collection cost you have to add in disposal costs, which are borne by the County Council. Collection and disposal combined is around 110 – 120 euros per household per year.

**Carlisle City Council**

**Key Waste Collection statistics 2009/10**

(Subsequently provided by Mike Gardner)

- Number of households in the City of Carlisle: 49,045
- Total tonnage of household waste collected in 2009/10: 43,854 tonnes
- Total tonnage of residual waste (i.e. waste not recycled): 23,340 tonnes
- Kg of residual waste (i.e. waste not recycled) per household: 476 kg
- Total tonnage of household waste recycled in 2009/10: 20,514 tonnes
- % of household waste recycled: 46.78%
- Total net revenue cost of household waste collection in 2009/10 = £2,090,403
- Total net revenue cost of residual waste collection in 2009/10 = £1,456,500
- Total net revenue cost of recycling collections in 2009/10 = £633,903
- Total cost of household waste collection per household (including capital charges not included in the above) = £52.00 / household (N.B. provisional figure subject to confirmation of final out-turn)

Nationally a district council with spend a 1/3 of their budget on waste management. So a joint waste management board with a County Council is very politically sensitive. Can a district council continue to exist if this function is taken away from them?

Details are given of the inefficient payment system. Council tax is paid to district council which pays a lot of this back to the County Council who then pay it back to the district councils in recycling subsidies.

**Impact Furniture Services: Meeting Social and Environmental Needs – Rod Yeoman**
Impact furniture services work in the social sector as a social enterprise and are not just driven by environmental principles.

Currently they can only take good furniture which they can recycle. In the future impact housing have a dream that they can take poor furniture and burn it – to stop it going into landfill.

Fanplastic is a new educational project. Currently manufacturers, e.g. coca cola can not get enough recycled plastics. Coca cola currently use 20,000 tonnes of recycled PET but could use more. Only 1/5 plastic bottles are being recycled.

Martin Allman elaborates on the importance of the relationship between the CCC and the not for profit sector. “Recycling should not just be environmental. It is social, economic and environmental. We help organisations in the 3rd sector because they are able to deliver programmes that the County Council can not. The County Council does not have the creativity, skills and flexibility to deliver some of the projects that Impact Furniture Services does. We (CCC) are very grateful and proud to be working with Impact”.

£120,000 + gate fee + tax = the amount that impact housing has saved the Council by recycling the furniture.

Q. Do you have any negative reaction to the project from the furniture shops?  
A. From time to time we do, in particular when we set up in a new town (especially in the West Coast of Cumbria). We argue that we are pitching at the low income market whereas furniture shops are aiming for a more general and wide ranging market. While there are uncomfortable moments, we have generally managed to work our way round these. At the end of the day it is tough we have a service to offer and we will do this anyway.

Impact housing did an exercise to see if it was worth them taking over the whole bulky waste collection service. The increase in reusable furniture collected was not economically sensible. They only collected 8% more reusable furniture by taking on the entire collection system. While Impact Housing is not a profit making business they do have to be aware of costs and overheads.

The group were given a tour of the premises which included the workshop, garden and shop. If was explained that anyone could shop in the store but that the target was for low income families to make use of the service. Impact price the furniture as low as possible to meet their overheads but when people can not afford to pay they get the furniture for free. Impact housing will not charge more than nominal amounts for items such as push chairs and cots and often receive these back to sell again once the child is older. There is a section for toys and books which are given free of charge to children. It was explained to the group that Impact Housing offer placements to young people who can not find work. These placements offer them valuable skills such as washing machine repair and something they can use on a CV / talk about in interviews.

Waste Education – Ian Garrow

The partners had a tour of the Cockermouth Eco School which highlighted the sustainable features of the building. This was followed by a workshop with students where they discussed
the negative perceptions of W2E. This workshop compared the perceptions of W2E in the UK with the other regions of Europe. It was found that there is common negative perception in many of the partner regions.

The Role of Waste Prevention – Martin Allman

Q. Is it that the more you reduce your waste the tougher it is to meet the 50% recycling target? A. This is a really good question. Recycling performance is based on how much waste there is in total. Hypothetically if we take waste out of the system through reduction programmes and the recycling level remains static then our recycling rate actually goes up because we are recycling a higher percentage of the total waste. So that is why we have projects like ‘love food hate waste’. These are an easy way to increase the recycling rate by simply having less waste in the waste stream.

Dr Viktoria Budavari described her how she read the waste prevention website in advance of the visit and was impressed with the real nappies campaign.

1/3 of waste is food waste. This food is not thrown away because it is out of date but because people have bought too much. The average family in Britain throws away 540 euros worth of food every year. Waste prevention at CCC encourages them not to. If people reduce food waste by half a kilo per person per year the council would have no issues meeting its targets and the ‘red triangle’ outlined by Nigel on day one would disappear and the council would no longer be liable for LATTs fines.

Martin outlined the award winning campaigns like recycle for Barrow. Recycling went from 22% and no service to 40% within a year. He described how it began as ‘recycle for Cumbria’ but then they realised they got more involvement by making the campaign specific to a town. After the campaign they got to take their success back to the people of Barrow ‘you won this award for Barrow’.

Waste to Energy – National Policy Perspectives – Alex Findlay (Government Office North West)

One of the great unknowns with waste policy is how it will be affected by the budget deficit.

Q. Is nuclear included in the 30% renewable energy target? A. There is some uncertainty as to whether this is included.

A desire for an increase in green technologies is not just environmental but has an economic motive. This is a job creating sector.

Ian Stephenson described how W2E and the waste hierarchy do not necessarily sit well together. The waste hierarchy encourages the reduction of waste but a W2E policy requires large amounts of waste. The two are therefore imposing forces with an innate tension. In the UK we are trying to resolve this with cross governmental working and by looking to the examples of Europe where they are able to reconcile the two, e.g. Holland and Sweden. In
Sweden there is 42% recycling rate and 45% energy from waste rate. In the UK there are financial and commercial interests in striving for a clearly set out W2E policy.

Q. Is the fundamental aim of the whole project to encourage W2E plants in the UK? (N.b. the ‘project’ refers to the project being presented by Government North West and not the Interreg IVC project).
A. The project is about promoting W2E as an option to consider in the UK. It is about making sure that the government’s message is being clearly communicated at a regional level e.g. what W2E schemes are both possible and more likely to be undertaken.

DEFRA had a lot of demonstrative projects in the UK which tested various new waste management technologies which have been successfully used abroad. We are eagerly anticipating the results of this study.

Q. Is there a single website where we can view the work of the amalgamated workstreams from across government, who are looking together at W2E?
A. Alex Findlay found no website specifically dedicated to this project during his research for the presentation.

Nigel requests further information on energy initiatives outlined in the presentation, e.g. tariffs (where there is a financial benefit from instigating a renewable energy scheme.) The feed in tariff is paid for feeding renewable electricity into the grid.

Q. What is the difference between ROC and the feed in tariff?
A. If you are a big producer you get paid the ROCs while if you are producing energy at a small domestic level (e.g. a burner in your garden) you will receive a feed in tariff. Issues surrounding the feed in tariffs are currently being discussed by the Cumbria renewables panel.

Government measures surrounding renewable heat starts next April. This will apply to all scales including domestic. There will be a gap funding scheme to enable people to invest in the infrastructure in order to create renewable energy.

However for all of these schemes the key issue is financial. Will there be the money to encourage renewable energy generation under the new administration?

The Courtauld Commitment was outlined. This is phase two of a voluntary commitment, which encourages retailers and retail produces to reduce their carbon footprint in the processing phase, e.g. by reducing packaging. This commitment may have an impact on the end product of recovery from fuel.

Greater Manchester has undertaken a £? million PFI scheme to upgrade their waste infrastructure. This is the biggest investment in Europe which involves establishing five plants around Manchester which will produce a refuge derived fuel. This fuel will then go to supply the CHP INEOS Chlor plant at Runcorn. Runcorn currently uses 5% of the UK’s energy use. The cost of energy has forced the company to look at the option of W2E.

The danger of reaching over capacity in W2E generation was discussed. In Sweden there have been problems with this and they have ended up importing waste solely to feed the plants – including from countries like Denmark.
Q. INEOS Chlor is a private company and yet Greater Manchester is committing itself to a contract for W2E plants on the basis that INEOS Chlor will provide a stable market for W2E. Is there not a danger that ultimately INEOS Chlor could leave the area and Manchester will be left unable to sell their fuel?

A. This is difficult. Is Greater Manchester not funding INEOS Chlor? There is speculation that the government could have intervened to make this deal happen as INEOS Chlor is a very important company economically for Britain. In contrast in Cumbria we only have 100 tonnes of SRF.

**Energy from Waste: Energy Islands - Shirley Newman**

This presentation looks at W2E from the perspective of small communities rather than large scale initiatives like that undertaken by Greater Manchester. The current perspective nationally is that we need to shift our focus to the recovery of energy from waste. This means we need to explore how it is best to do this at a local level.

Q. Where are the possible areas where you can import raw materials to Cumbria from?

A. We are looking to Lancashire, Manchester and the North East to meet these needs. However these areas have their own needs for raw materials which they have to meet.

Transport infrastructure is the key issue in Cumbria as we have poor road and rail connections. This is a huge consideration in future developments surrounding energy.

Companies including Centrica, Kimberly Clark and BIA have long term waste contracts. The current capacity of treatment plants in Cumbria is only MSW. They have no capacity for C&I waste. In order to move into this area Cumbria would need the infrastructure in place to collect the waste of medium sized industries. During the procurement process CCC only looked at its disposal responsibilities (MSW) and ultimately have only built enough capacity for disposal of its own waste. This was a short sighted failure to properly understand the potential of the C&I waste sector. However the difficulties of a local authority moving into the C&I sector was discussed. Companies do not tie themselves down to 25 year contracts. Therefore the local authority would have had to have found the finance for the extra capacity for C&I waste with no guarantee of a market for the energy produced.

There was a discussion of anaerobic digestion. While this provides only a small proportion of renewable energy in the UK overall it may suit a rural economy. It would be therefore misguided not to include this in W2E considerations.

The next section focused on combined heat and power. In the UK, and Cumbria, when we currently talk about combined heat and power, the focus is on providing energy to industry. There was discussion of the need to consider adopting the Swedish model and using the energy produced for heating domestic housing. If so the plants need to be located near urban areas. Yet this brings up infrastructural issues, ultimately who is going to pick up tab for combined heat and power infrastructure? In Sweden the government run combined heat and power plants as a business. They sell the heat to the public. In the UK we need to examine the financial potential of these facilities. In Cumbria sometimes we automatically say ‘it is too difficult’ and never invest time and resources in establishing if this is accurate.
A sensible option is energy Islands which provide energy locally for local use on a proximity principle. However this is not always a realistic option and requires careful thought and strategic planning about the type of facilities you use.

