

P.b.b. 02Z030115 M, WEKA Industrie Medien GmbH, Dresdner Straße 45, 1200 Wien, Retouren an Postfach 100, 1350 Wien

Official Publication of:
ISWA
International Solid Waste Association



WASTE MANAGEMENT WORLD®

Euro 12,-

NOVEMBER-DECEMBER 2017

Special Edition WASTE TO ENERGY

TURKISH DELIGHT

Europe's largest waste to energy plant to be built in Istanbul




Cutting Down

Two-tier food waste prevention
Page 8

Going Live!

Real-time emission monitoring
Page 28



Many existing waste-to-energy facilities replacing existing capacity considerably improve their energy efficiency and environmental profile. Norfors north of Copenhagen, Denmark is an outstanding example. The new unit 5 is replacing three existing units, which has led to an increase by 30 per cent of the energy efficiency and a reduction of emissions to one third of the limit values. Ramboll was the owner's engineer during the planning and implementation of unit 5. We assisted Norfors in establishing the new unit on a constrained site, ensured integration and maintained operation of the existing facility throughout the process.

REPLACING EXISTING CAPACITY (AND REACHING NEW STANDARDS)

See how we take Norfors from old to new at www.ramboll.com/Norfors

RAMBOLL

RAMBOLL HAS WORKED ON WASTE-TO-ENERGY PROJECTS IN 45 COUNTRIES AROUND THE WORLD, PROVIDING CONSULTING SERVICES FOR 155 NEW UNITS AND RETROFITS.

2017

THE GOOD, THE BAD & THE UGLY

A year of technical marvels and human tragedy for the waste industry



Ben Messenger Chief Editor

“FOR THOSE OF US IN EUROPE, IT’S NOT A PROBLEM CONFINED TO THE FAR FLUNG LANDS OF ASIA AND AFRICA. WE TOO WE STILL HAVE MOUNTAINS OF RUBBISH.”

As 2017 draws to a close, it seems a good time to reflect on the progress achieved this year. While 2016 may have been a year of political shocks, first the Brexit result and then the US election, this year has been somewhat dull, filled merely with recriminations, fake news and allegations of corruption.

But behind the scenes, away from the political spotlight, things have been happening and progress made. In the waste industry we’ve seen real innovation in both infrastructure and technology and in many places, some progress on policies.

We’ve seen advances in automation, sensors, electronic communications, energy recovery, bioplastics, enzymes, and much much more. Unfortunately, we’ve also had some tragic reminders of the very real risks poor waste management presents to the environment and human life.

In March a massive collapse at a dumpsite in Addis Ababa killed dozens of waste pickers. In September a collapse at the notorious Ghazipur landfill in Delhi took yet more lives. The site was due to close in 2002, yet still receives around a quarter of the city’s waste. At 50 metres tall it’s a monolithic landmark and a striking visual reminder of why waste management matters.

Aside from the impact sites like these have on human health, they take a serious toll on the environment too. And for those of us in Europe, it’s not a problem confined to the far flung lands in Asia and Africa. We too still have mountains of rubbish discharging leachate into the ground and rivers and methane into the atmosphere.

On page 32 we take a look at how SUEZ plans to clean up a huge polluting landfill in Belgrade, replacing it with a modern waste to energy plant, a C&D recycling facility and a sanitary landfill. With many millions of tonnes of waste having been dumped there since the 70s it’s a huge task, and an important one.

In Istanbul too efforts are being made to reduce the enormous quantities of waste being landfilled. On page 16 we find out more about a waste to energy project about to break ground in the ancient city. Being developed on behalf of the municipality by Hitachi Zosen Inova, at 1 million tonnes per year it will be Europe’s largest.

Elsewhere in the issue, on page 20 we look at plans to fly BA flights with fuel made from municipal waste using technology developed by Velocys. Meanwhile, on page 28 Johann Fellner, Chair of ISWA’s Task Force on Science, explains how waste to energy emissions can be monitored in real time producing data which even differentiates between renewable and fossil based CO₂.

On page 8 Dr Ramy Salemdeeb and Dr Adam Read explore the possibility of implementing a two-tier approach to food waste reduction, in which developed countries help developing countries with benefits for all.

Ben Messenger, Chief Editor

CONTENTS



Cover Story ISTANBUL GOES BIG ON WASTE TO ENERGY

Istanbul, the only city in the world to sit on two continents, is to build Europe's largest waste to energy facility with HZI as a turnkey partner.

Page 16



Take off for Velocys

Following the aborted Green Sky project, BA is once again teaming up with industry partners to get waste-based aviation fuel off the ground.

Page 20



Going Live!

Real-time emission monitoring for waste to energy plants with a capability to differentiate between fossil and biogenic emissions.

Page 28

GUEST AUTHORS



“In order to achieve our target, the introduction of a two-tier prevention target system that aims to tackle the issue of food waste locally is proposed.”

Dr Ramy Salemedeb, consultant
Ricardo E&E
Page 8



“The value of accurate real-time data on fossil and biogenic CO₂ emissions can be worth hundreds of thousands per year.”

Johann Fellner, chair of ISWA Task
Force on Science
Page 28



“The testing program has confirmed that all the commonly used, rechargeable electric battery cathode materials can be leached.”

Larry W. Reaugh, CEO, AMI
Page 38

Now!

- 8 Two-tier Prevention Targets**
Could a two-tier approach in which developed nations implement food waste reduction projects in developing countries offer the greatest benefits to all?

Waste to Energy Special Edition

- 16 Turkish Delight for HZI**
WMW investigates the latest developments in the rapidly advancing field of robotic waste sorting and artificial intelligence.
- 20 BA & Velocys Take to the Sky**
Partnership including Velocys and British Airways prepares the business case for a waste to renewable jet fuel plant in the UK.
- 24 IN BRIEF: Waste to Energy**
WMW rounds up the most innovative projects and innovations including developments in Australia and a new biobattery.

- 28 Real Time Emissions Monitors**
With big money riding on it, knowing the fossil v renewable CO2 emissions from a waste to energy plant makes great economic sense.
- 32 SUEZ Brings WtE to Belgrade**
Following a competitive tender process, SUEZ has secured a major waste to energy and C&D recycling contract in Serbia.

Recycling

- 34 Ecomondo: Italy in the Spotlight**
From the circular economy to the internet of things, this year's Ecomondo exhibition had it all.
- 38 Well Handled Waste**
With the electric and hybrid car ownership growing, it is increasingly important to find a closed-loop recycling method for lithium-ion batteries.

REGULARS

- 3 Editor's Letter**
6 ISWA Comments
12 News
15 Letter From: The Oceans
40 ISWA Information
42 Country Spotlight: UAE

COMPANIES INDEX

COMPANY	PAGE	COMPANY	PAGE
ACI Chemical	35	International Finance Corporation	32
American Manganese	13, 38	ISTAC	16
Amur	12	ITC	18
Babcock & Wilcox Vølund	44	Kemetco Research Inc	38
British Airways	20	Keppel Seghers	27
Bulk Handling Systems	42	Maserati Energia Srl	35
CDEnviro	39	MENART	11
COWI	43	Rambol	2
Doosan Lentjes	19	Rheinbraun Brennstoff GmbH	31
Ecomondo	34	Ricardo Energy & Environment	9
Eldan	14	Sebigas	35
Enerkem	25	SNAM	35
Erdwisch	36	Starlinger	12
European Environmental Bureau	13	SUEZ	3, 11, 21, 32
FCC Group	13	University of Alberta	26
Forrec	10	UNTHA	23
Fraunhofer-Gesellschaft	26	Velocys	20
Future Energy Systems	26	Veolia	13, 14
Hammel	37		
Hitachi Zosen Inova	3, 16, 26, 29		

Chief Editor

Ben Messenger
Email: Ben@WMW.News
Mobile: +44 7917 566259

International Advertising Manager

Terry Ash
Email: terry.ash@WMW.News
Office: +44 (0)20 3667 3715
Mobile: +44 (0)7956 491159

Publisher

WEKA Industrie Medien GmbH
Hans F. Zangerl, General Manager
Email: zangerl@WMW.News
Dresdner Straße 45, 1200 Vienna, Austria
www.industriemedien.at

Art Director: Nicole Fleck

Graphic Design: Johanna Kellermayr

Advertising

Editorial/News Contact:

Ben@WMW.News

Editorial Correspondence/Press Releases:

Please send to Waste Management World at
terry.ash@WMW.News

www.wmw.news

WASTED HEALTH: POLLUTION IS KILLING MILLIONS

Two years after ISWA's Report 'Wasted Health: The tragic case of dumpsites' that described the linkages between the world's dumpsites and human health, a new landmark report that was published recently by the Lancet Commission on Pollution and Health reveals that pollution kills at least nine million people and costs trillions of dollars every year.

This report stems from the most comprehensive global analysis to date, and warns the crisis "threatens the continuing survival of human societies". A comparison of the two reports reveals important common conclusions and concepts, highlighting that the health impacts of pollution, as well as the health impacts of dumpsites, remain rather underestimated.

The new report estimates that diseases caused by pollution were responsible for an estimated 9 million premature deaths in 2015. In the most severely affected countries, pollution-related disease is responsible for more than one death in four.

ISWA's report highlighted that the health risks from the exposure of 8.6 million people at the pollution of 373 toxic waste dumpsites in India, Indonesia and the Philippines could cause a loss of around 829,000 years of good health because of disease, disability or early death. By comparison, malaria in these countries, whose combined population is nearly 1.6 billion, causes the loss of 725,000 healthy years. The authors of the Lancet's report believe the figure of 9 million deaths per year could be an underestimate by some million people at least, since research on the impacts of some substances, like plastic, has not yet concluded. Furthermore, lack of data on many toxic metals and chemicals could not be included in the new analysis. Available data does not include

"SCIENTISTS ARE STILL DISCOVERING LINKS BETWEEN POLLUTION AND ILL HEALTH, SUCH AS THE CONNECTION BETWEEN AIR POLLUTION AND DEMENTIA, DIABETES AND KIDNEY DISEASE."



Antonis Mavropoulos
President, ISWA.

lead's impact from toxic sites like Flint, in Michigan, US, or Kabwe, the world's most polluted city in Zambia. Yet these populations experience enormous health impacts.

ISWA's report assessed that, in addition to environmental impacts, the financial cost of the health impacts due to open dumpsites runs into the tens of billions of US\$ annually. The relevant cost was calculated only for Brazil's dumpsites at 0.5 - 0.8 billion US\$ annually.

Lancet's report highlights that pollution is not the unavoidable consequence of economic development, and that it is much more important to formulate sound laws, policies, and regulations to control pollution than to wait for an economy to reach a magical tipping point.

This year, the UN Environment Assembly will gather in Nairobi from 4-6 December under the overarching theme of pollution. ISWA, in cooperation with other NGOs and international stakeholders, is pushing for a Political Declaration that will recognise the importance of sound waste management and a Resolution that will address the need to close the world's biggest dumpsites as a crucial step towards the Sustainability Development Goals. We will mobilise all our members to prepare the ground for decisions that will view dumpsites as a global health emergency and stimulate suitable policy responses. —

ISWA-SWIS

 **ISWA**
International Solid Waste Association

WINTER SCHOOL 2018



Sustainable Waste Management
Landfill & Landfill Mining



Registration until
www.ISWA.org
December 15, 2017



UNIVERSITY OF
TEXAS
ARLINGTON

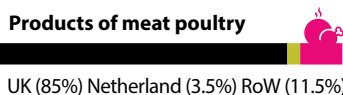
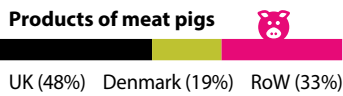
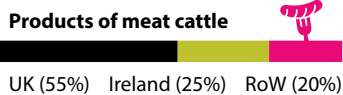
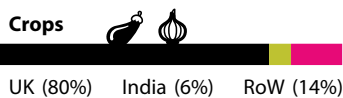
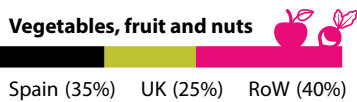
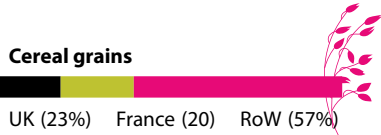
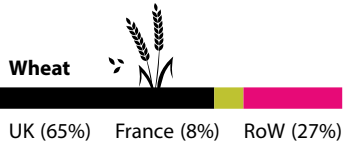


**THE UNIVERSITY OF TEXAS AT
ARLINGTON, USA, 15 - 26 JANUARY 2018**



FACTS

Additional insights into the magnitude of GHG reduction aggregated by product category and geographical area for this global study. It highlights the contribution analysis for GHG savings made due to food waste prevention across several food products. RoW= Rest of the world.