Q. Are you advocating small plants for the production of renewable energy?
A. We have to think carefully about the mix of renewable energy production in our country. Not all sensible forms of production are going to be connected to waste e.g. there is the potential for a small scale hydroelectric plant in Cumbria.

In terms of waste processing in Cumbria Shanks are talking about one medium sized facility to deal with all the waste in the county. Yet where would you put this facility, in Carlisle or Barrow? Given the size and poor transport infrastructure in Cumbria this is a major consideration. While it is easier for Shanks commercially to have one major plant this is not the best option for Cumbria. When considering issues of what plants to build and their location you have to consider who each option will benefit – your commercial partner of the Cumbrian population. A local authority serves the economy of Cumbria rather than the profit line of a waste management company.

There are currently problems of people getting cut off from the supply of electricity. An illustrative example was given of a small industrial estate in Cumbria. In the past when someone has put the kettle on in household waste recycling centre this has caused power to go off in the estate. Yet the cost of increasing the amount of power supplied throughout Cumbria is huge and there are issues of where this investment will come from.

Q. This presentation focuses on the Cumbrian situation. Do the other regions represented in the W2E project have infrastructural problems (e.g. transport / finding suitable locations for plants)?
A. In Poland, the source of renewable energy is predominantly biomass and combustion. But in Kujawsko Pomorskie Voivodship they only build small plants because of concerns of a lack of materials for combustion.
Q. Does your region have the same rural landscape as Cumbria?
A. The small energy plants in the region provide electricity to small numbers of people (roughly 2000). Methods include burning straw.
Q. Do you have enough feedstock to provide the energy you need or do you also rely on other methods of power?
A. Yes there is enough power overall but the supply of feedstock is seasonal. The region lacks materials for combustion over the long winter. The reason they have not built a big plant is the fear of insufficient feed stock. The small plants described are only found in villages. In the cities the more common method of energy from waste is anaerobic digestion from sewage sludge.

In Sweden there is less use of combined heat and power.

In Italy there are many issues. There are problems regarding transportation and the use of heat. There are no industries that can use the heat produced and a lack of need for the heat in a domestic context. In Italy they only use domestic heat for three or four months per year. In Italy the priority is to use new technology to maximise the production of electricity.
In Poland there is a use of geothermal energy.

Conclusion of the presentation: with W2E we need to think not just about the big plants but about using a mix of renewable energy forms which suit regions individual challenges.

**Energy from Waste in the North West of England; a Story of Supply and Demand - Adam Strafford**

This presentation presented a report on the likely amount of waste feedstock compared to the capacity of thermal treatment plants in the North West. If all plants currently in the planning process come online, will there be more capacity for energy production than there is feedstock available? This information is ‘hot off the presses’.

To establish this overview we need to look at the amount of waste that we have in the region along side the amount of capacity we are preparing to build. Other European countries have found that can not find enough feedstock for their large W2E plants.

Currently in the North West we have done well at getting developments providing energy from waste online, e.g. Greater Manchester’s plants to feed the energy requirements of INEOS Chlor. Yet while there is demand for fuel we must ensure that we have the supply of waste to feed this demand. A careful balance between supply and demand is needed.

Q. (Ian Stevenson): Currently we assume that recycling is the first thing that should happen to our waste. Given the increasing demand for W2E should the policy not be to feed all waste towards W2E plants? If carbon reduction is the focus of policy and W2E plants are more successful at reducing carbon than recycling do you not need to examine this as a potential fresh approach?

A. Martin Allman: That is only relevant if you look at carbon as your only bench mench. While you can only burn waste once you can recycle multiple times.

Presentation of waste modelling shows that currently in the first instance the focus is on recycling. By 2010 the aim is for 40% of recycling in the North West region.

Data collection and quality is a big issue. On the face of this data you are making billion of pounds worth of decisions, therefore you need your data to be accurate. Currently there is a good understanding of the amount of capacity of operational facilities in the North West. From the statistics that we currently have the total available feedstock is not far off matching the plant capacity currently in the planning process. However this is based on the assumption that those in the planning process will be approved. It is essential that we understand the market for W2E before we begin investing in generation capacity.

Q. Have those companies that have applied for planning permission found sources of feedstock?

A. At present this is based on speculative assumptions. It is a dynamic and developing market. Everyone is hoping that SRF will become a valuable commodity. Currently we perceive it as waste rather than viewing it as a resource.

Q. Could we control the supply of feedstock to artificially keep the price of the energy produced at a sensible level?
A. This is an issue of some difficulty, however there may well be a policy that controls this in future.

Conclusion: In the North West there is currently the potential for over capacity, but it is unlikely that all plants in the planning process will come online. Therefore in the immediate future there is likely to be under capacity. This will help generate markets and keep prices at a sensible level.

Energy from Waste Feedstocks and Solutions for the North West Region – Gill Tatum

The Isle of Man W2E plant is a classic example of issues of negative public perception. The Isle of Man continued with damaging and unsightly landfill because they could not get planning permission for a W2E plant, as the public would not accept it. Eventually permission was granted for a field outside the main town of Douglas. The emissions from the chimney are on the website 24 hours a day in an attempt to counter issues of negative public perception.

The real issue is understanding the quantities of feedstock available and what industrial sectors are producing this. Data is key, the large discrepancy between Adam Strafford and Gill Tatum’s interpretation of data from the same sources shows the level of the problem.

There is an inherent tension between what waste can be recycled and what can be recovered. This dilemma should form a key consideration of the policy tool. In the North West if 60% is recycled, 78.1% of the remaining waste is recoverable.

Q. What sort of materials comprise the non recoverable waste?
A. Solvents, hazardous waste along side other materials are all in the mix.

Q. If you are going to invest in a W2E plant how can you ensure that there is a sufficient supply of feedstock?
A. Urban mines produced a tool to look at this which Gill Tatum outlines.

She described that with the plants about to come online there is currently too much capacity for the supply of feedstock.

Lessons learnt:
• Good data is essential for effective strategic planning. You need background data on C&I waste as well as MSW.
• We need to understand the effects of pre treatment on the calorific value of waste. Currently there is a lack of research. What effect will new technologies have?
• With MSW you can control the supply of feedstock – there is a stable supply. This is much more complicated with C&I waste which is dependant on much more variables. Where is it? What sectors is it coming from? How do you collect and sort it? The answer to these questions requires co-ordination, therefore strategic planning is crucial.
Record from the study visit in Szeged, Hungary 10th – 11th June 2010

At the study visit in Szeged the following practices were introduced:

Presentation of the Down-Tisza-Region Environmental, Nature Reserve and Water Inspectorate
Legal background of the waste management
Organizational structure, legislation, administrative systems in waste management (who is responsible for what, license, controlling etc.)

Energetical point of view
The use of energy resources, plans for the future
The question of the renewable energy and the politics
Ideas about the waste as an energy resource

Practical information about the waste management
Especially about the Hungarian situation

Waste management plan
Statistics, hierarchy, recycling, disposal
Questions of the present and the future

The use of renewable energy sources
The possibilities in Hungary and the South Great Plain
Our consumption of renewable energy

Study visit: Szegedi waterworks, sewage biogas division

Study visit: Hódmezővásárhely – waste sorting company

Study visit: Kecskemét – Pilze-Nagy Kft., biogas factory

Study visit: Budapest, incineration

And this is the record of this study visit:

Presentation of the South Great Plain Regional Development Agency
(presentation by Zsanett Pigniczki, project manager)

- General introduction of the RDA
- Structure, divisions of the Agency
- Environmental projects from the past and the present
Presentation of the Inspectorate for Environment, Nature and Water of Lower Tisza District (presentation by Dr. Balázs Mader, from the Inspectorate for Environment, Nature and Water Lower-Tisza District)

- Legal background of the waste management
- Organizational structure, legislation, administrative systems in waste management (who is responsible for what, license, controlling etc.)

Potentials and barriers of sustainable Hungarian biogas production (presentation by Prof. Kornél L. Kovács, from the University of Szeged, Faculty of Natural Science and Informatics, Department of Biotechnology, member and former chairman of the Hungarian Biogas Association)

- Renewable energy use of Hungary, especially focusing on biomass
- Questions of political/public support and attitude concerning renewable energies
- Problems and contradictions of regulation (“it is a mess”, 24 permits from 24 different authorities to build a biogas plant, though according to the law, biogas is not yet accepted as a fuel)
- Role of education and the media, campaigns popularizing biogas production (reaching 1.5 million people, especially children)

The Hungarian Waste Management in Context (presentation by Dr. Viktória Budavári, from the Inspectorate for Environment, Nature and Water of Lower Tisza District)

- Especially about the Hungarian situation
- Special programs and financial supports
- The National Waste Management Plan
- The Hungarian Waste Information System
- Decrease of waste (waste and municipal waste) amount in Hungary
- The composition of municipal waste (66% of the total amount could be recycled, most of paper, plastic, glass and metal are wrapping wastes)
- Comparison of municipal and industrial commercial selective collection
- The management of municipal waste (fees independent of selective activities, which leads to lack of motivation)
- The management of industrial waste (motivation for prevention, reusing and recycling)
- The planned waste management from 2010 to 2014
- Strategy drivers (from legislative, financial, and educational point of view)

Q: Why is the planned other type waste higher in 2012 than in 2008? (page 10 and 17 in the pdf)
A: Because the planned data refers to the total (municipal and industrial) waste, otherwise it is not comparable.
Q: Which is the Lower Tisza District?
A: It is belonging mostly to the South Great Plain Region, and refers to several other rivers flowing into the Tisza along the area. There is also Middle and an Upper Tisza District upon this methodology and it is the Hungarian way of partitioning the catchment area.
- Base year is 2008 for the Local Waste Management Plan
- Legal regulation, framework directives
- Hierarchy of the Local Waste Management Plan, principles
- Changes and factors - that result in quantity and quality change - that should be considered when planning
- Questions of reuse and municipal solid waste
- PCB has to be removed from use due to its high environmental risk
- Sewage Sludge
- Special waste produced on the planning site

Possible use of renewable energies in the South Great Plain Region of Hungary (presentation by dr. Zsolt Benkő and Henrik Hidvégi; University of Szeged, Juhász Gyula Teacher Training Faculty, Institute of Applied Natural Sciences, Department of Technology)

Dr. Zsolt Benkő:
- Geothermal potential - geographical evolution, the crust is thicker than the average, expected total energy per year is 100 million PJ (very high), utilization (heating, greenhouses, swimming pool’s heating)
- Wind energy – areas of indirect and direct use due to the Danube-Tisza interflume, used for pumping and generating electricity

Q: How many wind energy plants and turbines are there in Hungary?
A: There is no big infrastructure for this kind of energy use, industrial use is not widespread, mainly wind energy plants are private ones. There are possibilities, but left unexploited.
- Biomass -
  - Wood and straw: heating, firing mini power plants
  - Cold pressed oil and biodiesel production 5-6 years ago (for instance: sunflower fields)
  - Fruits: alcohol producing, composting (replacement of alimentary substances)
  - Complex systems: a combination of the above mentioned technologies

Henrik Hidvégi (PhD Student):
- Solar Energy:
  - measurement
  - key factors
  - role of the atmosphere
  - solar energy potential in Hungary, especially Szeged (5129 MJ/m², 1425 kwh/m² during a year)
Study Visits:

**Waterworks of Szeged, sewage cleaning plant, biogas division**

Webpage: https://www.szegedivizmu.hu/public/en/?command=si_show_article&article_id=279&alone

Presentation by the Managing Director of the plant:

- Szeged is the largest town in the south of the Great Plain, it lies where the river Maros flows into the river Tisza. This is one of the deepest points of Hungary with its 84 meter height above sea level.
- Population of Szeged is 176,000, and the waterworks deal with an other village called Algyő as well.
- The majority owner of the Plant is the Municipality of Szeged, the minority owner is the French Veolia Eau.
- The plant has 350 workers, the revenue is more than 6 billion HUF (21.5 million Euros) a year.
- 2007: 79% sewage coverage in Szeged due to: new pipe system, water collectors, pump stations. Some of it has a performance of 8 m³/sec (!).
- The mechanical cleaning part has been operating since 1998.
- Then several other parts of the plant were constructed one-by-one: a sewage-pulling receiving station, a sewage sludge receiving station, two primary sedimentation pools, three biological treatment parts, eight final sedimentation sections, a UV-sterilizer, a sludge treatment part, two towers for fermentation, a biogas storing container of 1350 m³, a sludge dewatering engine-house (the whole plant is built in a way that at any time it may be expanded).

Q: Do you produce only gas, or also electric energy?
A: We produce biogas around the amount of 4200 normal m³/day, and generate about 10300 kWhs of electricity.

Q: What is the sludge used for?
A: After having been mixed with biogas, the sludge is transferred to the Municipality Landfill-zone of Szeged where it is composted.

Q: How does this composting process look like?
A: Two things happen to the sludge: it is either used as a layer, or as an agricultural material for the Municipality’s gardens.
- The – average – capacity of the mechanical sewage treatment plant is 60,000 m³/day.
- After the construction of the plant in 2003, there have been several trial periods without any serious malfunctions.
- The water pollution had been higher than the plant’s capacity according to the plans, but since that time the waterworks were keeping their values underneath the limit. In exchange for the miscalculation, the constructor built two 4000 m³ fermentors instead of two 3000 m³ ones; moreover, two gas-engines instead of one (with a 330 kWs performance each).
- The parameters of the treated water are very strict
- The characteristic features of the water in Szeged are as follows:

   Temperature:  22-25°C on the average
   Hardness:    111 CaO mg/l (medium hardness) *
   Nitrate content: 43,2 mg/l (appropriate for drinking and watering)

The Nitrite and Nitrate content is rather low, so it doesn't have any hazardous effect to health. The average amount of arsenic at the customers is below the average of samples taken in the south-eastern region, and the permissible limit value.

The ammonia content is typical of deep water-layers. Other toxic metal content (chrome, cadmium, copper, nickel, mercury, selenium and lead) is not significant, it is technically zero.

* the German standard for hardness (nk) is the 10th of CaO content, so the measured and shown rate of 111 CaO mg/l hardness (gs) equals to 11,1 according to the German standard. The measure can be indicated in "d" or "dH".

In the region of Szeged the rate is hardly changing (10-11 gs) with wells producing the same quality of water.

Some chemical characteristics of the network drinking water examined each month:
Some chemical characteristics of the network drinking water examined each month:

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>pH</td>
<td></td>
<td>7,68</td>
<td>6,5 - 9,5</td>
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<tr>
<td>Total hardness</td>
<td>CaO mg/l</td>
<td>111</td>
<td>50 - 350</td>
</tr>
<tr>
<td>m - The proportion of alkali</td>
<td>mmol/l&lt;br&gt;</td>
<td>5,88</td>
<td></td>
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<tr>
<td>Conductivity</td>
<td>µS/cm</td>
<td>467</td>
<td>2500</td>
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<tr>
<td>Sodium</td>
<td>mg/l</td>
<td>43,2</td>
<td>200</td>
</tr>
<tr>
<td>Potassium</td>
<td>mg/l</td>
<td>1,2</td>
<td></td>
</tr>
<tr>
<td>Ammonium</td>
<td>mg/l</td>
<td>0,73</td>
<td>0,5</td>
</tr>
<tr>
<td>Calcium</td>
<td>mg/l</td>
<td>45,8</td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg/l</td>
<td>20,8</td>
<td></td>
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<tr>
<td>Iron</td>
<td>mg/l</td>
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<td>0,20</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/l</td>
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<td>0,05</td>
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<tr>
<td>Arsenic</td>
<td>mg/l</td>
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<td>0,01</td>
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<td>Chloride</td>
<td>mg/l</td>
<td>3,0</td>
<td>250</td>
</tr>
<tr>
<td>Nitrite</td>
<td>mg/l</td>
<td>0,011</td>
<td>0,5</td>
</tr>
<tr>
<td>Nitrate</td>
<td>mg/l</td>
<td>&lt;0,7 (0,17)&lt;</td>
<td>50</td>
</tr>
<tr>
<td>Hydrogen carbonate</td>
<td>mg/l</td>
<td>359</td>
<td></td>
</tr>
<tr>
<td>Sulphate</td>
<td>mg/l</td>
<td>2,28</td>
<td>250</td>
</tr>
<tr>
<td>Permanganate index</td>
<td>COD(p,s)</td>
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<td>5,0</td>
</tr>
<tr>
<td>Cyanide</td>
<td>mg/l</td>
<td>&lt; 0,005 (0)&lt;</td>
<td>0,05</td>
</tr>
<tr>
<td>Copper</td>
<td>mg/l</td>
<td>&lt; 0,10 (0,005)&lt;</td>
<td>2,0</td>
</tr>
<tr>
<td>Chrome</td>
<td>µg/l</td>
<td>&lt; 5 (0,29)&lt;</td>
<td>50</td>
</tr>
<tr>
<td>Cadmium</td>
<td>µg/l</td>
<td>&lt; 1 (0,019)&lt;</td>
<td>5,0</td>
</tr>
<tr>
<td>Nickel</td>
<td>µg/l</td>
<td>&lt; 2 (0,4 )</td>
<td>20</td>
</tr>
<tr>
<td>Mercury</td>
<td>µg/l</td>
<td>&lt;0,4 (0,25)&lt;</td>
<td>1,0</td>
</tr>
<tr>
<td>Selenium</td>
<td>µg/l</td>
<td>&lt; 2 (0,08)&lt;</td>
<td>10</td>
</tr>
<tr>
<td>Aluminium</td>
<td>µg/l</td>
<td>26</td>
<td>200</td>
</tr>
<tr>
<td>Lead</td>
<td>µg/l</td>
<td>&lt;1 (0,4)</td>
<td>10</td>
</tr>
<tr>
<td>Fluoride</td>
<td>mg/l</td>
<td>&lt;0,07 (0,04)&lt;</td>
<td>1,5</td>
</tr>
<tr>
<td>Antimony</td>
<td>µg/l</td>
<td>&lt; 2 (0,0)&lt;</td>
<td>5</td>
</tr>
<tr>
<td>Boron</td>
<td>mg/l</td>
<td>&lt;0,1 (0,02)&lt;</td>
<td>1,0</td>
</tr>
<tr>
<td>All trihalo-methane</td>
<td>mg/l</td>
<td>&lt;4 ( 1,88)&lt;</td>
<td>50</td>
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</tbody>
</table>

The bacteriological and biological characteristics are examined every two weeks in water samples taken by our customers. The results show that the drinking water in Szeged corresponds to the prescriptions of the governmental regulation and those of the National Health and Medical Officer Service.
- Szeged Water Company Inc. produces drinking water of Szeged and Algyő from 180-560 meter deep wells, which are based on protected water layers of 10000 year. The high quality drinking water of Szeged is produced from different layers of the water base. The quality of the drinking water is regulated by order in council and insurance of the quality is of high priority in the activity of Szeged Water Company.
- The physical and chemical parameters are controlled according to remarkably strict regulation in the accredited laboratory of Szeged Water Company, which holds a quality insurance certificate. Bacteriological analysis is carried out by the Diagnostical Institution of Clinical Microbiology at the University of Szeged. Water samples are taken from the waterdrinking system at 28 locations of the town, at the water towers and premises. The quality control is carried out by experts of the company every two weeks, which means more than one thousand sample taking and the execution of more than ten thousand examinations.
- The ÁNTSZ (National Health and Medical Officer Service) takes random sampling and controls the quality of the drinking water irrespectively of the regular control of the Environmental Department (laboratory).

Q: Normally, there are a minimum number of two water treatment plants for each big city in case of a natural disaster. Why don’t you have two at least?
A: It is a matter of money, and we do not have that much of it. Furthermore, to have a 100%’s backup is not common at all. Though, there is a possibility of building another biological part – a fourth one – if it is necessary.

Q: Do you imagine the possibility of co-fermentating foodstuff-related material in your biogas producing technology?
A: We are right in the middle of the permission process in order to be able to receive lactic acid and sewage sludge from the milk producing (dairy products) industry. Hopefully, we are getting the permits in a week, for the case belongs to two authorities. Moreover, we are about to fill in applications so that to receive even more foodstuff-related by-products. The plan of expanding and improvement of the biogas plant has already been finished, along with the station that will be ready to transmit the surplus electricity to the central grid. It costs 500 million HUF (1,78 million Euros), though subsidiary funds are accessible from the Environmental and Energetical Operative Program.

- One of the plants is heated by the warmth-retrieval of the drinking water (heat pumps), this can be carried out because the drinking water of Szeged is warm. This will be achieved at the other five plants as well this year. Furthermore, there is a strong wish to utilize this heat pumping technology at the main sewage pumps as well, since there is a constant runoff of waste water.
- Three heat-sources are important in the above mentioned technology: drinking water, sewage, and by-products.
The annual energy cost of the whole water treatment plant is 300 million HUF (more than 1 million Euros), therefore, alternative energy resources are of a great importance to the plant.

Q: Is the ISO 14000 qualification (owned by the company) widespread in Hungary?
A: In 1998, we were the first water treatment plant in Hungary to have the ISO 9001 qualification for the drinking water, then furthermore, for the rest of the company. After that, we absolved the ISO 14000 certification. Finally, this year we were audited for the ISO 22000 certification of quality, which is a standard and a certificate for safety of drinking water. It takes a lot of money and time to maintain these standards, thus we are beginning to be rather over-regulated sometimes.