A NEW ERA IN THE WAR AGAINST WASTE:

TWO-TIER PREVENTION TARGETS

If the world is to feed its predicted population of 9 billion in 2050, the issue of food waste must be addressed. Could a two-tier approach, in which developed nations implement waste reduction projects in developing countries, offer the greatest benefits to all?

By Dr Ramy Salemdeeb and Dr Adam Read



There is a compelling need to address the issue of food waste as a global challenge – not as an issue that is constrained to the geographical borders of one country or another, or, in the UK, between the devolved administrations.

According to the majority of waste professionals, prevention strategies are the ace card of alleviating both the environmental burdens of food waste and improving food security.

This overarching consensus has led to a recent shift in government policies towards the introduction of waste prevention targets such as the Scottish Government's 33% food waste reduction by 2025 as part of the new Circular Economy Strategy: Making Things Last. Food waste prevention has also been featured in two recent reports: the Clean Growth Strategy[, and the National Infrastructure Commission report.

However, there are drawbacks to nation-specific approaches concerning prevention targets and introducing an innovative concept which will help meet the UN Sustainable Development target to halve food waste by 2030 and ensure food security.

GLOBAL FOOD LOSSES

Numerous reports have concluded that huge quantities of food waste are gener-

“IN A FINITE WORLD WITH LIMITED RESOURCES, WE SHOULD ALSO REMIND OURSELVES THAT VAST QUANTITIES OF ENERGY AND RESOURCES ARE CONSUMED ACROSS THE FOOD SUPPLY CHAIN.”

Dr Ramy Salemddeeb
consultant, at Ricardo Energy
& Environment

ated throughout the global food system. According to the Food and Agriculture Organization, 50% of vegetables and fruits in Sub-Saharan Africa and Latin America are wasted before even reaching our homes. These food losses, which are generated at early stages of the food value chain such as during agriculture, post-harvest, processing and distribution, occur mainly in developing countries and can be traced back to financial, managerial and technical constraints in harvesting techniques as well as often inappropriate or inefficient storage and cooling facilities.

ENVIRONMENTAL BURDENS OF A GLOBAL FOOD SYSTEM

In a finite world with limited resources, we should also remind ourselves that vast quantities of energy and resources are consumed across the food supply chain and consequently increase the overall environmental burden of food production.

In a research project published in the Waste Management Journal, we quantified the environmental benefits of preventing food waste being generated by UK households. Our analysis takes into consideration the fact that nearly half the food consumed in the UK is produced overseas.

The study model, developed using an innovative hybrid life-cycle assessment model coupled with a highly detailed multi-regional and environmentally extended input-output tool, estimates that food waste prevention could lead to substantial reductions in greenhouse gas (GHG) emissions in the order of 706 to 896 kg CO₂-eq. per tonne of food waste prevented, with most of these savings (78%) occurring as a result of avoided food production beyond UK borders, particularly in developing countries.

Our analysis shows that food waste prevention targeting foodstuffs produced in India alone could help to reduce the food bills of UK households by 6% and contribute to GHG reductions of nearly 18%.

In this particular example, the rice products category is the largest contributor to these savings, which would be made across several industries in India,



Due to less efficient production techniques, more foodstuffs produced in developing countries are wasted and their production has a greater environmental impact. For example, in India rice products offer the largest potential savings in GHG emissions from India's food sector.

such as coal-based electricity (50%), nitrogen fertiliser (18%), phosphorus fertiliser (4%) and the paddy rice sector (9%).

TWO-TIERED PREVENTION TARGETS

The importance of addressing the growing issue of food waste across the global supply chain can be quantitatively confirmed, in particular in developing countries where food is produced using both energy-intensive and resource-draining technologies.

For example, the findings show that foodstuffs produced in the UK tend to

have less environmental burdens than those sourced abroad, due to the reasonably efficient food production system and low-carbon energy sources used in the production and manufacturing of food products in the UK.

By contrast, food production technologies in developing countries are inefficient and depend heavily on conventional fossil-fuel energy sources and synthetic fertilisers. Therefore, further emphasis should be placed on improving the efficiency of food waste production beyond UK borders, in particular in developing countries, if the UK is indeed to lead the world in sustainability and food security.

In order to achieve our target, the introduction of a two-tier prevention target system that aims to tackle the issue of food waste locally as well as beyond the geographical borders of the UK is proposed. This scheme, which includes onshore and offshore targets, will encourage food retailers to invest in the downstream agri-food supply chain and claim credits towards their overall prevention targets.

The proposed scheme works as follows: retailers will be able to claim credits towards their onshore target by providing evidence of food waste diversion that occurs as a consequence of investment in their local supply chain.

Regarding the offshore target, we propose a similar approach to that of the UK Packaging Recovery Note system where retailers can claim credits towards their offshore targets by purchasing Food Waste Diversion Notes (FWPNs), documents issued by accredited re-processors/organisations that have invested in projects downstream within the agri-food supply chain.

FWPN issuers will be able to generate FWPNs again based on food waste diversion that can be attributed to their investment in improving the supply chain. These FWPNs can then be sold to UK retailers in order to help them meet their offshore targets. Radical? Yes, but isn't this just the kind of step change needed to drive both local and global improvements in the food production system? The UK could take the lead, and others would follow as the green



credentials and PR opportunities for some global brands would come to the fore.

CROSS-SECTOR COLLABORATION

The introduction of this system will prove to be monitored by relevant authorities to ensure compliance. Our approach may also face other challenges such as potentially fraudulent practices. Nevertheless, we strongly believe that all potential challenges could be identified and resolved whilst piloting the scheme here in the UK.

In order to ensure successful implementation, we recommend launching the project in one developing nation initially. We also suggest partnering up with the Department for International Development (DFID), the United Kingdom’s government department which is responsible for administering overseas aid to end extreme poverty and food insecurity. DFID’s extensive experience

in designing and implementing projects in developing countries could prove essential in ensuring effective implementation and constitutes a trustworthy partner with whom to test the scheme. DFID, along with potential collaboration from DEFRA and others, would issue FWPNS that could then be purchased by UK retailers.

The revenue generated would subsequently find its way back into expanding projects of future benefit to the retailer, the food chain and the country of origin and consumption, thus improving the global food supply chain and further ensuring food security in multiple regions.

This collaboration would not only help retailers to ensure the efficiency of the global agri-food supply chain but also fight food poverty and manage to feed 9 billion, the planet’s predicted global population in 2050. —

“THE WASTE SECTOR’S ‘UNIQUE SELLING POINT’ IN TERMS OF FOOD WASTE AND CARBON ACCOUNTING IS IN FACILITATING AVOIDED EMISSIONS.”

Dr Adam Read
external affairs director at SUEZ
Recycling & Recovery UK

Composting technologies & recycling solutions

MBT of municipal solid waste

For more information take contact with our sales department

MENART

Rue Benoît 31 • B-7370 Dour
Tel: +32 (0)65 61 07 60 • Fax: +32 (0)65 61 07 49
Email: info@menart.eu • Web: www.menart.eu

The new recycling headquarters in Weissenbach, Lower Austria.



© Starlinger

NEW RECYCLING HEADQUARTERS FOR STARLINGER

Austrian equipment manufacturer Starlinger has inaugurated the new headquarters of its recycling technology division. The building is located in Weissenbach, Lower Austria, in close proximity to the existing Starlinger factory. Until recently, the division was operating from the head office in Vienna as well as from the Starlinger factory in Weissenbach. The construction of a separate additional building started one and a half years ago. This summer the company's staff from sales to engineering moved into the new recycling headquarters.

On 23-24 October, the firm used its customer event 'Dynamic Days' to officially inaugurate the building. 150 participants from 34 countries attended the customer event, which included two days of educational events. Odour reduction on polyolefins took centre stage on day 1. Day 2 was dedicated to polyester recycling. For fibre production (bottle-to-fibre recycling), Starlinger recently developed a new filter, the Rapid Sleeve

Changer (RSC). According to the company, this filter not only allows for extremely fine filtration (a necessity in fibre production), but also for a rapid change of the filter elements without having to stop production. During the live demonstration of polyester fibre recycling, visitors got a first-hand impression. The event concluded with a visit of Starlinger's PET Competence Center, where rPET flakes were used as input material for the production of tapes for woven fabric.

“WE ARE COMMITTED TO THE FUTURE OF RECYCLING AT STARLINGER. RECYCLING IS HERE TO STAY.”

Starlinger managing partner **Angelika Huemer**



DIARY OF EVENTS

2ND ANNUAL DUBAI GREEN HOTEL INNOVATION

Dubai, UAE
5-6 December 2017
www.dubaigreenhotelinnovation.com

POLLUTEC

Lyon, France
27-30 November 2017
www.pollutec.com

ENERGY FROM WASTE

London, UK
6-7 December
www.smi-online.co.uk/energy/uk/conference/energy-from-waste

ADBA NATIONAL CONFERENCE

London, UK
7 December 2017
<http://adbioreources.org/events/adba-national-conference-2017>

WORLD BIOGAS ASSOCIATION

Brussels, Belgium
11 December 2017
www.worldbiogasassociation.org

ENERGY FROM WASTE 2018

London, UK
28 February – 1 March 2018
www.efwconference.com

IFAT 2018

Munich, Germany
14-18 May 2018
www.ifat.de

FEDERATION OF NY SOLID WASTE ASSOCIATIONS 2018 CONFERENCE

The Sagamore in Bolton Landing, New York
20-23 May 2018
www.nyfederation.org

SUPER FAST BMP TEST DEVELOPED FOR AD OPERATORS

AD operator and services provider Amur has launched a new test for measuring biomethane potential (BMP) of feedstocks, to coincide with the expansion of its laboratory services. The company said that the new test is a faster and more accurate system to rate feedstock samples in order to give operators a potential gas yield for that material. Unlike existing methods, which Amur said take at least three weeks to generate results, its Bullet BMP technology reports back in four days. The technology uses near

infra-red spectral analysis to identify the components – such as starch, sugar, or fat – in a sample. The findings are calibrated and benchmarked against known biomethane potential from a range of waste materials, then mathematically calculated and converted into BMP. Amur has invested in its own 3MW gas to grid AD plant in Yorkshire and recently expanded its laboratory services to York Science Park, where it shares a home with other organisations focused on the bioeconomy.



Nigel Lee

general manager at Amur

“AD PLANTS ARE OFFERED NEW FEEDSTOCKS ON A REGULAR BASIS AND BEING ABLE TO UNDERSTAND THE VALUE OF THOSE FEEDSTOCKS TO THE AD OPERATOR IS CRITICALLY IMPORTANT.”



“BY AVOIDING FURNITURE WASTE, EU POLICY MAKERS CAN BOOST A MARKET THAT WAS HARDLY SHOULD THIS BE ‘HARD’?”

OPPORTUNITIES FOR BETTER RESOURCE MANAGEMENT IN EU FURNITURE INDUSTRY

As many as 157,000 new jobs and 6 million tonnes of CO₂ equivalent saved in the EU with improved refurbishment and remanufacture of discarded furniture, a new European Environmental Bureau study has found. The study presented a range of policy options to improve waste prevention and resource management in the European furniture sector, which would in turn allow value recovery, economic growth and job creation while saving resources and protecting the environment. The EEB is Europe's largest network of environmental organisations with 140 members in over 30 countries. The report noted that the European furniture sector faces a number of challenges due to increasing raw material costs, poor turnover in its workforce and growing

competitiveness of low-cost countries such as China. As such, the waste of valuable materials is a missed opportunity for the economy and also undermines efforts to transition to a circular and low-carbon economy.

Among the most effective measures recommended in the report are:

- Stricter criteria for ecodesign, including restrictions on the use of chemicals to facilitate reuse, repair and recycling
- Better business models to cut furniture waste
- Incentives to take back discarded furniture and mandatory producer responsibility schemes
- Life-cycle impact information for procurers, repairers and recyclers as well as consumers.