Hódmezővásárhely – A.S.A. Hungary Ltd., Regional waste handling centre
Mr. Imre Reith, Managing Director

The company has been founded as a joint venture in 1994 by the Austrian company called A.S.A. and the local trustee. A.S.A. is the majority owner with 68%.

At that time in Hungary there was no act for waste treatment, so the centre took the Austrian standards. The basic objective was to create a landfill zone based on the – so called – Western European standards, because the “pit” near the city reached its full capacity.

These standards are valid up till now, where the EU standards are operating. Only three companies had these high standards in Hungary at that time (between 1993 and 1999): one in Debrecen, one in Hódmezővásárhely, and one near Budapest, when the total number of the landfill zones was 2700. According to the very strict rules, now, we have only 72, including the above mentioned three zones operated by A.S.A.

In 1995, the first act was introduced concerning waste materials. Since then, all the acts and laws – including EU ones – are followed and taken into consideration. The basic idea of the Austrian norm was to extract biogas. The biogas-extracting division was built in 2000, and we burnt all of it, thus lowering the greenhouse-effect causing gas concentration by 21%. From 2003, the amount of biogas extracted from waste reached an extent that we got our heating and warm water from it. In 2006, we extracted even more gas we could handle; therefore, we had to think about further utilization. We attained gas engines (generators), and started to produce electricity which we transmit to the national grid. We are going to see the engines later.

The European Union’s waste handling acts urge that as many waste as possible should be diverted from landfill. In 2004, we introduced the municipal/residential selective waste collection parallel to the commercial/industrial selective collection. Today, 4500 tons of useful
Material (plastic, paper, glass) are taken out of waste and reused this way.

- In 2009, a new act was implemented which directed that the amount of biodegradable waste should be reduced by 50%. Since then we compost this kind of sludge. Many other companies do the same in Hungary, but they don’t know what to do with the compost when it is ready. In May this year, we received permission that we can unlimitedly place our compost for agricultural usage.

- We have an entering weighing-, and an administrative system, so we record all the movements, quantities, and contents of waste that is coming in and going out of the centre according to EWC (European Waste Code). There is an other measuring machinery under construction these days, which will weigh the outbound traffic. The incoming traffic is directed to the assigned site depending on the type of waste they carry (green waste, sludge, recycling material).

- Regionalism is of great importance and a main objective as far as waste handling is concerned, this way it is more economic, and takes less human resource. This company became the regional centre for waste handling, treating waste of 210.000 people (4 surrounding towns). We have 1500 industrial partners.

- Security issues: we have a monitoring system that checks the groundwater’s quality four times a year. Fortunately, we had no problem with the quality and the authorities since 1995.

- The centre handles 80.000 tons of waste annually, 4500 tons of it is reusable, and 8000 tons are green material and sludge. We would like to have these figures even higher.

Q: Why would you like to increase the amount of green waste?
A: We wouldn’t like to, but it is mandatory. The above mentioned 50% reduction (and diversion) concerning biodegradable waste will be modified to 35% (of the 100%) by 2016.

Q: Is there a difference in the gate fees of the composting materials and the landfill materials?
A: Landfill fees are high, around 35 Euros per ton. Sludge costs around 17 Euros per ton, and there is no fee for green material.

Q: How much is the landfill tax in Hungary?
A: There is no tax yet, there are only fees at depositing. Though, in the future it is in plan to have a tax.

Q: Is the company a private one? Has the company A.S.A. been chosen by tender?
A: The company is operating privately. There were six companies in the first round, three companies remained in the second round, and finally A.S.A. took the first place. Every ten years there is a new tender for operating the landfill. The year of the next tender will be 2012.

Q: Are there plans to expand the landfill?
A: For the next 50 years, we have enough territory to operate on. There are a possible number of 15 sections/items to create, and we are at the third one. Therefore we are ready to take waste from Szeged as well as other cities like Arad (Oradea), though there is a landfill near Arad, too, operated by A.S.A.
It is not the optimal solution to take waste to landfill, the best way would be the energy recovery from waste \( \rightarrow \) incineration. Thus, the landfill volume could be decreased by 75%.

Q: When is it realistic to have an incineration here?
A: Within eight years if everything goes well, that is what we are working on.

Q: How many times do you face disasters like fire on the landfill?
A: We have annually two smaller fires if we take care, but when we don’t pay enough attention, we have one big fire like last year.

Q: If incineration becomes reality, how many megawatts will be able to be produced?
A: On the first place, this region’s waste is not enough for energy recovery (210,000 people). We should have 400,000–600,000 people’s waste to become economically effective.

On the other hand, at the planning procedure, we always have to exclude EU support. Incineration has to be handled as an investment with calculated revenue, where the investment’s costs have to be returned, and then the profit may be produced. This centre is famous of not applying for EU or governmental subsidies or funds, every investment is financed from bank loans.

Q: Does A.S.A. have any experience in operating an incineration?
A: Yes, they do. 60 kilometres North of Vienna there is an incineration.

Q: Is there enough political will to build an incinerator here?
A: Political will is inevitable. From both economical and environmental point of view, incineration is the only way. Politicians have to understand that. This year, one of the political parties has won a great authority in the Parliament, and the Mayor of Hódmezővásárhely is on the winning side.

Summing up, the political side is minimum 50% in this project.

Q: There are plans in Szeged and Békéscsaba for an incineration. What is your opinion, what are the chances of having one here in Hódmezővásárhely?
A: Those cities do the planning only to win money from the EU and the government. Their goal is to win all subsidies, not to solve the problem. In 1994, when we started to operate here, no one heard about environmental protection, waste management, or a vehicle park like ours – though we did it without any support or subsidy.

Q: What is your relationship like with other complex waste handling companies?
A: They don’t let me go inside of their territories. That is when I get onto a plane, and take pictures of their sites. On the other hand, I maintain a very good relationship with the more serious waste handling companies.

Q: There is a PCP Greenenergy project which is aimed at the introduction of a technology that processes waste plastics and transforms them into liquid fuel. They are planning to have 25 plants with two items each with a capacity of 1000 tons of plastic per item in a month (7 plants in this region).
A: Another good example of the only-for-money behaviour. The technology only works in a very pure environment with very pure
materials. I don’t find it economically beneficial and manageable.
Additionally, we don’t have that much plastic at all.
(Comment – Peter Benko) I think countries like Slovakia, Poland, Hungary etc. need standard solutions, not experimental methods, because they are very expensive, and not proven.

(At the composting site)
- The compost is layered in prisms, and the quality of it is always the same, that is why we received the special permission for agricultural use. The main part of the technology is a special mixing machine: when the temperature of the prisms reaches 70 degrees, it rotates/mixes the compost and it becomes homogeneous.
- It takes two and a half months for one line of the prism to be ready for use as a fertilizer. There is a screener machine which finalizes the process. It is even possible to use the final product as a soil for flowers, though some other materials need to be mixed with it. We have a sacking machine which packages the soil after measuring.

Q: Are there any economical reasons for composting and selling the product as a soil for vegetables and flowers?
A: I am famous of thinking in an economical way on a long run; of course, there is profit at the end of the process. There are two aspects of the case: on one hand, the sewage sludge comes in for 17 Euros per ton, it goes through the composting process, and at the end there is the final product (soil), which also has a price. This is an economic procedure, an investment, and the returning time of the investment is 6 and a half years according to my calculations. Basically, a market research has to precede all economical decisions and actions; in this case it took place last year in November – which was illegal, for I did it earlier than the rules allowed.

Q: How does the thickening and packaging business operate?
A: It is not our business, we do it in a lease-work. The industrial material belongs to us.

Q: Is it allowed to put the sludge directly to the fields?
A: No, it is not, though in some places they do it. There are serious penalties for this kind of activity, and it is very dangerous for the environment. The Inspectorate for Environment is growing up to the task, and starts to monitor these acts. It is impossible to compete with these renegade groups.

(At the landfill site)
Q: Does the generator (gas engine) operate with biogas only, or is there natural gas use as well?
A: It is economically worth using natural gas as well if there is a biogas shortage, because the warm water and the heating come from the heat of the generator. Thus it is remunerative to keep the engines working, and what is more, the electricity transmitted to the national grid pays off also.

Q: Where does the landfill’s residual- and rainwater go?
A: After the pollution is dissolved, it goes into a separate basin through a ditch and a pipe-system, so that it will not get onto the fields. So there is a separate basin for the rainwater, and another for the polluted water. The
water of the former pool is so clean that you may even find wild ducks in it.
Kecskemét – Pilze-Nagy Ltd., biogas factory
Webpage: http://www.pleurotus.hu/?chlang=en
Mrs. Adrienn Nagy, Managing Director

Presentation in the Chamber of Agriculture, Kecskemét:

- There are three running biogas projects in Kecskemét:
  - Pilze-Nagy Ltd. Agricultural biogas plant
  - Bácsvíz Zrt. Sewage sludge biogas reactor
  - Ener-G Zrt. Landfill gas

- The Pilze-Nagy Ltd. is in the business of oyster mushroom substrate production, growing and trade. It is a family run enterprise, which started its operation in the vicinity of Kecskemét in the beginning of the 1990s.

- The company is the country largest oyster mushroom producer and exporter. The company is also considered as one of Europe’s largest oyster mushroom plants based on plant size and annual revenues.

- Input material:
  - Agricultural residues: 3200 tons of spent substrate, 4000 tons of corn waste from canning industry
  - Other biomass: 3000 tons of pig manure

- Outputs:
  - Biogas production: 1 230 188 m³ per year
  - Total electrical energy: 2 580 MWh per year
  - Available thermal energy: 2 658 MWh per year
  - Digestate: 12 814 m³ per year

- Project budget: 350 M Ft (1.4 M Euro)
- 33% of the budget covered by subsidy (Hungarian Government and EU co-fund)
- Actual efficiency: 60%
- The waste material from the mushroom production is used by our fermentor; during this process, biogas is produced. The biogas is utilized by the gas engine, where heat and electricity is generated. The electrical energy is transmitted to the central grid. Part of the heat (10%) is used to heat up the fermentor, for 38 degrees have to be kept constantly. The rest of the heat is utilized in the mushroom production, in the mushroom-houses.
- Our digestate makes a good fertilizer for the agricultural fields.
- This integrated system of renewable energy has plenty of benefits on the environment, for instance:
  - the organic waste is recycled
  - less greenhouse-gas emission
  - thus, fertilization of the agricultural fields is solved
  - the positive extern-effects of the self-sustaining system

- The authorization process is very complicated in Hungary. In the first place, it is considered a biotechnological plant (since biotechnological process is going on in there); on the other hand, it is a power plant (because of the electricity produced); and finally, it is an agricultural plant for its agricultural role.
This led to eight different building permits, a Simplified License from Hungarian Energy Office to be able to supply electric energy to the grid (for obligatory electric energy acceptance), several different contracts, a Balance Circle contract (in order to receive feed-in tariff)

- The feed-in tariff is not differentiated according to waste utilization, heat usage, etc. The amount of the tariff is also the lowest in Hungary according to the EU data; thus, economically it is not really remunerative to build a biogas plant.
- The “biogas-knowledge” is still a young profession in Hungary, there are no professional experts on the field; therefore, experience is limited concerning the matter.

Q: Why did you choose this kind of alternative energy? Did you do a market research or make a feasibility study before?
A: Because we can use our organic waste material there; and since the energy cost increased in mushroom growing, we could save a lot; and additionally, we ended up on the energy-producing side, not only the energy-consuming side. Our feasibility study three years ago was inadequate due to the lack of the knowledge concerning this kind of energy use. It was a “pioneer-venture” then, and was almost impossible to position ourselves in an unknown environment. Today, we would be able to make a good study, but it is too late.

**At the biogas plant site:**

*Audio files: Biogas_plant1 - Biogas_plant6*

Q: How many tenderers were there to provide infrastructure for your biogas plant?
A: There were four offers. Two of them were not taken into consideration at all: one had a very high price, with almost the double price compared to the others; the other one did not give an exact price as far as the budget was concerned. Two offers kept standing, and we accepted the German EnviTec Biogas tender – with a Hungarian contractor.

Q: Was it the cheaper one?
A: No, the two offers were not really comparable. One of them came up with a 230 kW biogas engine, the EnviTec Biogas offered a 250 kW engine. Finally, the engine-size difference determined our choice.

- This is Hungary’s 6th agricultural biogas plant. We are the smallest one, though among the 20 plants that have been planned to be built in the future are of this size (farm size) – between 300 and 600 kWs.
- There is a tank for all the liquid material (pig manure, water coming from the mushroom production, etc.). The whole liquid material is carried through a pumping system underneath the ground. A separate building gives place for the engine, the operational room, and the workers. The last part of the building is where the mixing takes place before the material is pumped into the biogas plant.
- A separate pool/basin is for the daily storage of the mushroom substrate and all non-liquid materials. This is where the spent substrate and the low-quality mushroom go as well.

Q: Is this the solid material that goes into the digester?
A: Basically, this is how the solid material is fed to the mixer tank before it goes to the digester. There is a grinder/screw below the ground level.

Q: Is the proportion of the solid material important (the mixture)?
A: Yes, it is important. The solid content has to be less than 7% because of the pumping system. Therefore, the proportion of the solid material is constant through the pumping, the mixing, and the fermentor stages.

- There are separate storages for the silage, the corn waste from the canning industry, and the spent substrates from the mushroom production. Plastic is the by-product of mushroom production. There is a site where the plastic is separated from the spent substrate.

- The vehicle park consists of a fork-lift trailer.

- In the mixing part, the material is measured exactly, and then it is pumped into the fermentor. Measuring all the feed-in material is vitally important for the accurate registration, administration, and analysis of the input data.

- All the anaerobic fermentation occurs in one digester, which has a net volume of 2000m².

Q: Is there a cleaning system inside of the fermentor tank to clean the biogas; to remove sulphur, and CO₂ for instance?
A: We clean the sulphur in a biological way by pumping oxygen into the fermentor, so that the bacteria can do the cleaning.

Q: How long is the retention time (the time the material spends in the fermentor)?
A: The retention time is around 40 days.

Q: How much is the proportion of methane in the biogas?
A: The methane-concentrate is between 52 and 58% - depending upon the outside temperature (lower outside temperature results in higher methane-concentration inside the digester).

Q: Is there an optimal temperature where the maximum amount of methane is produced?
A: The biogas-yield is depending on the raw materials. More biogas is produced from silage than from spent substrate. However, since we have plenty of spent substrate from mushroom production with minimum costs of transportation, it is economically much more remunerative to use that (instead of buying silage) even if the biogas-yield is lower.

Q: Do you buy fermentation material from local farmers?
A: No. The climate around the city Kecskemé is not suitable for corn-growing so that to have silage. We have a contractor who grows raw material for us. They are a bit further from our location, but we need a certain amount of silage of standard quality every year.

Q: Why do you have to put silage into the mixture? Why is it a central component?
A: We need a certain C – N ratio, but that is only one point. The other point is the sugar content. The spent substrate contains more cellulose and micelle, the silage has more sugar, which is better for digestion. Therefore, it is better to make co-digestion rather than use only one component.

Q: Did you know what proportion of silage and substrate had to be used at the beginning, or did you have some experiments?
A: The proportion is not that important. We did it in a “farmer’s way” by putting one fork-lift of silage, and one fork-lift of substrate into the system, and it worked out well.

Q: Do you measure the methane-leakage?
A: Yes, we have to do that. There are sensors around the plant monitoring the methane, and the CO₂ level. The data is processed into the computer, and recorded accurately. Should any malfunction happen, we get a signal to our mobile phones.

Q: How often do you get alarm signals?
A: Never happened.

Q: How is the pressure of the biogas managed inside of the fermentor?
A: Everything is computerized. If the pressure rises in the digester between the liquid and the membrane, a pump begins to work to transmit the biogas out of the fermentor. When the pressure decreases, it stops.

Q: What happens if the engine is not working?
A: There is a burner that burns the surplus in this case. The burner automatically starts working even if there is so much biogas-surplus that the engine cannot work up.

Q: The mixture that goes in the digester is created on an hourly basis. But the retention time inside the fermentor is 40 days. How is that in harmony?
A: We feed 40 tons every day, and the digester’s volume is 2000 tons. On a 100% capacity we put 80 tons of raw materials per day. This is how we calculate according to the retention time.

- There are tanks for containing liquid digestate with an overall volume capacity of 6000 m³, which is enough for a 180 days’ storage (a half year). This storage time is optimal, because the application of the digestate on the fields is best before plantation. In Hungary, there are 2 plantation periods: in the spring, and in the late summer; thus we are able to store the digestate until it is needed for the farmers.

Q: Is it liquid inside the tanks? Is it sprayed on the fields?
A: Yes, it is liquid and applied by spraying.

Q: Is there any solid residue at all?
A: The digestate has two phases: the solid phase and the liquid phase. The liquid phase contains the more nitrogen; the solid is the organic material which is not digested inside the fermentor. The liquid part is good for the plants; the solid part is beneficial for the soil for giving it a good structure.

Q: How is the solid part extracted from the tank?
A: Before we feed the raw material into the tank, there is a chopping machine that cuts every solid material into very small particles. This is the part that is not digested yet, and may be called humus.

(At the gas engine; at the operating room)

Q: The methane-concentration is only 49% at the gas engine. Why is it so low?
A: It is because the outside temperature is so high.

- We are in a project that will – hopefully – allow us to use the heat of the engine in the mushroom growing, because now – in the wintertime – we have to heat the mushroom growing rooms traditionally. In the summer, we do not need the heat.
The computer system is constantly collecting information on the whole biogas and electricity generating procedure. The system allows us to analyse any process at any time, and tells us how effectively we do our job. If any technical problems occur, the computer shows us where to look for them.

Q: How often do you empty the digester?
A: It is a continuous digestion, the digester is never emptied.

Q: What is the estimated returning time of the investment?
A: Approximately 10 years.

Q: What kinds of bacteria are there at the digestion?
A: There are special mixtures of bacteria that are doing the digestion/fermentation. These are available at larger scales (for industrial use). Under laboratory circumstances, scientists are able to examine each steps of digestion and degradation process.

Budapest – Waste Incineration Plant (Waste-to-Energy Plant)
Ms. Ildikó Sőregi

- Director of the Plant is Mr. László Sámson.
- The plans for building the plant were made in 1976, and the plant opened in 1982. At that time the flue gas was cleaned with electro filter. The filter operated until 2002. Due to the new environmental rules, we had to build a new flue gas treating system. The upgrading lasted from 2002-2005.
- We have four boiler lines: two of them were being reconstructed, two of them were still working during these three years.
- The waste we receive is only municipal waste. Waste goes through a scaling system whenever a car arrives – as it is shown on the monitors on the wall. An average daily waste amount is between 1000 and 2000 tons from Monday to Friday.
- 25,000 people directly receive heating and warm water from us, and 116,000 people receive electricity. For this plant, heating, warm water, and electricity is also generated.
- Pollution is officially measured every month by a laboratory.
- The maximum capacity of the plant is 420,000 tons of waste per year. Before the reconstruction, it was only 350,000 tons/year. Last year, 410,000 tons of municipal waste were utilized.

Q: Where does the ash go?
A: It is separated (non-hazardous waste) through 5 steps, pulled down, and taken to landfill (Dunakeszi – 20 kms away) as a cover/layer. The flying ash are separated into 4 silos, and then taken to hazardous waste disposal sites. Hazardous waste is only 5%. More than 70% of the waste is utilized.

Q: Is it a public or a private company?
A: It is owned by the capital city’s municipality.

Q: How many people are working here?
A: 180 people are working right now. There are 4 shifts for non-stop operation (20 people in one shift). The whole company – not only the plant – has 3000 people working. This municipal company collects waste, takes
care of the roads, de-ices (salting) the roads in wintertime, does the painting of roads, etc.

Record of the study visit in Östergötland, 03-11-10 to 05-11-10

At the study visits in Östergötland the following practices were presented:

• Recycling centre in Malmen, Linköping
• Svensk Biogas, Linköping
• Scandinavian Biogas, Linköping
• Fiskeby Board, Norrköping
• The Municipality of Norrköping
• Returpack, Norrköping
• E.On, Norrköping
• Finspångs Tekniska Verk, Finspång

And this is the record of these visits:

The Recycling centre in Malmen

One of three recycling centres in Linköping, this particular centre is considered the most available site for the citizens, due to it’s proximity to the heart of the metropolitan. Roughly estimated, about 500 cars pass through here on a regular day, and even more on weekends. This estimation also applies to the two other centres, making it roughly 1500 cars per day. “It’s in the minds of the locals, to dispose of the old and recycle before you buy more”, Lennart says.

It’s of common knowledge that excess groceries gets incinerated, glass bottles gets sorted for recycling, aluminium cans get melted and re-used, but what about the rest of your household waste? The worn couch, the depleted batteries or the broken electrical apparatuses? That’s the purpose that the recycling centres fill. Open to the public six days / week, Lennart and the rest of the staff keeps the site accessible and clean while also providing help for the visitors.