GUEST-IMATOR APP TARGETS FOOD WASTE IN THE HOLIDAY SEASON

A new app, dubbed the ‘Guest-imator’ has been designed to eliminate unnecessary over-purchasing, save consumers’ money and prevent food waste. The tool allows users to plan how much food to buy and serve for holiday gatherings and other large dinners. To use it, hosts plug in the number of guests they expect to have and select the types of dishes they plan to

prepare, including mains, sides and desserts. They can also indicate the number of leftover meals desired. From there, the Guest-imator calculates the amount of each food to prepare (i.e. eight potatoes or a 10-pound turkey), taking into consideration not only the number of portions needed, but the number of dishes offered, and whether the dishes being served are heavy or light. Guest-imator has been created pro bono by SapientRazorfish, for the Ad Council and Natural Resources Defense Council’s Save The Food national public service campaign.

Save The Food is aimed at combatting food waste from its largest source—consumers.

THE NEWS IN NUMBERS

6 MILLION TURKEYS

WASTED OVER THANKS GIVING 2016 with a value of roughly **\$293 MILLION**. The ‘Guest-imator’ app aims to cut that.

500,000

PAPER CUPS COLLECTED FOR RECYCLING at Reading and Leeds festivals this year.

€ 2,359 MILLION

VEOLIA ENVIRONMENT’S EBITDA of 1.7% for first nine months of the year – **UP 1.6%** year on year.

40 YEARS

SINCE FCC GROUP INTRODUCED electric vehicles to its fleet. Today it has **550 ELECTRIC, HYBRID OR SELF-RECHARGING VEHICLES**.

100%

LITHIUM RECOVERY claimed to have been achieved with American Manganese Inc.’s **NEW BENCH SCALE RECYCLING PROCESS**.

“ALL IN ALL, THE COMBINATION OF PROFITABLE GROWTH AND COST SAVINGS TRANSLATES INTO AN OVERALL ACCELERATION OF EBITDA AND EARNINGS, IN LINE WITH OUR PLAN.”



Antoine Frérot
Veolia Environnement's chairman and CEO

STRONG GROWTH IN FIRST NINE MONTHS OF 2017 FOR VEOLIA

Revenues at French environmental services firm Veolia increased by 4.4% in the first 9 months of 2017 to reach €18,221 million. The Group said that its consolidated revenue increased by 3.7% (+4.4% at constant exchange rates) from €17,569 million for the nine months ended 30 September 2016. Third quarter revenue increased by 4.3% and waste volumes were up by 3.3% “Veolia’s 9-month results are satisfying, and support our strategy of growth and efficiency,” said Antoine Frérot, Veolia Environnement’s chairman and CEO. “The solid development of our revenue is confirmed, as announced at the beginning of the year.

Good commercial momentum and revitalised attractiveness of our offerings resulted in new contract awards across all our businesses and geographies,” he continued. Frérot went on to cite the firm’s new 10-year hazardous waste treatment contract with Antero Resources, an oil and gas producer in the US. However, the company noted that the unfavourable movement in exchange rates negatively impacted revenue growth by 0.7% for the first nine months of 2017 (-€123 million). At constant consolidation of scope and exchange rates (i.e. like-for-like), revenue growth for the nine months amounted to 3.1%, as in the first half of 2017.



GOOD TO KNOW

10 MILLION TONNES

Furniture put on the EU market annually - around the same as is discarded, the majority of which is landfilled or incinerated.

Equipment for **HIGHLY PROFITABLE RECYCLING** of e.g. tyres, cable and e-waste.

ELDAN RECYCLING

ELDAN Recycling is recognized as a world leader in supplying equipment for profitable recycling. We are proud to offer you equipment developed based on 60 years' experience, manufactured in our own factory and delivered to several hundred satisfied customers worldwide. We offer you equipment and recycling solutions for processing of e.g. tyres, cable, electronics (WEEE) and industrial waste.

www.eldan-recycling.com. Phone: +45 6361 2545

A LETTER FROM... THE OCEANS



Arguably, the ‘hot topic’ in the Waste Management sector has been the astronomical growth of global plastic waste. As P&G have already shown, now is the time to be innovative, educational and actionable.

Globally, we now produce a staggering volumes of plastic waste. With more than half of all plastic products designed for single use, 8 million tonnes are dumped into the ocean every single year. It is crucial to understand the impact plastic pollution is having on our environment, wildlife, and own personal health. The outcomes shown below are all 100% preventable. To reverse these effects, corporations and individuals must work hand-in-hand to not only spread the message, but to consciously change their daily decision-making:

Seabirds

The vast majority of seabirds have been affected by plastic pollution, with more than 90% carrying plastic materials in their stomach. Over time, this can lead to serious congestion, starvation and suffocation of individuals and ultimately endanger entire species. The same impact is observed in fish, which could in turn have impact on human well-being. Plastics carry toxins, which can be absorbed into the bloodstream of fish. When humans later consume the fish, these toxins could be passed on and cause multiple illnesses.

Entanglement

There are many types of plastic litter, from discarded water bottles and bags to disposable razors. You will also find plastic wrapping films (such as those

“THESE ISSUES CANNOT BE IGNORED, AS THEY POSE A DIRECT THREAT TO MARINE SPECIES, THEIR HABITATS AND WILDLIFE ACROSS THE GLOBE.”



Alex Way is the Managing Director of UK-based travel agent, Just Fly Business and Plastic Oceans collaborator.

used for multipack cans) discarded in the ocean, and this provides a significant and direct threat to wildlife in the ocean.

A shocking 33% of all marine species have been found entangled in some form of discarded litter, having either been killed or injured by the waste.

Destruction of Marine Habitats

Dolphins, surely among the most loved animals in the world, bear the brunt of plastic pollution. In addition to physically ingesting waste and chemical toxins, they are seeing their habitats and carefully structured eco-systems destroyed beyond recognition. This means that dolphins are one of several species that are seeing their homes as well as their health destroyed by plastic pollution. In fact, their survival is under serious threat, as plastic pollution is also diminishing the food supply of dolphins at a dramatic rate, placing the species in even greater danger.

Time to Act

These issues cannot be ignored, as they pose a direct threat to marine species, their habitats and wildlife across the globe, and this is without mentioning the threat to human health. Now is clearly the ideal time to take a stand against plastic pollution.

Let’s start making sustainable changes that minimise plastic consumption and waste! —

TURKISH DELIGHT FOR HZI



Every day, Istanbul's 39 municipalities produce some 17,500 tonnes of waste. Currently, nearly all of that is sent to landfill. Now, following a deal with Istanbul Metropolitan Municipality, Hitachi Zosen Inova is preparing to develop Europe's largest waste to energy plant.

By Ben Messenger

Over millennia, the ancient city of Istanbul has reinvented itself many times. Known in previous incarnations as Byzantium and then Constantinople, it is the world's only city to straddle two continents, Europe and Asia, across the Bosphorus Strait. It may have lost its status as the capital of the Ottoman Empire

with the formation of the Turkish Republic in 1923, but with a growing population of 14 million, there is no doubting its importance to the country and its economy.

In common with most countries which experience years of strong economic growth, Turkey's waste generation has increased dramatically. Between 2008



and 2013, waste generation in Istanbul more than doubled from around 8000 tonnes per day to over 16,000 tonnes per day. Today, the Istanbul Environmental Management Industry and Trading Company (ISTAC) collects around 17,500 tonnes of MSW per day. Founded in 1994 as an affiliate company of the İstanbul Metropolitan Municipality, the firm is one of the largest waste management businesses in Turkey.

The city already plays host to one of the largest composting facilities in the world, also operated by ISTAC, and a bio-drying facility with a capacity of 2000 tonnes per day, where wastes are recycled through mechanical and biological processes and alternative fuel is derived. However, landfill still accounts for around 84% of waste disposal.

With a massive population to house and pressing environmental concerns, including landfill diversion targets, in 2010 the City and ISTAC began to contemplate an alternative to burying waste. By 2014, a plan to develop a huge waste to energy plant was taking shape.

WASTE COMPOSITION

During the initial investigation into the feasibility of the project, ISTAC carried out the waste characterisation study to compare the composition over a number of years in both summer and winter. The study followed the ASTM D5231 American Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste and European Commission Methodology for the Analysis of Solid Waste standards.

To ensure the waste characterisation was representative of the overall waste processed in Istanbul, ISTAC used samples from 24 counties with a mix of both affluent and less-affluent districts to ensure the study was reflective of the whole city's waste stream. It also used waste collected both during the week and on the weekend.

The moisture content was found to be between 45% and 55% while the calorific value of the different waste streams was between 6000 kj/kg and 9000 kj/kg. The density of the waste was also analysed to

“THERE ARE ALSO PLANS BEING DRAWN UP TO DEVELOP A 45,000 TONNE-PER-YEAR ANAEROBIC DIGESTION PLANT FOR PROCESSING THE CITY'S ORGANIC WASTES.”



Fatih Hoşoğlu
operations manager ISTAC A.S.

calculate the correct size for the refuse pit and overhead cranes. It was estimated that the waste density was approximately 270 kg/m³ when delivered by truck and around 400 to 500 kg/m³ when delivered by trailer due to additional compaction of the waste.

However, according to Fatih Hoşoğlu, operations manager at ISTAC, it is anticipated that in the future Istanbul's waste composition could change as both population and wealth increase. He says that numerous studies have shown that the MSW heating value generally increases with people's living standard.

LOCATION LOCATION LOCATION

During the first stage of the project, 11 locations were identified, eight on the European side of the city and three on the Asian side. During the second stage, the number of potential sites was reduced through the use of evaluation criteria.

A number of factors were considered during this evaluation process, including: compliance with applicable laws and legal regulations; municipal approval - preferably for a location in a commercial area; public acceptance; land ownership; transportation distance from source to plant; grid connection for power customers; proximity to potential heat customers; and available local infrastructure.

The various locations were scored by using a weighted system, considering environmental factors, planning considerations, political and legal implications, and financial and economic criteria be-

REFUSE DERIVED FUEL

In an effort to recover unrecyclable, but high calorific-value waste at its Kemberburgaz Recycling and Composting Plant, back in 2008 ISTAC installed a 96 tonne-per-day Refuse Derived Fuel (RDF) facility. The plant processes wastes rich in organic content from vegetable markets and open bazaars as well as some wastes collected from towns. The compost produced is used in various parks and gardens of Istanbul. However, much of the non-compostable material is now also being used for energy recovery. The waste is first crushed down to a fraction size of around 250-300 mm. Metals and organics are then separated and the material is reduced to 0-30 mm in size in fine crusher. The resultant RDF has a calorific value in the range of 4000 kcal/kg and is sent to cement plants as an alternative fuel. —

COVER STORY



FACTS

17,500

TONNES

MSW collected in Istanbul every day

51.71%

Organic content of MSW in 2010

3%

Material recycled in Istanbul each day, or 500 tonnes

2000

TONNES

MSW sent for bio-drying with ISTAC each day

fore it was finally decided to locate the project in Eyüp.

DECISIONS DECISIONS

Having considered various energy recovery technologies, the municipality and ISTAC, which will operate the facility, reached the conclusion that traditional mass burn incineration with energy recovery was the most prudent means forward.

Hoşoğlu explains that to ensure that the project was based on proven technology with a good track record, which allows it secure financing as well as staying in operation for the minimum operating term of 20 years, the moving grate mass-burn technology was chosen.

A competitive tender process followed and in September this year, Swiss waste to energy firm Hitachi Zosen Innova (HZI) was selected as the technology partner.

The plant will process 1 million tonnes of waste per annum, generate around 70 MW of electricity, and cost approximately 2.6 billion Lire (\$690 million). Located close to Istanbul's new airport in the northwest of the city, from 2021 its three



The architectural design of the facility was selected to correspond with the natural environment in which it will sit.

incineration lines will process around 15% of the city's municipal solid waste. The plant is also being designed to exceed EU emission regulations.

Under the turnkey contract, HZI will oversee the design and build of the Eyüp Kemberburgaz Domestic Waste Incineration and Power Generation Facility, together with its Turkish construction partner Makyol. Beside the design and construction, the contract covers also the operation and maintenance of the turnkey plant for at least one year.

Speaking at the signing of the agreement, Istanbul's Mayor, Kadir Topbas, said that when he came to office in 2004, the priority was to focus on regular collections and sanitary disposal. However, if the city continues to landfill waste at the current scale a considerable amount of additional land will be required in the future. "For this reason, we are signing for the establishment of a state-of-the-art facility," he said. "We are proud to be a model for Turkey and the world."