They also co-operate with the Swedish second-hand company, called “Myrorna” (The Ants), allowing them to have certain containers to gather clothes and furniture that otherwise would have been destroyed.
Moving on with the tour, we learned that the management plan for depleted batteries stretches no further than storage while just about every component in a car battery is salvageable and fit for recycling. Thus, they are sorted in separate containers. Strip lights are also a good example of how thoroughly things must be sorted. One might think that they would end up in the same field as regular lamps but as they may contain mercury, they’re kept in a separate container. Electrical equipment is stored in a locked container to avoid thefts and the same routine is applied to dangerous chemical substances. The recycling centre is owned and run by Tekniska Verken, thus it also provides fuel for the combustion plant. This fuel consists of subjects such as unsalvageable furniture, fabric and tires. With tires being the least combustible material, it needs to be mixed with woodchips and paper reject, which also is collected at the recycling centres. When a container of combustible subjects is full, Lennart calls for a transport vehicle from the plant to pick it up. Lennart has played an important role getting all the recycling centres running and considers himself as an environmental ambassador for the region of Östergötland. He also tells us that he and the other workers inspire others by always trying collect things left behind, outside the area or on their way to work, to store and recycle it at their centre.

Q & A

Q: How big is the city?
A: 140 000 inhabitants.

Q: Do you charge people for this service?
A: As the inhabitants pay for their regular garbage disposal service, the service offered here is included.

Q: How do you make people aware of the charity service?
A: Whenever we see a trailer coming here, or something else that might contain furniture, we simply ask if they’d rather donate what they’re carrying to charity.

Svensk Biogas

Svensk Biogas is a part of the Tekniska Verken-group, thus also a municipal company. As they work with biogas production, they’re part of a greater, growing market and because of this they rely on profit while also maintaining their responsibilities as a municipal, infrastructure company.
Their chosen end for biogas production is refining it to the standards where it meets the quality of vehicle fuel. All the buses in Linköping, for instance, run on biogas distributed by Svensk Biogas. The company was founded 14 years ago and has been growing ever since, because of the constantly increasing demand for renewable fuel in this region. International co-operation plans are being developed too, to enable knowledge from this region to get exported on demand.

A legislative change spurred the business in this field, as it required carbon dioxide-emissions to be mapped and taxed. As a result, biogas was concluded to be the most efficient fuel regarding the carbon imprint. To be a suitable fuel, the biogas has to be refined to a level of 97% methane and the upgrade of the raw gas is pretty much the greatest expense in the process.

In Linköping, the waste-streams consist mainly of slaughterhouse and food industry residues, so co-operation with the private sector is a requirement. The city has great potential as lots of major food producers reside here, such as Cloetta and Scan. However with this potential comes competition, so experiments to utilize more streams of waste are currently being looked at and will be invested in next year. The industries represent 20 000 tons of waste every year and with today’s capacity and technology, just about as much gas can be recovered after digestion. Household waste is one of many areas looked in to for further development, but it won’t bring a dramatic change any time soon.

For other future projects, or potential streams, the company works closely with the University for researching. Products currently looked into (other than household waste) is algae, corn, sugar beets and residues from paper production in Norrköping. While some streams show potential, others have been discarded, such as the manure from cattle. The complex digestion of cattle makes them utilize too much of the energy contained in their food, which makes the manure hardly worth the effort of using and processing. As for goals, the production of biogas is meant to be doubled within three years.

**Q & A**

**Q: Do you still use petrol?**

A: Yes, our heavier vehicles require it. Their engines are harder, and very expensive, to change from petrol to biogas.

**Q: How’s the national spread of biogas?**

A: There’s much to be done there. But we conduct the idea of having adaptable vehicles, and more contracts for biogas keep our grids growing.

**Q: How do you transport the substrates?**

A: By special tank trucks that seals the substrates to avoid methane seeping out.

**Q: How do you remove the carbon from the gas?**
A: One method is to use chemicals to purify the gas, then treat (or “scrub”) the chemicals with water.

Q: Do you co-operate with other producing companies?

A: To a certain extent, the competition for substrates makes co-operations hard to maintain.

Q: Does this mean that biogas production is financially unstable?

A: We’ve had 14 years of red digits but this last year we will make a profit.

Q: Have you considered using pipelines for distribution?

A: It’s hard to invest in; there are experiments with it in Mjölby though. But that’s directed to the gas produced from the agriculture sector.

Q: What impact would utilization of household waste have?

A: It wouldn’t be a dramatic change, but it’s a good opportunity nonetheless.

Scandinavian Biogas

Scandinavian Biogas was founded back in 2005 to further develop the potential of biogas, with both the national and an international market locked in sight. With Sweden having more than 50 years of experience in this field and 250 plants producing 147 million Nm³ (1.3 TWh) of biogas annually, Scandinavian Biogas grew to become one of the leading producers of biogas from waste water sludge and industrial waste.

Like Svensk Biogas, they work towards using biogas as vehicle fuel. Their headquarters is located in Stockholm, but here in Linköping they got a research and development department. This department work to find new mixtures of substrates for co-digestion and conducts tests with additives to improve the gas’ quality. The techniques are verified in both the laboratory and the pilot plant in Norrköping before they’re put into industry-scale production.

Following the incentive from the Swedish government twenty years ago, biogas was declared to be the most viable renewable fuel due to it’s’ efficiency and minor carbon imprint. While the common idea of biogas as a fuel is the compressed gas, Scandinavian Biogas also promotes the idea of liquid biogas. Their arguments are that liquid biogas is easier to transport over long distances, cheaper to distribute, less costly to produce as it’s easier to compress and as more diesel hybrid vehicles are produced, liquid biogas is a perfect fit as primary fuel.

Scandinavian Biogas, unlike other private producers, does not simply sell their technology and equipment (fire and forget). They’ve developed a model called “Build-own-operate”, where they get full control of production and research, based on the conditions of the client. So rather than selling a standardized concept, they offer a tailor made, long-term production plan.
As an example of how Scandinavian Biogas works, they won the bidding on being the biogas supplier for the public transportation authority in Uppland, Sweden. Run by the county council and the eight municipalities, they conduct 240 regional busses that currently consume 11 000 000 litres of diesel annually. However, they’ve set two environmental goals: to be 40% fossil free by 2012 and 90% by 2020. They chose biogas to reduce their environmental impact and to liberate them from the diesel dependency, but also because the price trend displayed for biogas has been a lot more stable compared to oil. Scandinavian Biogas is going to run the production at local wastewater treatment plants and because liquid biogas is the chosen fuel for it’s’ flexibility, methane from landfills in the region also get utilized. Other substrates are industrial waste, crops and the usually un-desirable, household waste.

Q & A

Q: Is organic waste crucial for biogas production?
A: It’s a matter of economy and production goals.

Q: Why is household waste worse than any other waste stream?
A: It’s hard to get people to sort properly and with pre-treatment representing 20-30% of production investments, it doesn’t go along well with optimized production.

Q: Are there any good examples in Sweden with plants using household waste?
A: The plant in Borås, but it’s a huge investment and requires a lot of manual pre-sorting.

Q: Should household waste get sorted for composting then?
A: No, biogas is much more worth it, but it will require a lot of research and a change of attitudes.

Q: Some municipalities, like Stockholm, allows household waste to be sorted through the sewer system?
A: Yes, we conducted that idea. But it required lots of discussion and pressure from our side.

Q: In project Uppland, will you be running the pumping stations as well?
A: In this particular project, yes. It was a requirement to acquire the contract.

Fiskeby Board
Fiskeby Board in Norrköping manufactures cardboard boxes for food producers, mainly targeting frozen food. It might seem like there’s nothing out of the ordinary, but they do so with 100% recycled fibre. While this kind of environmental production is often seen with municipal companies, Fiskeby is a private company with clients all over Europe. They export roughly 80% of their total 160,000 tons of production per year, with an estimate turnover of 900M SEK. Their product is called WLC (or white lined chipboard) and is gained from recycling paper, provided by both companies and households.

Their environmental agenda stretches further than recycling, as they’ve used various goals throughout the years. To begin with, they strived to increase their production while decreasing their energy consumption. To decrease the energy and fuel consumption would not only mean decreasing their environmental imprint, but also greatly reducing two of their biggest expenses – steam production and energy from an external source. This is a massive task to execute while you’re also competing with the other European WLC-producers. In before approaching the solution, a short description on how the production works would be in order:

Paper and cardboard is brought to Fiskeby and gets shipped on conveyor belt to a drum where plastic gets sorted away. The mix gets soaked with water to create various kinds of pulp that is formed into the final product, WLC. A boiler heats water to create steam and the steam gets put to use in the mill to extract the water from the pulp, making it reach the right moisture content before it’s rolled onto an iron cylinder.

To address the issue of using boilers running on fossil fuel, they switched to a waste combustion boiler instead and started using industrial waste (65%) and their own paper reject (35%) instead. Thus, they get paid to handle the industrial waste and re-use it as fuel. Eventually, they installed a steam turbine as well, which led to a 30% reduction in terms of their external energy usage. A portion of the steam is also used as local heating for the site.

They are now aiming to decrease their external energy consumption by an additional 10%, as well as to become the most profitable WLC-mill in Europe.

Q & A

Q: Do you get paid for handling the industrial waste?

A: Yes, a little bit, but the incineration requires some investing to get the right mixture.

Q: How do you get rid of the water in the waste or your own rejects?

A: We don’t need to get rid of it, but it’s of course important to make sure that there isn’t too much of it as it would reduce our steam production. It’s not good for the supplier either, as the water adds weight to the waste and it’s the weight that sets the price on the waste handling.

Q: Do you have a waste acceptance criterion to keep the composition of industrial waste consistent?

A: That has been a hard work to develop. At first we said that it should be one third of wood, one third of plastic and one third of paper. It didn’t work out very well, so we constantly try to
work with the suppliers to improve the mixtures. At this point, we don’t have a good way of controlling the waste we get, but we’ll get there.

Q: Wouldn’t it be better to only use your own waste?

A: No, it’s necessary to use other streams of waste to get the right mixture for combustion.

The Municipality of Norrköping

The Technical Service Department of the Municipality works with the co-ordination of public transportation, planning central parks and waste management in Norrköping. The target area of this introduction will be the waste management and a project to collect household and industrial waste viable for biogas production.

It’s been a tradition in Norrköping to sort the organic waste for composting, starting primarily in the rural area. Legislative tools have been used over the years, to shape the general attitude into sorting organic waste. Since 2007 this sorting has been optional but statistics display that 62% of the residents still sort their organic waste for composting, 10% of them using a home composting system. There are certain bio-bins, coupled with bio-bags obtainable at local recycling stations, as well as there a regular garbage bin for combustion. Currently, the 130 000 inhabitants produce 4500 tons of organic waste annually.