ADDING VALUE

As well as supplying electricity and disposing of waste, the new plant will also deliver added value for the region economically. Over 20% of all the components for the plant will be produced by local businesses, while all of the work connected to the construction will be carried out exclusively by local workers.

"We will have eliminated 25% of the daily garbage from the European side," says Mayor Topbas. "There are solar panels on the roof of the plant that will reduce greenhouse gases. It is a terrific en-

LANDFILL GAS



At ITC's existing landfill gas site in Ankara it uses the heat from the engines in a greenhouse to grow tomatoes and strawberries.

With so much waste already deposited in landfill, recovering energy from landfill gas is also seen as a major opportunity in Turkey. While Istanbul already generates around 50MW of electricity in this fashion, elsewhere in Turkey other major projects are underway. In August this year, plans to install 16 new GE Jenbacher gas engines with a combined generating capacity of 22 MW across three landfill sites owned by ITC-Ka Enerji Uretim Sanayi Ve Ticaret AS (ITC) were unveiled. In total, the three facilities will process 1,387,000 tonnes of municipal solid waste annually from the surrounding households, vegetables, fruit and garden waste and comprise more than 50% of the household waste of the cities of Antalya, Eskisehir and Alanya. With much of that waste being landfilled, gas generation is high. Four of GE's Ecomagination certified, Jenbacher J420 biogas engines will be installed at Eskisehir, nine at Antalya and three at the Alanya landfill site. —



environmental project that produces electrical energy while disposing of waste.”

MORE TO COME?

Istanbul already generates more waste than many European countries, and with its population set to grow both in numbers and wealth, the problem will not be

going away on its own. According to the European Environment Agency, across Turkey the share of MSW going to landfill increased by 5% between 2001 and 2010. The number of sanitary landfill sites increased from 15 in 2003 to 68 in 2012.

However, with Turkey eyeing potential membership of the European Union at some point in the future, it is adopting a number of EU environmental regulations. While there is clearly room to improve material recycling rates in both Istanbul and the country as a whole, there is also clear potential for additional waste to energy infrastructure. Hitachi Zosen Inova chief executive officer Franz-Josef Mengede agrees that “the region has enormous potential in the area of energy from waste,” and concludes by saying that the development is “paving the way for further EfW projects going forward”. —

COVER STORY



“BECAUSE ISTANBUL'S POPULATION AND GARBAGE ARE CONSTANTLY INCREASING, WE WILL BUILD THIS HUGE FACILITY.”



Kadir Topbas
Mayor of Istanbul

Doosan Lentjes
Your partner for waste recovery



At Doosan Lentjes, we help our customers get the maximum from their residual waste: Latest technologies across combustion, steam generation and flue gas cleaning allow maximum energy and material recoveries while securing compliance with strict emissions standards.

Depending on your specific project requirements, we deliver individual process sections, chute-to-stack or full turnkey solutions that make us your preferred one-stop partner for waste-to-energy.



To learn more about our capabilities, please contact us on:
Tel: +49 (0) 2102 166 0 Email: DL.Info@doosan.com

www.doosanlentjes.com

FACTS

60 %

Expected GHG reductions from the use of renewable jet fuel

90 %

Reduction in particulate matter emissions

1 BILLION GALLONS

Projected annual demand for renewable diesel by 2030 in California alone

18 BILLION

Renewable fuels produced or imported into the US which qualified under the RFS in 2016



FLYING HIGH

WASTE TO FUEL FIRM REACHES FOR THE SKY

Elon Musk and his Tesla car company might be leading the charge to electrify road transport, but when it comes to flying, batteries are unlikely to be the answer anytime soon. Decarbonising aviation will require a move to more sustainable jet fuels. Velocys thinks it has the solution.

By Ben Messenger



With Velocys' team on site the Oklahoma gas to fuel plant will continue ramping up to its target capacity of 250 bpd.

After five years of development, on 6 January last year British Airways (BA) announced that it had scrapped a groundbreaking scheme to create jet fuel from waste. The much hyped GreenSky project was dead. However, not to be deterred the airline vowed to continue to pursue the prospect of renewable aviation fuel.

At the time BA cited a lack of government support as being partly to blame for the failure of the project. Nearly two years later, and on the back of recent amendments to the Renewable Transport Fuels Obligation (RTFO), the airline has forged a new partnership with renewable fuels and chemicals technology firm Velocys

“THE RECENTLY ANNOUNCED CHANGES TO THE RENEWABLE TRANSPORT FUELS OBLIGATION HERE IN THE UK NOW OPEN THE DOOR FOR A HIGH GROWTH MARKET.”

Neville Hargreaves
project leader at Velocys

and environmental service giant SUEZ. The partnership also includes Norma, an affiliate of Ervington Investments and Velocys' largest investor.

The proposed plant would take hundreds of thousands of tonnes per year of post-recycled waste, destined for landfill or incineration, and convert it into sustainable fuels. Velocys believes that there is an opportunity to develop a series of waste to jet fuel plants in the UK.

“This jet fuel delivers two key benefits compared to conventional jet fuel,” explains Neville Hargreaves, project leader at Velocys. “It cuts greenhouse gases by over 60% and it’s also a much cleaner burning fuel. For example the particulate matter emissions are over 90% reduced, thus improving local air quality around airports.”

MARKET DRIVERS

According to Hargreaves the changes to the RTFO recently published by the Department for Transport provide the required commercial platform for this opportunity. For the first time, jet fuel is to qualify for credits.

“Velocys is about creating a scalable supply of premium renewable diesel and jet fuel,” he explains. “Our main focus is in the US, where there is favourable pricing and ample supply of wooden biomass. We’re making great progress there. However, the recently announced changes to the Renewable Transport Fuels Obligation here in the UK now open the door for a high growth market with a series of plants using waste as a feedstock.”

“These changes to the RTFO are designed to promote sustainable aviation and heavy goods transport; once implemented, they are expected to provide long term policy support for this market,” continues Hargreaves.

The first plant is expected to take household waste including nappies, plastic food containers and chocolate bar wrappers, and convert it sustainable fuels. According to BA, this will contribute to its commitment to reduce net emissions by 50% by 2050. The planned plant will produce enough fuel to power all British

The planned facility is expected to produce enough renewable fuel for all BA's 787 Dreamliner operated flights from London to San Jose, California and New Orleans, Louisiana.



Airways' 787 Dreamliner operated flights from London to San Jose, California, and New Orleans, Louisiana, for a whole year. It will also be the first plant of its type at this scale. The airline says that it plans to supply its aircraft fleet with increasing amounts of sustainable jet fuel in the next decade.

"Sustainable fuels will play an increasingly critical role in global aviation, and we are preparing for that future. Turning household waste into jet fuel is an amazing innovation that produces clean fuel while reducing landfill," comments Willie Walsh, chief executive at IAG, BA's

parent company. As well as helping the airline industry reduce its carbon emissions, the initiative will also significantly reduce the 15 million tonnes of waste the UK still sends to landfill each year.

TECHNOLOGY

Velocys' technology centres around a three-stage process. First the waste is gasified to convert carbon-containing materials into carbon monoxide and hydrogen. This is achieved by reacting the material at temperatures in excess of 700 °C.

The second stage uses a Fischer-Tropsch (FT) process, which the company



LANDFILL GAS TO LIQUID FUELS

In addition to converting solid waste into liquid fuels, Velocys has also recently commissioned a plant that is converting landfill gas into renewable fuels - ENVIA Energy's GTL plant in Oklahoma City. ENVIA Energy is a Joint Venture, made up of Waste Management Inc., Ventech Engineers International and Velocys. It was formed in March 2014 to produce renewable fuels and chemicals from biogas and natural gas using GTL. By June this year, the first of the Fischer-Tropsch products began being fractionated at the site to produce premium, renewable waxes, diesel and naphtha, meeting customer product specifications.

The on-site operations team completed the debugging of several units at the plant, something which the company said is routine during the start-up of a plant of this complexity.

In developing the project, Velocys made available to ENVIA Energy up to \$12 million of further funding as part of a stakeholder capital contribution. This was later raised to \$13.4 million.

By 30 October this year the plant had reached an operational capacity of around 200 barrels per day. This is expected to rise to 250 barrels per day at the plant if tweaked.

The project provides a commercial reference plant for the use of Velocys' technol-

ogy and Ventech's modularisation with a combination of landfill gas/natural gas as feedstock. It deploys a number of Velocys' full-scale Fischer-Tropsch reactors and utilises Waste Management's landfill gas recovery and clean-up techniques.

"We are pleased that ENVIA's Oklahoma City plant has reached the capacity milestone of 200 bpd," comments David Pummell, CEO of Velocys. "ENVIA's customers' tankers now arrive regularly on site and load product from the plant. The aim is now to optimise operations to maximise production and plant availability going forward, whilst always assuring safety and minimising the risk of impact to the environment." —

says has traditionally only been economically viable at plants producing 30,000 barrels per day (bpd) or more. However, Velocys claims that its microchannel FT technology is commercially optimal at capacities of as low as 1400 bpd (around 19 million gallons per year), making it an ideal choice for biorefineries.

The resultant raw FT products are upgraded by light hydro-cracking, isomerisation and fractionation to produce a range of possible hydrocarbon products including diesel, jet fuel, naphtha and waxes. Velocys says that these products are generally of higher quality (and command a higher price) than those derived by conventional means. “We will supply the Fischer-Tropsch technology which is at the heart of the plant,” says Hargreaves. “With that we’ll provide engineering, operations and technical services to support the project. But we’re also doing much

more than that. In line with the new strategy we announced last year, we’re developing a new integrated offer with our partners. Assembling all the technology components, the feedstock supply, the off-take agreements, the financing – everything that’s required to progress a project through to the final investment decision and ultimately through to construction and operation.”

NEXT STEPS

Velocys will lead the project through the next stages of development, explains Hargreaves: “This is a feasibility stage where all members of the partnership are providing funding. It includes an engineering study and the preparation of a detailed business case. Subject to that business case and the successful completion of all the development stages, we aim to achieve a final investment decision in 2019.” —

“THIS OPPORTUNITY LEVERAGES FURTHER OUR TECHNOLOGY, INTEGRATED PLANT DESIGN AND SKILLS BASE, AND IS CONSISTENT WITH OUR RENEWABLE FUELS.”

David Pummell
CEO of Velocys



shredding technology

The reliable brand!

AS FLEXIBLE AS YOUR REQUIREMENTS: THE XR-CLASS

Efficient single step shredding:

- C & I waste 25 t/h < 80 mm
- Waste wood 40 t/h < 100 mm
- Pulper ropes 10 t/h < 50 mm



www.untha.com/xr-class

IN SHORT: ALTERNATIVE FUELS

VICTORIA CONSULTS ON WASTE TO ENERGY

THE AUSTRALIAN STATE OF VICTORIA'S GOVERNMENT HAS RELEASED A DISCUSSION PAPER ON CONVERTING WASTE TO ENERGY TO SUPPORT THE DEVELOPMENT OF NEW TECHNOLOGIES, INCLUDING BOTH ANAEROBIC DIGESTION AND THERMAL TREATMENT.

A recent Sustainability Victoria report found that as the state's population increases, its waste generation is projected to rise from 12.7 million tonnes per year to over 20 million tonnes by 2046. However, the state is also aiming to reduce its GHG emissions to 15% to 20% below 2005 levels by 2020, and to net zero emissions by 2050.

According to the government, the recycling and reuse of waste materials are already well established, but it is looking into how residual wastes could be better managed to contribute towards the GHG reduction targets. The discussion paper covers all processes and technologies which recover energy or fuel through the thermal, mechanical or biological processing of solid or liquid wastes. It is intended to present a preliminary position for discussion.

Following the consultation, the government says that it will develop a position on waste to energy for the whole of the Victoria intended to provide certainty for investors and communities about when waste to energy facilities will be a good fit for Victoria - and when they won't be.

Have your say

The government wants to hear from businesses in the waste and energy industries

about challenges they're experiencing in trying to establish waste to energy facilities. It also wants to hear from local governments about their plans for making better use of municipal waste, as well as from large industrial energy users, including those that generate large volumes of waste, and about the potential of 'industrial ecology' and 'closed loop' solutions.