The Municipality has adopted a waste management plan that requires 75% of all business and industrial operators to sort their organic waste by 2012. This percentage also applies to households and to spur more people to separate organic waste, waste collection fees are higher for those who chose not to. The plan also requires all vehicles assigned to collect organic waste to run on renewable fuel by 2013 and for all biologically treated substrates to meet a certified, national standard. The last goal with this plan is to reduce the organic waste used for combustion to no more than 15%, the current number being 30%, by 2012.

The political incentives to undergo these changes are the plans to build a biogas plant at a municipal landfill. The biogas plant will produce the fuel for municipal vehicles and the bio-fertilizer as a by-product will be returned to the agriculture sector. With the existing attitude among residents to sort organic waste, the substrates from households can prove to be a viable stream. The methane from the landfill and waste from the agriculture sector are expected to be the main streams of substrates. Furthermore, restaurants are required to use certain devices to separate grease from wastewater for re-collection. The construction of the new biogas plant is expected to begin during 2011.

Q & A

Q: Who is responsible for equipping restaurants with grease traps?
Q: Are there any penalties for companies who don’t use this system?
A: The grease traps aren’t optional, by law.

Q: How will you control the quality of the fertilizer?
A: Both by improving and controlling the waste streams with public information campaigns as well as using thorough chemical analyzing.

Q: Will you only be using waste?
A: Yes, we have no interest in using crops for the biogas production.

Q: Is the landfill still used?
A: Yes, but it produces gas with a 58% value of methane. To meet the quality of vehicle fuel, refining is required.

Q: What’s the political background to this project?
A: In Norrköping, the political interest in developing waste management plans is a tradition. We want to re-purpose the organic waste from households and to reduce the costs of the transports.

Q: The current 4500 tons of organic waste, what is it used for?
A: It’s used for composting.

Q: Is the municipality going to own and operate the biogas plant?
A: Yes, according to our calculations it would decrease the costs and give us greater control of the production.

Q: Will you build pump stations or grids?
A: We won’t be using regular pump stations and the private sector has grids.

Q: Are there any successful Swedish examples of extensively sorting organic waste?
A: Yes, about half of the Swedish municipalities are doing it.

Q: What are the estimated costs for the plant?
A: About 140 to 150 million SEK.
Q: Will this project get in conflict with the local company E.On?

A: Biogas is only a small concern of theirs and their substrate is residues from ethanol production.

Returpack

Returpack is a deposit company that manages the recycling of all aluminium cans and PET bottles sold in Sweden. In 1982 the Swedish government identified the need for a deposit system for aluminium cans containing beverages and two years later, in 1984, Returpack was founded and in 1994 PET bottles were introduced to the same deposit system. Since 2003, both the production plant and the company headquarters reside in Norrköping.

The task at hand was vast: to make recycling a nationwide mentality. To achieve this, cooperation with every manufacturer and retailer was necessary, of course, but in the end it’s the customer that has to recycle the bottle/can. One way to inspire people is, of course, the actual deposit system, meaning to pay an additional fee for your beverage and get the deposit fee back once you hand the empty container in for recycling. But the system had to be convenient and available as well, to reduce the risk of consumers ignoring the recycling because it’s easier to choose not to. To address this issue, the use of so called “reverse vending machines” is utilized. These RVM’s can be found in food stores throughout the entire country.

Once a customer puts a can or a bottle in an RVM, the RVM compresses the product and places it in a container. The contents of the container get transported to the production plant in Norrköping for further sorting and further compression. The products get compressed into bales and get re-sold to packaging companies. The PET-company is wall-to-wall with Returpack and is called Cleanaway PET.

With our constantly increasing consumption, there’s a need for a more efficient way of transporting compressed containers from stores to the production plant. One solution to this issue is to allow the vehicles to further compress the bottles and cans, to allow more recycled material get transported in one route.

The shareholder majority lies within the breweries (50%), while grocer federations and the food retail federation hold 25% each. That being said, everyone is involved in the chain of consumption, manufacturing and recycling strive to improve the system. The numbers as of today tells us that 90% of all aluminium cans and PET bottles containing more than one litre get recycled, while only 70% of PET bottles containing less than one litre get recycled. This year and 2011, huge investments and efforts are made to improve the return rates. Like giving people the opportunity to donate their deposit fees to charity, or placing RVM’s at airports and train stations as well as raising Returpack bins at central locations to remind people not to dispose of recyclable containers in regular trash bins. The number of cities willing to participate in these projects has increased rapidly and we’ll see more campaigns in 2011.

Q & A

Q: Are there two barcodes on beverage containers?
A: No, there’s only one, but it serves two purposes. There is a sign on every beverage container verifying that it’s a part of the Swedish deposit system.

Q: How many times can products be recycled?

A: Aluminium cans can be recycled an infinite amount of times, but plastic requires further production as only 40% of the recycled PET material can be used for new bottles.

Q: Do you have a monopoly?

A: No, we’re open for competition. But with the extensive system we’ve built over the years we’re favoured among our customers.

Q: Are you a private company?

A: Yes, we’re owned by stores and breweries.

Q: What’s your approach on foreign bottles and cans?

A: They get recycled regardless, but as they’re not in the Swedish system, no deposit gets paid back to the customer.

Q: Is international competition an issue then?

A: We haven’t felt any competition. Just like foreign beverage containers get recycled in Sweden, a lot of Swedish containers leave Sweden too.

E.On Norrköping

E.On is an international heat, steam, electricity and district cooling producer. They’re biggest power producing company in the world. E.On has set a goal, extending internationally, to reduce their carbon emissions by 50% by 2030. The CHP plant in Norrköping, however, runs almost exclusively on renewable fuel, as the Swedish carbon tax legislations in 1991 required the business to develop new ways of producing heat and electricity. In addition, E.On Norrköping controls a small cooling grid and has one big steam-customer.

The steam-customer is a group called Lantmännen. The purpose is to use the steam for their ethanol production, which leaves a by-product fit for E.On’s biogas production. Although the biogas production only represents a fraction of E.On Håndelö’s business, it’s a good example of how loose ends can become cycles that benefits both business and nature.

E.On is in charge of handling the municipal waste in Norrköping but, as companies dealing with waste incineration tend to discover, more waste is needed. Due to the plant’s proximity to the industrial area, they’re also entitled to waste streams from the private sector, and the adjacency to the harbour enables smooth importation of waste from other countries. Woodchips and other residues from forest production abroad are also imported for bio-
combustion. Once the waste is brought to the plant, it gets shredded twice to improve the combustion process. The former pre-treatment included a stage where the waste was compressed with hammers before shredding, but the hammers were replaced with another shredder as they continuously broke or malfunctioned.

The CHP plant has five separate boilers, customized for different kinds of fuels and co-combustion. Like the incineration plant in Linköping, the E.On Händelö plant incinerates waste and utilizes the heat produced as district heating. Eventually the condensed water returns to the plant and gets used as cooling, which saves the company from the expense of having cooling towers. It’s of common knowledge that pressure from the steam is utilized by passing through turbines to create electricity, but there are ways to further develop these techniques. For example, E.On Händelö will build a new boiler in 2011 using hot, fluidized sand. This technique allows the incineration process to be more even and for more energy to be gained from the bio-fuel.

**Q & A**

**Q:** Will the new boiler be optimized for energy production?

*A:* Yes, a high pressure chamber allows the turbine to work more efficiently.

**Q:** What waste do you receive?

*A:* Everything, basically, but the new waste separation policy in Norrköping will reduce the amounts of organic waste.

**Q:** Are woodchips produced specifically as an incinerator fuel?

*A:* No, sawmills simply doesn’t want it because of its’ low production value.

**Q:** Are there any coal mines in Sweden?

*A:* Not many and they’re used for ceramic production these days.

**Q:** Do you buy the waste?

*A:* Not here, we’re paid to handle the municipal waste. We do import waste as a supplement though.

**Q:** What’s the gate fee for the municipal waste?

*A:* Around here it’s 30 euro per ton.

**Q:** Do you co-operate with the industries for their production heat as well?

*A:* No, pipelines and new grids are too expensive considering how low the profit from heat is.

**Q:** How do you handle emissions from tire incineration?
A: Our effective flue gas cleaning system removes the hazardous particles.

Q: To what extent are you monitoring your emissions?

A: We monitor it all the time and make reports quarterly to the agencies.

Q: How’s the situation with fly ash?

A: It’s considered to be hazardous waste in Sweden unless it’s from forest fuel.

Q: Are you monitoring wood emissions too?

A: Yes, but the regulations aren’t as strict with wood emissions as they are with other kinds of fuel.

Finspångs Tekniska Verk

The region of Finspång in Östergötland has 22,000 inhabitants and the municipality runs a profit company called Finspångs Tekniska Verk. Finspångs Tekniska Verk manages waste collecting, fresh water supplying, sanitary systems and energy production in the region. They also run a heat combustion plant, which was our last visit the 4th of November.

While there are examples of big CHP plants in Östergötland, the plant in Finspång only supplies heat as the power is provided through water plants. The grid infrastructure used is the same as back in the 70’s when fossil fuel was used in district boilers around Finspång. These boilers are nowadays kept as back-up in times when the waste incineration plant can’t create a sufficient amount of heat. However alarming that might sound, only 5% of the fuel incinerated annually is of fossil origin.

At the plant, there are two fossil boilers, one waste boiler and one bio-fuel boiler for woodchips. The plant itself is of the smaller kind, having 9 employees to operate it, with a waste storage capacity of 1500 m³. The heat production is however ceaseless and runs every hour of every day. Finspångs Tekniska Verk is paid to handle the municipal waste in Finspång and faces very little competition considering how lucrative waste has become as a potential fuel. This plant, not unlike others, needs additional waste streams to maintain their heat production and to accumulate more waste a contract has been signed with Tekniska Verken in Linköping, to regulate the additional amount of waste needed.

Finspång is a smaller region, in regard of inhabitants, than the neighbouring regions of Norrköping or Linköping. Thus, having a small-scale production plant is the ideal solution to meet the regional needs, but they’re facing some difficulties. For instance, heat isn’t a very lucrative business but since electricity can be gained from installing steam turbines, there’s another potential profit. The plant’s design, however, doesn’t include pressure chambers or turbines, so gaining electricity from the heat production would require investments. These investments have continuously been stalled due to unstable tax situations and without pressure chambers; the steam turbines wouldn’t produce energy efficiently. Whether they’ll upgrade the plant or not, this combustion plant remains a good example of how well waste-to-energy plans can be applied to smaller regions.
Q & A

Q: Do you expect the amounts of waste to lower?
A: No, it seems stable.

Q: Are you guaranteed the waste from Finspång?
A: There are no guarantees, but we’re the closest plant which makes us preferred.

Q: Do you compare yourselves to the CHP plant in Norrköping?
A: There is, of course, some comparison. But there’s also a lot of secrecy, regarding contracts and digits.

Q: Do you run 24 hours / day?
A: Yes, within the fields of heat and energy. We’ve divided the day into three shifts among our employees.

Q: Do you have any plans of expanding?
A: We’re planning a heat-recovery project from one of the industrial areas. Their emissions reach 700 degrees, from which we expect to produce 6-10 MWh for the district heating. This would reduce our use of fossil boilers further.

The four selected good practices:

Four practices were selected as particularly good:

Cockermouth Eco School

Biogas plant PILZE

Finspångs Tekniska Verk

Fiskeby Board

Cockermouth Eco School

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<thead>
<tr>
<th>Title of the practice</th>
<th>Engagement with Cockermouth Eco-school</th>
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<tr>
<td>Topic of the practice</td>
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Waste awareness, education and sustainable resource management

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<tr>
<th>Location of the practice</th>
<th>Country</th>
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<td>UK</td>
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<tr>
<td>NUTS 1</td>
<td>NORTH WEST</td>
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<td>NUTS 2</td>
<td>Cumbria</td>
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**Detailed description of the practice**

The Education Team at Cumbria County Council Waste Management have engaged with and supported Cockermouth school over a number of years, to encourage good practice of sustainability, utilise the school students to take the message home so as to stimulate better domestic practice, and use the school's network of local schools to spread good practice. The principal stakeholders are: the County Council, which focuses on reducing waste arising from schools and households so as to reduce its expenditure on waste disposal; the school (and other schools in its hinterland) which benefit from reduced costs of waste disposal as well as more informed students via the curriculum; and the Cumbrian public, which will benefit from reduced council expenditure on waste and the concomitant reduction of Carbon Dioxide production. The school was helped on its journey to gain Eco-Schools Award Green Flag status by regular educational input and advice on waste minimisation practices. Liaison with local district councils produced a better recycling service for the school, and the Education Team also supported the school, helping it to hold a series of Eco-days at which surrounding schools were given exemplars of good practice, and were encouraged to take steps themselves to become more sustainable. The school has hosted a number of seminars for external projects including hosting a visit from European delegates involved in the Interreg IVC Waste to Energy project who were able to discuss how the learning about waste management has changed the students behaviour and the management of the school.

**Evidence of success**

Cockermouth School has retained its Green Flag status for the international Eco Schools programme following successful inspection. It has become a beacon of good practice, attracting visitors from other Local Education Authorities who wish to see exemplars of good practice. As a result of practical audits and other activities in the school by our officers, students have had access to real-world data on the impact of their own activities to use in their learning, rather than having to use hypothetical examples. They have seen how much waste they actually produce, and have been able to suggest practical and feasible ways of reducing this. As a result of pupil engagement, the school has taken practical steps to reduce its waste.

**Contact details to obtain further information on the practice**
Biogas plant PILZE

<table>
<thead>
<tr>
<th>Title of the practice</th>
<th>Agricultural biogas plant of Pilze-Nagy Ltd.</th>
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<tbody>
<tr>
<td>Topic of the practice</td>
<td>Pilze-Nagy Ltd. is the largest oyster mushroom producer and exporter in Hungary. The company operates on renewable energy. The spent substrate is put into their own biogas plant, and the produced thermal energy is applied at mushroom production, the electrical energy is fed-in to the national electrical network.</td>
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<tr>
<td>Location of the practice</td>
<td>Country: HU; City: Kecskemét</td>
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<tr>
<td>Detailed description of the practice</td>
<td>The Pilze-Nagy Ltd. is in the business of the production and trade of oyster mushroom from the beginning of 1990s. The increase in the energy cost, and in the amount of spent mushroom substrate caused an increased problem for the company. To meet the financial and environmental challenges, during the project development the company has established a biogas power plant with 330 kW electric and 400 kW thermal capacity biogas-engine utilizing agricultural residues. 3200 tons of spent substrate, 4000 tons of corn waste from canning industry and 3000 tons of pig manure are converted to biogas in the plant a year. The outputs are: 1.23 million m3 biogas production, 2 580 MWh total electrical energy, 2 658 MWh available thermal energy a year. The cost of the project was 1.4 M Euros.</td>
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</table>
Evidence of success

With this development (i.e., with building the biogas plant), the company solved the problem of spent substrate management, while the energetical aspects of the mushroom production became more economic. The biomass needed to biogas production is from nearby companies (spent substrate is their own waste, pig manure and corn waste is from other companies not far from the biogas plant), so there is no problem with the transportation. That kind of waste management is environmentally friendly and economical, the produced "green" electricity is sold to the national electricity supplier, the utilization of thermal energy increases the thrifty management of the main activity. The digestate coming out from the biogas plant is good fertilizer in agriculture, instead of applying chemical manure. The environmentally friendly technology is the base of the sustainable development. The main activity of Pilze-Nagy Ltd. operating in the Kecskemêt region for 20 years is the production of oyster mushroom and the substrate necessary for the mushroom production. The company produces substrate in an annual quantity of 12.000 tons, and provides fresh oyster mushroom for sale in an annual quantity of 1.000.000 kg, with which it gives the 50% share of the domestic production. The sales revenue was HUF 850 million in 2009. Upon its plant size, the Pilze-Nagy Ltd. is ranked within the 10 largest oyster mushroom plants in Europe. The Pilze-Nagy Ltd. needs 4.000 - 5.000 tons of wheat straw, 8.400 m3 of water, 500.000 kWh of electric energy, 4.000 tons of coal, 5.000 kg of PB gas, and 17.000 Nm3 of natural gas annually for its production. The energy costs achieve the 12% of the production costs. Significant quantity of organic waste remains after the oyster mushroom production annually: 3.000 tons of used mushroom substrate, 150 tons of mushroom stripes, and packaging waste of mushroom parts. The Pilze-Nagy Ltd. agricultural biogas plant with gas engine of 330 kW electric power capacity started its operation in October of 2008. The plant has a potential to process agricultural organic waste material in a quantity of maximum 10.000 tons annually, a part of which supplied by the mushroom production. The produced biogas is the basis of generating electricity (2.400.000 kWh annually) and heat energy (3.100.000 kWh annually) in the CHP plant. The produced electricity is supplied to the national grid upon the green electricity take-over system. The heat quantity remaining over the biogas plant needs is not jet utilised. The biogas plant is in continuous operation throughout the year. The quantity of digested material remaining after fermentation is 12.774 m3 annually. Currently the total quantity is used on agriculturally cultivated fields as soil conditioner. By establishing the biogas plant, the entire problem of the organic waste of oyster mushroom growing has been eliminated, the company turned to be decentralised renewable energy producer. Further advantage of the development is that a multiple utilisation of an agricultural by-product – the wheat straw – is realised in the mushroom production and energy generation complex system, and at the end of the process the final digested material is given back to the soil as a fertilizer. The proposed payback period of our biogas project was 11 years, the subsidy has reduced it to 7 years. But because of the immaturity of the Hungarian biogas professional, economical and regulation background, our project went through more problems in the starting period than it was expected. Recently our calculation is that the payback period is not less than 15 years.

Contact details to obtain further information on the practice

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<tr>
<th>Name</th>
<th>Adrienn, Somosné Nagy</th>
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<tr>
<td>Organisation</td>
<td>Pilze-Nagy Ltd.</td>
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Finspångs Tekniska Verk

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<tr>
<th>Title of the practice</th>
<th>Finspångs Tekniska Verk - Small scale waste incineration heat plant</th>
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<tbody>
<tr>
<td>Topic of the practice</td>
<td>Waste management, district heating, energy recovery</td>
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</table>
| Location of the practice | Country: SE  
City: Finspång |

Detailed description of the practice

The region of Finspång in Östergötland has 22,000 inhabitants and the municipality runs a profit company called Finspångs Tekniska Verk. Finspångs Tekniska Verk manages waste collecting, fresh water supplying, sanitary systems and energy production in the region. They also run a heat combustion plant. While there are examples of big CHP plants in Östergötland such as Linköpings Tekniska Verk, the plant in Finspång only supplies heat as electricity is provided through water plants. The plant itself is of the smaller kind, with a waste storage capacity of 1500 m³. The heat production runs every hour of every day. The plant burns 20,000-25,000 tons of waste every year, which produces 60gWh annually. Finspångs Tekniska Verk has 700 residential and 200 rental properties as their customers.
### Evidence of success

Finspångs Tekniska Verk is paid to handle the municipal waste in Finspång. 100% of the household waste in Finspång municipality is used for district heating. The district heating is provided at a market competitive prices compared to other heating sources. and also The price of district heating provided by Finspåns tekniska verk in 2011 was 825 kr Mwh ca (88€ for Mwh) and the average for the whole country for the same period was 770 kr/MWh ca (82€/MWh). This proves that even small sized waste incineration plants can produce marketable district heating from renewable sources.

### Contact details to obtain further information on the practice

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<th>Name</th>
<th>Ranko Simic</th>
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<td>Organisation</td>
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<td>E-mail</td>
<td><a href="mailto:ranko.simic@lansstyrelsen.se">ranko.simic@lansstyrelsen.se</a></td>
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### Fiskeby Board

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<th>Title of the practice</th>
<th>Fiskeby Board - industrial energy recovery from paper reject</th>
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<tr>
<td>Topic of the practice</td>
<td>Renewable energy, energy recovery.</td>
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</table>
| Location of the practice | Country: SE  
City: Norrköping |
| Detailed description of the practice | Fiskeby Board in Norrköping manufactures cardboard boxes for food producers, mainly targeting |
frozen food. The cardboard boxes is produced from 100% recycled fibre. The companys product is called WLC (white lined chipboard) and is gained from recycled paper, provided by both companies and households. They export roughly 80% of their total 160 000 tons of production, with an estimate turnover of 900M SEK. The companys enviromental agenda stretches further than recycling. To begin with they strived to increase their production while decreasing their enviromental consumption. To decrease the energy and fuel consumption would not only mean decreasing their enviromental imprint, but also greatly reducing two of their biggest expenses steam production and energy from an external source. This is a massive task to execute while your also competing with the other European WLC-producers.

To address the issue of boilers, Fiskeby switched to a combustion boiler instead and started using industrial waste (65%) and their own paper reject (35%) instead. Thus they get paid to handle the industrial waste and re-use it as fuel. Eventually they installed a stream turbine as well, which led to 30% reduction in terms of their external energy usage.

Evidence of success

The company was in a dire economic situation before this practice was introduced, the high energy costs were a huge burden for the company. Now they are able to: 1. handle their own waste and 2. use it for energy production for their industrial process. They produce 5 MW of electricity and 53,6 tons/h of steam. They cover 40 % of their electricity needs and 100% of their steam needs. They handle around 80 000 tons of waste per year and 75 % of their energy is from renewable sources. The payoff for this investment was 6 years. The company is nowadays one of the leading cardboard manufacturers in Europe.

Contact details to obtain further information on the practice

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