It also welcomes the views of communities that would like to see their waste used locally to generate energy, and those that might have questions or concerns about potential environmental impacts.

Feedback received on the discussion paper will help inform the Labor Government's development of a waste to energy policy, to be released in 2018.

Waste to Energy Fund

Minister for Energy, Environment and Climate Action Lily D'Ambrosio released the paper during a visit to Shepparton, where she also announced five grants from the \$2.38 million Waste to Energy Infrastructure Fund.

The government says that the grants will help businesses and water corporations upgrade waste management practices and support projects. The grants include:

- Western Region Water Corporation will receive \$802,784 to collect organic

- waste material and generate energy
- Diamond Valley Pork will receive \$284,929 to install an anaerobic digester to improve waste management and generate energy and nutrient rich digestate
- East Gippsland Region Water Corporation will receive \$209,765 to enhance an existing bio-digester to process septic tank waste, food waste, fats, oils and greases
- Nestle Australia will receive \$182,510 to create a system where organic waste from starch-based soft confectionery is used for bioenergy
- Resource Resolution will receive \$900,000 to help it build an anaerobic digester to divert local commercial food waste and other organics from landfill.

The Waste to Energy Infrastructure Fund was announced in the 2016 state budget as part of the government's Climate Change innovation and Jobs Initiative. "The recipients of our Waste to Energy Infrastructure grants will be upgrading their waste management practices, diverting waste from landfill and reducing their energy costs," Minister for Energy, Environment and Climate Change Lily D'Ambrosio said. __



With a growing population of over 4 million, Melbourne is the capital city of Victoria and by far its largest. Around 75% of the population of Victoria live in Melbourne.



“WASTE TO ENERGY TECHNOLOGIES HAVE THE POTENTIAL TO REDUCE OUR RELIANCE ON LANDFILL, BOOST OUR ECONOMY AND BETTER PROTECT VICTORIA'S ENVIRONMENT.”

Lily D'Ambrosio

Minister for Energy, Environment and Climate Change

ENERKEM'S EDMONTON WASTE TO BIOFUEL PLANT APPROVED BY EPA

CANADIAN WASTE TO BIOFUELS AND RENEWABLE CHEMICALS SPECIALIST ENERKEM HAS BEEN APPROVED BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) TO SELL CELLULOSIC ETHANOL PRODUCED AT ITS EDMONTON, CANADA, FACILITY UNDER THE U.S. RENEWABLE FUELS STANDARD (RFS).



In 2017 Enerkem's Alberta Biofuels facility received the lowest carbon intensity value ever issued by the British Columbia Ministry of Energy and Mines under the Renewable and Low Carbon Fuel Requirements Regulation

The company uses a four-step process to chemically recycle the biogenic content of waste materials: feedstock preparation, gasification, cleaning and conditioning of syngas and catalytic synthesis. According to the firm, in less than 5 minutes its conversion process first transforms this carbon into a pure synthesis gas and then converts it into biofuels and renewable chemicals using commercially available catalysts.

The plant was officially inaugurated in June 2014, and in August last year Enerkem obtained certification from the International Sustainability and Carbon Certification system, allowing it to sell fuel produced at the facility in Europe. By April 2017 the company had met all operational milestones set by its senior lender, Integrated Asset Management, for its first full-scale commercial facility. Earlier this year, Enerkem

expanded its Edmonton biofuel facility to produce some 13 million gallons of cellulosic ethanol annually following the commissioning of its methanol-to-ethanol conversion unit. This pioneering facility has been financed by private sources and received funding support from Sustainable Development Technology Canada (SDTC), Alberta Innovates and Alberta Energy.

The RFS

Under the 2007 Energy Independence and Security Act, 16 billion gallons of cellulosic biofuels are to be blended in the conventional transportation fuel pool by 2022. Enerkem explained that its advanced biofuels facility has now completed all the necessary steps required by the EPA to qualify. The EPA's registration process seeks to ensure that the stringent regulatory

requirements of the U.S. RFS are met. Enerkem is now registered for D3 Renewable identification numbers (RINs) credits. These RIN credits are purchased by U.S. refiners to comply with the U.S. RFS program. The company claimed that it is the first ever municipal waste to cellulosic ethanol plant to receive approval to sell in the US and noted that the EPA has established that cellulosic biofuels reduce greenhouse gas emissions by at least 60% when compared to gasoline. —

“WITH THIS EPA APPROVAL, WE ARE NOW ABLE TO SELL ONE OF THE LOWEST-CARBON TRANSPORTATION FUELS INTO THE WORLD'S LARGEST BIOFUELS MARKET.”



Vincent Chornet

President and Chief Executive Officer of Enerkem

Fraunhofer-Gesellschaft and the University of Alberta signed a research collaboration agreement to launch a new technology platform partnership including a biobattery to convert wastes to energy.



CANADIAN & GERMAN RESEARCHERS TO DEVELOP BIOWASTE BATTERY

GERMAN RESEARCH INSTITUTE FRAUNHOFER-GESELLSCHAFT AND CANADA'S UNIVERSITY OF ALBERTA HAVE SIGNED A RESEARCH COLLABORATION AGREEMENT TO LAUNCH A NEW TECHNOLOGY PLATFORM PARTNERSHIP TO INVESTIGATE THE POTENTIAL OF A BIOBATTERY PROJECT TO CONVERT RESIDUAL BIOWASTES INTO HEAT AND POWER.

Through its \$75 million Future Energy Systems research initiative, University of Alberta researchers will have the chance to put cutting-edge equipment to the test. The Fraunhofer-Gesellschaft, Europe's largest organisation of its type, specialises in technologies for real-world applications. The

new platform will support joint projects that develop new energy technologies including biofuels, storage batteries, and alternative uses for CO₂. "These are new technologies that can directly benefit Alberta communities, and need to be assessed in the real-world," explains Dr. Amit Kumar, deputy director with Future Energy Systems and principal investigator on the joint Biobattery project, "Our expertise in life-cycle assessments and the unique testing opportunities with Alberta feedstock make us natural partners with Fraunhofer."

Energy from waste

The Technology Platform's first joint project is Biobattery, which will bring thermo-cata-

lytic reforming (TCR[®]) technology developed by Fraunhofer's Prof. Dr. Andreas Hornung to Edmonton. The TCR is a shipping-container sized pilot plant that can process a variety of wastes into three valuable products (bio-oil, char, and gases) at a rate of 30 kg/hour.

"Depending on the situation, the TCR[®] unit could power itself with one of those products, while we utilise the others. With the correct feed stock, it could even produce viable jet fuel," explains Hornung.

The Biobattery project will test a variety of Alberta feed stocks such as municipal, agricultural, and forestry waste. The Government of Alberta's ministry of Economic Development and Trade, Alberta Innovates, Susteen Technologies Canada, and WestJet have joined Future

Waste as an Energy Source

The Path to a Low-Carbon Economy

The goals agreed at the 21st United Nations Climate Change Conference (COP21) in 2015 are an ambitious call for action: the aim is to keep global warming below 2 °C. For this to happen, the emission of greenhouse gases will have to be completely halted between 2045 and 2060, and the production of CO₂ reduced to levels that can be absorbed by natural photosynthesis. According to current studies, this will entail stopping the burning of fossil fuels entirely from 2040 and switching completely to renewable sources of energy.

However, it is not just industry and transport that are responsible for imbalances in the carbon cycle: landfill sites currently account for around 8% of greenhouse gas emissions. Amid rising population numbers and the resultant volumes of waste, this number is also set to increase – experts expect waste volumes to reach 2.2 billion tonnes by 2025, producing 1200 million tonnes of CO₂-equivalent greenhouse gases.

Sustainable waste management thus has a direct bearing on the global climate. Swiss cleantech company Hitachi Zosen Inova (HZI) is committed to addressing this issue with a product portfolio com-

prising a range of complementary energy-from-waste (EfW) technologies. HZI has also begun operating in the power-to-gas segment this year, thus making a key contribution toward a low-carbon economy.

In many parts of Europe, recyclables are collected separately, with the residual waste then processed in EfW plants. This offers a range of advantages. It reduces or completely eradicates the need for landfill, cuts greenhouse gases, and protects the human habitat from contamination.

First-class grate incineration, flue gas treatment and material recovery technologies ensure the smooth running of plants and the environmentally friendly conversion of waste into energy, which is then fed into the grid as base load power to supply a large number of households with electricity or district heating.

A modern EfW plant can deliver enough district heating from a tonne of waste to replace around 240kg of oil, for example, or generate 800kWh of electricity – enough to light an average household for a year.

In addition to renewable base load power from EfW plants and hydro power facilities, biogas plants round out the energy generation portfolio: HZI's

Kompogas[®] plants convert green waste and biowaste into high-grade compost and fertilizer, and also into biomethane, a storable fuel that can be used on demand. This renewable biomethane thus replaces fossil fuels. A tonne of green waste is the equivalent of around 60 litres of fuel, enough to cover a distance of some 1000km. It can also be used to generate 220kWh of power.

Variable energy resources such as solar and wind often generate more power than is actually needed. The Etogas power-to-gas technology harnesses these peaks in renewable energy to produce synthetic natural gas at cheap rates from surplus energy. This is made storable and can be used flexibly and on demand by feeding it into the gas grid or converting it back into electricity. Together with pumped-storage power plants, power-to-gas technology is an effective means of regulating grids.

The 2015 Paris Climate Change Conference marked a major step toward achieving energy transition worldwide. By continually developing its own technologies within a renewable energy economy, Hitachi Zosen Inova is playing an important role in achieving this goal.

Energy Systems and the University of Alberta as partners on the project.

Underway

Fraunhofer has already begun testing the technology in Birmingham, UK. However, in Alberta there are hopes that the TCR could allow decentralised communities to turn local waste products into energy, although its practicality will vary across the province.

“The business case for a TCR unit is highly dependent on what waste products are readily available in a given area,” Kumar says. “Our research will assess Alberta waste products to see which ones produce viable fuels, so we can understand what characteristics a community would need for this technology to make economic and environmental sense.” The TCR test unit is expected to arrive in Edmonton in

2018. One week prior to the signing of the contract in Munich, the Canadians visited the Energy Institute at the University of Birmingham in England together with Prof. Dr. Andreas Hornung.

Other Technologies

According to the University of Alberta, plans are developing for another project bringing Fraunhofer-developed vanadium redox-flow battery technology to Alberta for testing. Redox-flow batteries are intended to support renewable power installations, allowing intermittent energy from sources like solar and wind to be temporarily held for later use.

“We have been exchanging knowledge and ideas for several years, and through the signing of the contract, we can further expand our strategic partnership with Canada,” concludes Hornung. —

“THIS AGREEMENT ESTABLISHES A PLATFORM UPON WHICH MANY FUTURE ENERGY TECHNOLOGIES CAN BE DEVELOPED FOR USE IN CANADA, GERMANY, AND AROUND THE WORLD.”

Dr Andreas Hornung

deputy director with Future Energy Systems

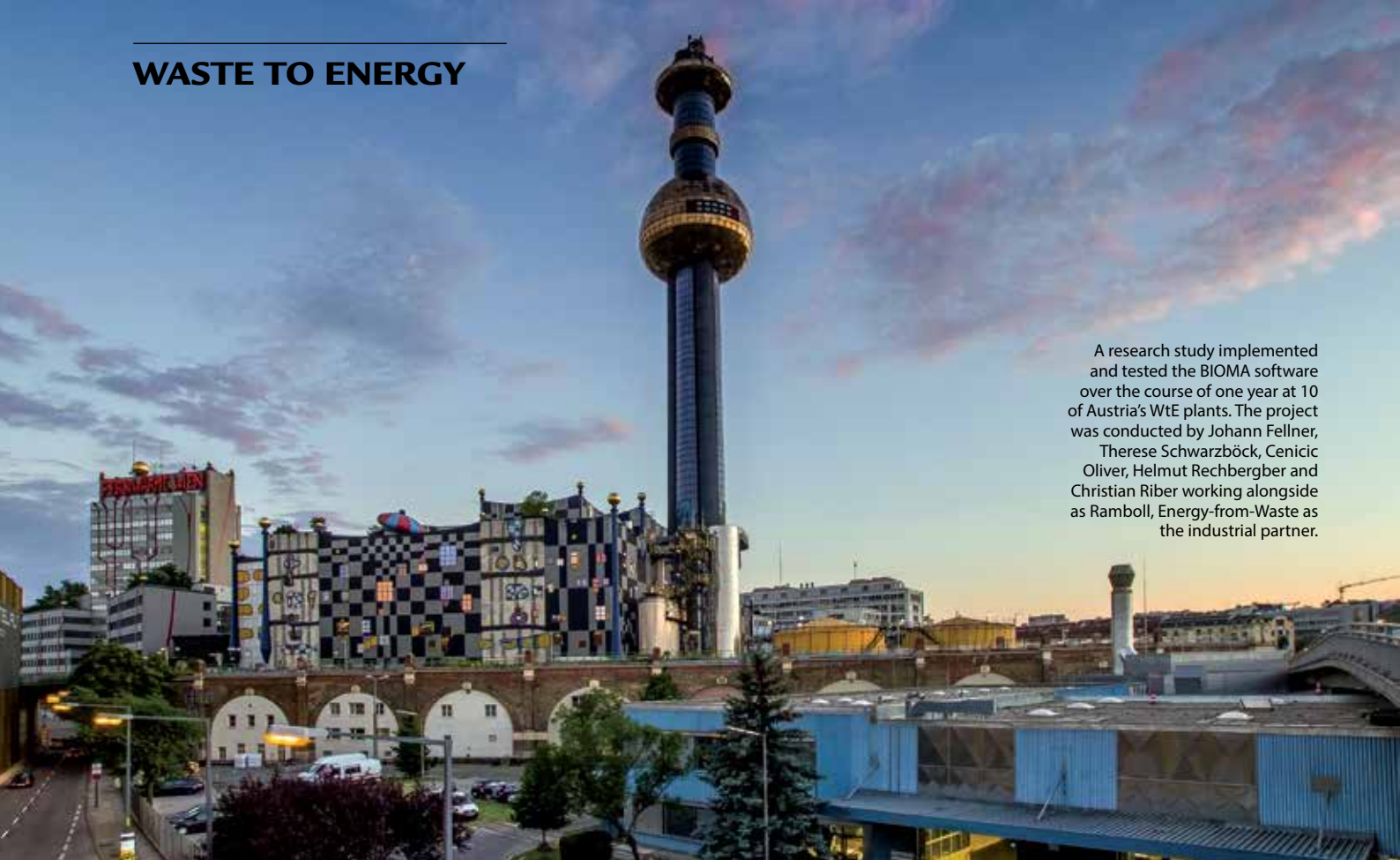
Leading environmental technology and engineering solutions provider for the Waste-to-Energy industry



Keppel Seghers

Solutions for a Cleaner Future

Keppel Seghers Belgium N.V. • Hoofd 1, 2830 Willebroek, Belgium • info@keppelseghers.com • www.keppelseghers.com



A research study implemented and tested the BIOMA software over the course of one year at 10 of Austria's WtE plants. The project was conducted by Johann Fellner, Therese Schwarzböck, Cenic Oliver, Helmut Rechbergber and Christian Riber working alongside as Ramboll, Energy-from-Waste as the industrial partner.

REAL-TIME CO₂ FOSSIL MONITORING

With the variable nature of MSW, and the large sums of money involved in running costs and emission taxes, the value of accurate real-time data on fossil and biogenic CO₂ emissions can be worth hundreds of thousands per year. BIOMA's here to help.

By Johann Fellner

Operators of Waste to Energy (WtE) plants are increasingly required to monitor the composition of their waste feed with respect to biomass and fossil organic matter. The mass fractions of both materials are not only of relevance for the amount of fossil and thus climate-relevant CO₂ emissions of the plant, but also for the ratio of renewable energy recovered since biomass in wastes is a renewable energy source.

In recent years different methods, including manual sorting, selective dissolution, the radiocarbon method and the Balance Method have been developed to determine the biomass content of waste. Among the various methods, the Balance Method, which is based on a distinctly different elemental composition of biogenic and fossil organic matter, has been

proven to be practical for a continuous monitoring of the biomass content in the feed of WtE plants.

One of the main advantages of this method is the fact that it is solely based on routinely recorded operating data of WtE plants, which avoids the need for additional sampling and measurement efforts.

In recent years, the concept of the Balance Method has been standardised (ISO 18466:2016) and implemented in the BIOMA software - a user-friendly application which provides real-time information for the operators.

So far, the software has been applied in more than 40 WtE plants in Europe, mainly to report the amount of fossil CO₂ for emission trading or the amount of renewable energy recovered. However, BIOMA has a large untapped potential in addition to the typical applications

in the area of performance monitoring. In a recent research study, the software was tested for 1 year at all operating WtE plants in Austria to determine the sector's contribution to Austria's CO₂ inventory on behalf of the Environmental Protection Agency. Besides these results, the application of the software provided further outcomes beneficial for the operators of the WtE plants, which are presented within this article.

BIOMA

The BIOMA software utilises the Balance Method, which combines data on the elemental composition of moisture- and ash-free biogenic and fossil organic matter with routinely measured operating data of the WtE plant to determine the composition of the waste feed. In principle, the method is based on one energy and five mass balances, whereby each balance describes a certain waste characteris-

tic such as organic carbon content, lower calorific value, ash content, etc.

Prior to solving the set of balance equations for calculating the waste feed composition in terms of such contents as water, inert, biogenic and fossil organic matter, the operating data of the plant are checked regarding their plausibility. There, too, correlations between flue gas (volume and composition) and the steam production are used. BIOMA reports operating data which are outside the expected limits of these correlations and excludes them from further calculations.

DETECTION OF ERRORS IN THE PLANT OPERATING DATA RECORDED

Based on the plausibility checks implemented in the software, errors were detected in the operating data recorded at the WtE plants. Besides "wrong" flue gas volume measurements, data transfer errors and conversion errors (e.g., related to

Table 1:
Input data are required by the software

Operating data of the WtE plant - preferably hourly values	Elemental composition of the "pure" biogenic and fossil organic matter
Mass flow of waste feed	Ranges for contents of C, H, O, N, S and Cl (derivable from literature data)
Mass flow of auxiliary fuels	
Mass flow of solid residues (Bottom ash, fly ash)	
Volume and composition (O ₂ and CO ₂ content) of dry flue gas	
Steam production (incl. pressure and temperature of steam and feed water)	
Boiler efficiency	

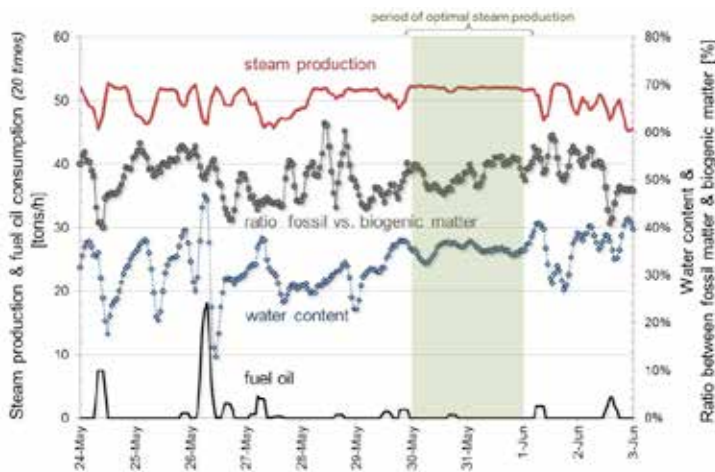
**We Are Closing the Cycle:
Your Expert Partner for Thermal and Biological Energy-from-Waste Plants**

**Hitachi Zosen
INOVA**

Our solutions are based on efficient and environmentally sound in-house technology, and cover the entire life cycle of an Energy-from-Waste facility. Our proven technologies have been part of more than 700 plants worldwide. As a global leader in energy from waste we are proud to be able to say: We deliver. Check our references.

Waste is our Energy www.hz-inova.com

Figure 1: Hourly Averages



Hourly averages for steam production, fuel oil consumption, water content and ratio between fossil and biogenic matter in the waste feed for a period of 10 days.

11 % O₂ or dry vs. wet flue gas) have also been identified at different plants and could subsequently be corrected.

In the results of the plausibility tests from one plant as an example, it can be seen that a large share of the data points displayed are outside the theoretically plausible band. It is observed that both O₂ consumption vs. calorific value and C-content vs. calorific value exhibit a similar pattern, with data points lying outside the theoretical band.

Based on this observation, it can be concluded that the flue gas volume measurements at the plant are implausibly high for a certain period and are very likely faulty. Plant operators use the flue gas flow to evaluate air ingress, to calculate facility efficiency and, in some Member States, to pay emission taxes. Big errors in the flue gas flow might result in incorrect tax payments, faulty efficiency estimations and biased conclusions on the air ingress at the facility.

CLIMATE RELEVANT FOSSIL CO₂ EMISSIONS

All operating data from the plants classified as plausible are used to calculate the composition of the waste with respect to the content of biogenic and fossil matter. On this basis, BIOMA determines the amount of fossil and thus climate-relevant CO₂ emissions for any time period of interest. The results in-

“LARGE VARIATIONS IN WASTE COMPOSITION ARE MOST PROBABLY A CONSEQUENCE OF INSUFFICIENT MIXING OF THE WASTE RECEIVED, WHICH GOES ALONG WITH VARYING AND THUS ALSO REDUCED STEAM PRODUCTION.”



Johann Fellner
is Chair of ISWA's Task Force on Science

dicating large temporal variations in the specific CO₂ emissions, which are even more pronounced when daily values are considered. Furthermore, significant differences in the feed of the different plants are observable, resulting in specific CO₂ emissions ranging from 25 (plant C) to almost 55 kg CO₂/GJ. These significant differences indicate that the usage of generic emission factors for emission trading or national inventories may result in considerable over or underestimations of fossil CO₂ emissions.

RATIO OF ENERGY FROM RENEWABLE BIOGENIC SOURCES

Besides the fossil CO₂ emission, the software also determines the share of energy from biogenic sources. This information is of particular interest for incineration plants producing electricity as, on the one hand, they are obligated to label the electricity put on the market and, on the other hand, they may acquire a higher feed-in tariff for electricity produced from biogenic and thus renewable sources.

CONTENT OF PLASTICS IN THE WASTE FEED

BIOMA also allows the amount/content of plastics in the waste feed to be assessed. Results for the mass fraction of fossil matter in the waste are thereby combined with generic data on the content of inorganic additives in plastics.

Information about the amount of plastics sent to thermal recovery are of interest for waste authorities for different reasons. First of all, these data allow the performance of waste plastics collection schemes in place to be evaluated by comparing the amount of plastics separately collected to the amount collected via commingled waste. Secondly, continuous information about the amount of plastics in the feed of WtE plants enables trends in waste plastics generation to be analysed. And thirdly, the overall potential for plastics recycling becomes evident.

INFORMATION ABOUT MIXING OF THE WASTE FEED

The software can also be used to assess the performance of the waste crane op-

erator with respect to the mixing of the waste in the receiving bunker. Figure 1 shows an example of hourly averages for steam production, consumption of auxiliary fuel oil as well as the water content of the waste and the ratio between fossil matter and biogenic matter for a period of 11 days for one plant.

The temporal trend of these four parameters clearly indicates that within the time period of May 30 until June 1 the plant yielded the most constant and thus also the highest rate of steam production, which was also associated with the highest rate of waste throughput (16.2 t/h).

During these two days the water content as well as the ratio of fossil and biogenic matter in the waste feed exhibited comparatively small variations, indicating perfectly adequate mixing of the waste prior to its combustion. In contrast, the time periods before May 30 and also after June 1 were characterized by significant changes in waste composition.

Furthermore, the consumption of auxiliary fuels (40 vs. 1.8 kg/h) increased and waste throughput decreased (14 vs. 16.2 t/h) during the times of highly variable waste composition. Translating all these effects into economic terms reveals that the overall income losses and additional costs for the operator caused by insufficient waste mixing amounted to almost €50,000 for a period of less than 8 days.

The software allows these losses to be avoided, or at least significantly reduced, as it provides the possibility for real-time monitoring and control of the waste mixing in the receiving bunker. Insufficient mixing is detectable by the software and can be reported to the personnel operating the waste crane continuously.

CONCLUSION

Based on the results obtained by utilizing the software in different WTE plants, it is estimated that the potential savings/additional income for plant operators is in the range of several hundred thousand Euros per year.

BIOMA might assist realisation of that part of this significant potential that can be influenced by means of improved crane operator performance. —

MIRCOVER.NET



THE HOK® SOLUTION

- Solution for waste gas treatment -



HOK® Activated lignite. Flue gas adsorbent and catalyst.
 First choice for gas cleaning in refuse and special waste incineration and metallurgical processes.
 Substantial reduction of dioxins and furans.

Sometimes, a single, well-considered decision is all it takes: for the benefit of your company, for the good of the environment.

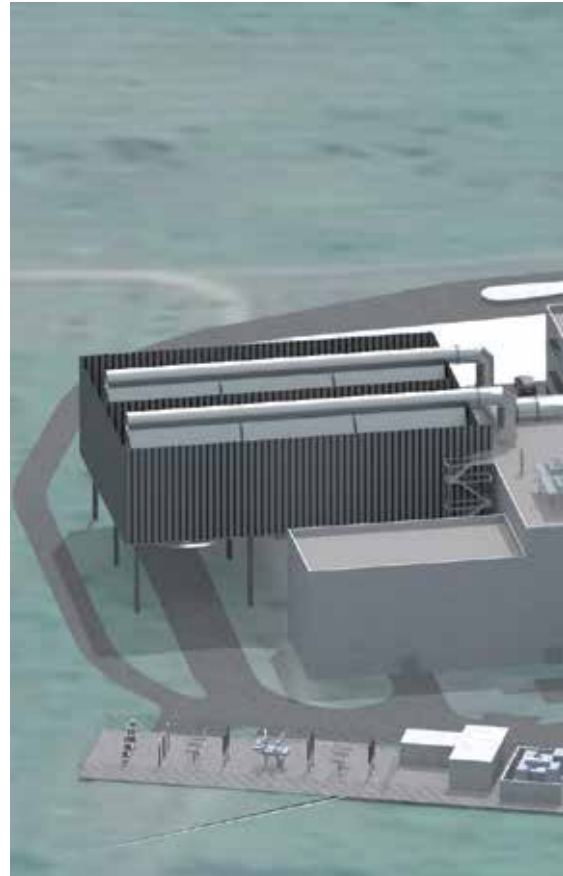


Rheinbraun Brennstoff GmbH | D-50416 Köln
 Tel.: +49 221-480-25424 | www.hok.de

SUEZ CLEANS UP IN SERBIA

In January 2015, Belgrade issued an Invitation for Expressions of Interest in a proposed PPP to develop waste treatment, recycling, and energy recovery facilities. Advised by the IFC, the City recently selected a consortium composed of SUEZ and Itochu to deliver the project.

By Ben Messenger



“THE PROJECT IS SOLVING A MAJOR ENVIRONMENTAL PROBLEM FOR THE COUNTRY - THE ENVIRONMENTAL IMPACT OF THE EXISTING LANDFILL.”



Fabrice Rossignol
CEO SUEZ Italy, Central & Eastern
Europe and CIS

Home to the largest dumpsite in Europe still in use, Serbia’s capital city Belgrade has turned to French environmental services firm SUEZ as it looks to clean up its waste disposal.

Following a competitive bidding process, SUEZ has secured the largest PPP contract in the country so far to build a new waste to energy plant and a C&D waste recycling plant. As part of the 25-year deal, the firm will also build a new waste disposal facility and take on the significant task of remediating the old Belgrade municipal waste site. Through a Special Purpose Vehicle with its partner ITOCHU, SUEZ will also be responsible for financing, construction and the long-term operation of the new facilities.

Fabrice Rossignol, CEO SUEZ Italy, Central & Eastern Europe and CIS, explains that the bidding process was “very

complex but Public-Private Partnerships are among the best solutions to combine technical, financial and contractual performance”. Therefore,, as part its Cities Initiative, the International Finance Corporation (IFC), a member of the World Bank Group, advised the city of Belgrade on structuring and implementing the PPP.

“The Belgrade Waste PPP is a landmark and pathfinder project for a region which has huge investment needs in infrastructure, in particular in the environment sector” says Marie-Ange Debon, senior executive vice-president at SUEZ in charge of International.

HEAT & POWER

Under the agreement, SUEZ and ITOCHU’s SPV will raise over €300m to build a 340,000 tonne per year combined heat-and-power waste to energy facility.



Belgrade's new waste to energy plant will be able to operate with a single line thanks to the proximity of a new waste treatment facility. Its grate technology will also future-proof it against changes to waste composition.

Once operational, it is expected to generate 25 MW of electricity 56 MW of heat.

When it comes to waste composition, Rossignol explains that it's not so different to that being processed by similar plants in Western Europe, but there is a bit more moisture and less packaging than in more developed countries.

The electricity is to be sold to the grid, while the City of Belgrade will take the heat for its district heating system, which currently meets 86% of its energy requirements using natural gas.

Being a 25-year contract, there is always the potential that the waste stream entering the plant may change over time. Rossignol explains that that was one of the reasons behind the choice of combustion technology. "We're talking about a fairly classical grate incineration plant, so the grate can take anything," he says. The combustion and emissions techno-

logy are being carried out by French firm CNIM, which will also manage construction of the project alongside Serbian construction company Energoprojekt.

OUT WITH THE OLD

In use since 1977, Vinča landfill is the largest in the Belgrade area. It's been receiving around 2700 tonnes of waste every day for years, with little by way of environmental control. In June this year, a fire at the site burned for over a month causing alarm over air pollution among residents.

"We're going to build a waste disposal facility in line with European standards and rehabilitate the old dump," says Rossignol. "It's a huge dump with leachate going straight into the Danube. We will have to excavate the waste and move it. It's quite a complex remediation project, with a significant investment involved. For that we rely on our know-how, but also on local companies."

"From a technical point of view, the beauty of the project is that we can do one line [at the waste to energy plant] for all 340,000 tonnes, which is not usual," he continues. "The fact that we can do it with only one line is due to the fact that there will be a landfill. When you close the line for maintenance, you need to have a place for the waste. Also part of the project is to collect the landfill gas and recover heat and energy."

THE FUTURE

While the contract also includes the construction and operation of a facility to process 200,000 tonnes of C&D waste per year, it does not include dedicated municipal waste recycling infrastructure.

According to Rossignol, while the city is not developing an MRF for municipal recycling right now, a significant quantity of the available recyclable materials are collected by the informal sector at source. However, he does expect a more formal approach to the collection and sorting of recyclables in the future, but says that at the moment the focus is on diverting waste away from a highly polluting dumpsite and ensuring that what is landfilled is done so at a sanitary facility. —

FACTS

56

Waste to energy facilities already operated by SUEZ

€ 300 MILLION

Financing to build a 340,000 tonne per day waste to energy facility

2021

Expected opening of the new waste to energy to be operated by SUEZ for 25 years

60 HECTARES

The Vinča landfill is among the world's 50 largest and currently pollutes one of Europe's most iconic rivers



Once again the Italian resource and renewable energy industries gathered in Rimini for the annual Ecomondo exhibition. One of the key focuses of this year's show was the Bioeconomy, for anyone interested in the sector it did not disappoint.

ECOMONDO, ISWA AND INTERNET OF THINGS

With attendance rising to 116,131, this year's Ecomondo was certainly busy.

Central to the event this year was the concept of the Circular Economy and the 4th Industrial Revolution. A number of presenters and exhibitors, including ISWA, made important presentations on the topic.

By Ben Messenger

Exhibiting at the substantial 113,000 square metre Rimini Expo Centre were some 1200 organisations of all types with over 200 events taking place. This year's show was opened by the States General of the Green Economy, an organisation promoted by the Italian National Council of the Green Economy. It is made up of 66 business organisations that represent the green economy in Italy and it works in collaboration with the Ministry of the Environment and the Ministry of Economic Development.

"We must try not to conceive different economies any longer. The 'green' economy is the only one possible if we want to look to the future," Luca Galletti, Minister for the Environment, said at the opening.

Echoing the sentiment was Italian Exhibition Group President Lorenzo Cagnoni, who added: "The circular economy is the common denominator of every idea of development, with great results also in social terms, and the expos were able to interpret, in the concreteness

of knowledge, experience and business, what is happening in the world."

THE ROLE OF BIOWASTE

Playing a major part in the Circular Economy, the role of the bioeconomy was in the spotlight at Ecomondo. At an event organised by the Ecomondo Scientific Committee and chaired by Professor Fabio Fava, the audience heard from a number of high-level speakers about the huge potential for growth in the industry.

Open Source Circular Economy (OCSE) representative James Philip explains that all the G7 nations have their own national strategies connected with bioeconomy and so far there are about 50 countries worldwide that have one, or have begun work on the matter.

"Italy is an interesting area, with numerous possibilities," he tells the crowd. "As opposed to other European countries, the bioeconomy is applied to numerous sources: domestic waste, but also agriculture, forests and the maritime sector.

There is interesting interconnection between circular economy and bioeconomy to be found here in Italy and it is also for this reason that I am here at Ecomondo.”

Philippe Mengal, executive director of the BBI JU, the European Union’s public-private €3.7 billion joint undertaking dedicated to developing the bioeconomy in Europe, also addressed the audience.

“The sector’s critical situations can be overcome by means of the development of the bioeconomy,” he says. “It’s sufficient to think of the use of hay, which, rather than waste, can be considered an important raw material. The BBI JU European initiative helps to carry this development forward, maintaining it in the respective countries and creating jobs.”

NEW BIOMETHANE-TO-GRID PLANT

Underlining Italian commitment to the bioeconomy, Sebigas – a division of the Maccaferri Industrial Group focused on

“THE BIOECONOMY IS REPORTING DOUBLE-DIGIT GROWTH FIGURES IN EUROPE AND REPRESENTS A GREAT OPPORTUNITY.”



Philippe Mengal
executive director of the BBI JU

biogas – used the event to announce a new 55,000 tonne-per-year biomethane plant in Sarmato.

The facility is specifically designed for the energetic valorisation of organic waste, with the company guaranteeing a production of over 600 cubic metres of biomethane per hour, 5.3 million cubic metres per year. The biomethane produced will be injected into utility firm SNAM’s natural gas grid at a connection located near the plant. It has been developed on behalf of family-run Italian waste firm, Maserati Energia Srl.

With the assistance of a technology partner, Sebigas says that it has employed a membrane-based cleaning and separation system for the conversion of biogas into biomethane. Thanks to the different pressure between the two sides of the hollow fibre membrane, across three different stages, the raw biogas is refined in biomethane, eliminating carbon dioxide,

www.acichemical.com



Air Ballistic Separator



One stop separator
Combined Separator of
Air Dynamics and Ballistics
One machine separating the waste into 5 categories.

SURVEY RESULTS

97%

Believe that the waste industry will be affected by technology

57%

Know "something" about the 4th Industrial Revolution, 14% know "a lot"

30%

Think drones will be collecting recyclables by 2030

80%

Are confident of fully robotic waste sorting by 2030

25%

Believe the 4th Industrial Revolution will make the Circular Economy a reality for consumer goods.

69%

Expect a Circular Economy for plastics by 2030

water, oxygen and sulfured hydrogen.

This high-pressure procedure requires a lower compression of the gas before the injection in the grid, which makes the management of the plant simpler and improves the ratio between costs and advantages. To reduce the environmental impact of the plant, Sebigas integrated it with a post-treatment technology that requires a series of different stages, starting with the separation of the solid and liquid fraction resulting from the anaerobic digestion process.

The liquid fraction is subjected to ultrafiltration and inverse osmosis together with an evaporation phase with triple effect for the osmosis concentrate. The result is a clean effluent suitable for river discharge. The solid fraction is sent to the existing composting facility to produce quality compost. "The plant," says Roberto Salmaso, deputy general manager at Sebigas, "represents one of the first integrated sites for the management, treatment and upgrading of organic waste in Italy, and it is an example of a virtuous circular economy replicable for different public and private entities."

Arch. Paolo Maserati, from Maserati Energia srl added: "Maserati Energia wanted to create a circular economy system that could completely exploit the 'resource' waste for the contemporary production of electrical energy and compost, reducing leftovers and management costs." "Replacing the cogeneration units with an upgrading system for the production of biomethane represents a further

improvement and valorisation of our project," he concludes.

SMART CITIES: AMERICAN LESSONS

With societies around the world becoming increasingly urbanised, another key to the circular economy is the implementation of 'Smart Cities'. It's a topic that was covered in depth at a flagship event, Circular & Smart Cities, at which engineers and administrators from the US cities of Portland, Oregon, and San Leandro, California, shared their experiences.

The participants elaborated on the application of circular economy concepts in an urban environment, supported by increasingly advanced technologies such as the Internet of Things and Big Data analytics.

"As well as being model cities for sustainability solutions, Portland and San Leandro play an important role in the implementation of the Global Cities Team Challenge (GCTC)," explains Professor Gian Marco Revel of the Ecomondo scientific committee. "The government Smart Cities program launched in the United States by the Obama administration favours the implementation of advanced solutions, mainly based on the Internet of Things at urban level."

Portland has a population of almost 600,000 and is the 28th most populous city in the US. Kristin Tuft of Portland State University adds: "The county of Multnomah has been working for some time on environmental sustainability, for renewable energy and the reduction of carbon emissions. The 2015 climate ac-

WEEE CAN DO IT: EFFECTIVE PRE-SHREDDING WITH ERDWICH



IERC
2018

Visit us at IERC 2018
in Salzburg
Booth 8

**SHREDDING MACHINES
& RECYCLING PLANTS
FOR E-SCRAP**

ERDWICH
... SHREDDING UNLIMITED ...

- Boilers
- Washing Machines
- Refrigerators
- Copiers & Printers
- other E-Scrap

www.erdwich.com

tion plan foresees the reduction of local carbon emissions by 80% and reaching 100% use of renewable sources by 2050.”

ISWA AND THE INTERNET OF THINGS

As a key enabler of the Circular Economy and the Fourth Industrial Revolution, a hot cross-sector topic at the moment is the Internet of Things (IoT). It’s a subject close to the heart of Carlos Silva, ISWA vice president. Presenting the results of ISWA’s recent Global Survey on the Impact of the Fourth Industrial Revolution in Waste Management and Recycling, he explains that “those who continue to insist on the traditional model, will not be in the market beyond the next 15 years”.

“We are living in a new era,” he says. “We are living in an era of intense communications. We are living in an era of intense waste generation. To illustrate it, we have waste on the highest point of our planet, on Mount Everest, and we have

waste at the deepest point on our planet, in the Mariana Trench. Wherever we are, we find different types of waste.”

For more than 80% of the 1000+ respondents, the 4th Industrial Revolution will make the circular economy a reality for most of consumer goods. Around 50% of respondents cited mobile apps, new sensors, social media and big data as drivers to attract most of the investments during the coming years.

According to Silva, the Circular Economy will never be possible without the advances of the Fourth Industrial Revolution. However, it will also accelerate resource depletion and create more difficult and complex problems, more irreversible damages if it goes on without a Circular Economy. “The Waste Management Sector,” he says, “has the opportunity to steer towards Circular Economy, redefining its business models using the advances of Industry 4.0.” —

“THE INTERNET OF THINGS IS ALREADY A REALITY IN SAN LEANDRO.”



Pauline Cutter
mayor of San Leandro




HAMMEL®
RECYCLINGTECHNIK



www.hammel.de

WE SHRED FOR YOU
shredding | screening | sorting | conveying

HAMMEL Recyclingtechnik GmbH
Leimbacher Str. 130 • 36433 Bad Salzungen
+49 (0) 3695 6991-0 • info@hammel.de

Kemetco demonstrated the extraction of 100% of lithium, cobalt, nickel, and manganese from cathode powders used in LCO, NMC, NCA and LMO batteries.



ELV BATTERY RECYCLING READY TO BOOM

You don't need a crystal ball to realise that the automotive industry is going electric. Driven by significantly improved battery performance, the sale of electric cars is on a steep upward trajectory. However, with early models already reaching end-of-life, the the number of batteries entering the waste stream is set to boom. Surrey, British Columbia, based American Manganese Inc. (AMI) sees the recycling of cathode materials as a significant opportunity.

Cathode materials comprise approximately 25% of the value of lithium-ion battery packs and there is increasing demand for cathode raw materials, namely cobalt, as well as other raw materials such as lithium, nickel, manganese and aluminium - but from an inelastic supply chain.

According to the Cobalt Development Institute, with 94% of global cobalt supplies coming from nickel and copper mines which produce it as a by-product, increasing production in response to growing demand is not practicable. Increasing supplies from secondary sources could then prove lucrative.

In addition, environmental regulation, as well as voluntary environmental stewardship by socially conscious companies, is expected to add to the demand for recy-

clad materials for the production of lithium-ion batteries.

"The cathode metal markets continue to be robust, especially cobalt at \$61,000/tonne, lithium carbonate at \$12,000/tonne, with nickel up 35% in the last 60 days to \$12,000/tonne," explains Larry W. Reaugh, president and chief executive officer of American Manganese. "This bodes well for AMI's recycling opportunities."

RIPE FOR A REVOLUTION

In a bid to plug the looming crunch between supply and demand with secondary sources, AMI is developing what it claims to be a "revolutionary" hydrometallurgical closed-loop recycling process.

To prove its concept, the company turned to independent scientific research firm Kemetco Research Inc. to conduct a testing programme. According to AMI, in bench tests Kemetco demonstrated that, using the technology, leach extraction of 100% is possible for lithium, cobalt, nickel, and manganese from cathode powders used from LCO, NMC, NCA and LMO cathode chemistries.

Seven leach tests were conducted with a range of conditions. The time required to extract these metals ranged from 30 to 120 minutes, depending on the leaching conditions. The company says that the bench scale research program, initiated in

With the number of electric and hybrid cars reaching end-of-life set to grow exponentially, it is increasingly important to find a clean, closed-loop recycling method for lithium-ion battery packs. Canadian firm American Manganese may have the solution.

By Ben Messenger

2016, has now been successfully completed by Kemetco Research. It has also produced rechargeable lithium ion cobalt and lithium nickel manganese button cell batteries from its recycled cathode material. As such, in November this year, AMI filed its Non-Provisional Patent Application for recycling lithium ion battery cathode material with the United States Patent Office.

INDUSTRIAL SCRAPS

As it looks to monetarise its technology, one opportunity the company is exploring is recycling unused cathodes rejected in the manufacturing process. Up to 10% of manufactured lithium-ion battery cathodes are rejected as ‘scrap’. These consist of the aluminium foil backing and the cathode metal powder AMI believes could be recycled into usable cathode material using its process.

As part of this effort, in early 2018, AMI intends to build and begin operating a pilot plant for continuous recovery of cathode material, with the ability to scale up and design a full-scale recycling plant. Construction of a hydrometallurgical plant capable of recycling scraps would have a number of advantages over recycling spent lithium-ion batteries:

- Up to 4000 tonnes/year of cobalt recycled annually
- Other valuable cathode metals such as Ni, Al, Li and Mn also recycled
- Lower capital and labour costs as no disassembly of batteries required
- Demonstration of the process at commercial scale.

BRIGHT FUTURE

In the next phases of work, AMI will be conducting further work on technical opportunities that have been identified during the research program. The goal is to expand and strengthen its intellectual property portfolio and expand market opportunities. The Company also intends to initiate a pilot plant study.

“Over the next ten years, that usage is expected to increase to above 65%. With such a significant increase in anticipated demand, recycling is poised to be an important part of the supply solution to the emerging cobalt shortage,” concludes Reaugh. —

Automotive Shredder Residue



Road Sweepings & Gully Waste

Waste Glass



Materials Recovery Facility Fines

**HIGH-EFFICIENCY
SYSTEMS FOR YOUR
MATERIAL-RECOVERY
AND RECYCLING NEEDS**

Trommel Waste Fines



CDenviro
www.cdenviro.com

ISWA INFORMATION

Visit www.iswa.org for more information

Circular by Design

Björn Appelqvist, Chair of ISWA's Working Group on Recycling and Waste Minimisation

What does it take to go circular? How can we re-make and re-think the products of today into something more sustainable and circular? These were some of the questions we were asking ourselves in ISWA after having finalised our six-volume report on waste management and the circular economy.

One of the messages of our report was that all actors throughout the value chain have to work together to create change. To investigate further, we gathered a group of manufacturers, designers and waste managers around two specific and tangible cases: jeans and plastic packaging.

The idea was to try to see what new solutions and innovations could be developed by bringing these actors together, and to illustrate that we are stronger working together than separately. Since we were trying to explore what we could achieve together, we avoided policy issues – not because policy can't be a powerful change enabler, but because focusing on policy has a tendency to shift responsibility for doing something from ourselves to someone else.

What did we find out? We came up with five overall recommendations for

manufacturers wanting to go circular, and matched them with five commitments from the waste management sector to support that movement. You can find them at iswa.org/resource-management.

DEMAND

The concept of the circular economy was created in a time of booming material prices. It was thought that rising material value alone would be enough to drive the circular economy. However, material and oil prices have since fallen and material value alone is not a sufficient driver. The concept of the circular economy stayed with us, however, with progress driven mainly by policy-induced supply rather than market-driven demand - this is particularly true for fast-moving consumer goods and packaging. Recovery targets for household waste and landfill reduction targets are both examples of such supply-driving policy instruments.

A viable circular economy cannot be realised without strong and sustained demand. Supply of recycled materials is useless without demand for those materials. Waiting for the global battle for energy, water and fer-



tile farmland to drive the raw material prices to levels where sustainability will be good business in and of itself will lead to many more decades of unsustainable production and consumption, environmental degradation and human suffering.

When prices are finally high enough to induce behaviour change, it will most probably be too late. Therefore, we need to consciously and actively create demand: demand for sustainability, demand for secondary raw materials, demand for clean energy, demand for dematerialisation and demand for longer lasting products.

Such demand can be created by policy and law making, but also by good, old-school marketing - both



ISWA's six high level reports detail the challenges and opportunities of a shift away from a linear economy towards a circular one.



Björn Appelqvist, chair of ISWA's working group on recycling and waste minimisation presents the results of the reports at ISWA's recent World Congress in Baltimore.

rather than actively driven by with it. In the transition from the linear to the circular economy, as in all major shifts, there will be winners and losers – and now is the time to choose a side. Things will change – and we have to change, too.

COOPERATION

To make the circular economy a reality, traditional value chains and the way that actors in them cooperate need to evolve. Suppliers, manufacturers, designers, wholesalers and waste managers have to find new ways to interact and cooperate. We must all really listen to the customers, while ensuring that old dogmas don't hinder new and more circular approaches.

The designer's tool box has proven to be very useful, but designing for the circular economy is a sustainability street battle. It's a tough task that has to be taken on product by product, service by service while trying to defend positions won against consumerism and planned obsolescence counter-attacks. And while doing so, the three pillars of sustainability and more than 7.5 billion desires and ambitions have to be fulfilled. It won't be easy, but together we can make it.

Going forward, ISWA remains focussed on ensuring that the waste and resource management sector plays a leading role in establishing a circular economy, exploring in practical terms how modern production and consumption patterns can transition from linear to circular. —

disciplines must be pursued simultaneously. We all have to contribute: designers, manufacturers, waste managers, environmental NGOs and policy makers, because without demand, there will be no circular economy.

CHANGE

To create change we have to do things differently. Going from linear to circular calls for new ways to work together throughout the value chain. All aspects of our products, businesses and ways of doing things must be open to change - even aspects of the business that seem set in stone.

Change can be exciting, uncomfortable or scary, and change can be truly disruptive, particularly if it is forced upon a business by a changing world,

ISWA Calendar

4–6 DEC 2017

ISWA International Workshop on Landfill
Istanbul, Turkey ISWA

15–26 JAN 2018

Winter School on Sustainable Waste Management including Landfill & Landfill Mining
Arlington & Denton, Texas, United States ISWA

22–27 APR 2018

ISWA Study-Tour Collection – Sorting – Recycling
Vienna, Austria ISWA



For more events and details please go to www.iswa.org or scan the QR code.

UNITED ARAB EMIRATES



With GCC countries having among the highest rates of per-capita waste production in the world, sustainable waste management solutions are both critically important and a clear business opportunity. To meet this challenge Bee'ah has upgraded its huge MRF in Sharjah with the latest in sorting technology.

By Ben Messenger

In the UAE, Sharjah-based environmental services firm, Bee'ah, has begun processing municipal solid waste at its recently refurbished and upgraded Material Recycling Facility (MRF). With a capacity to process 75 tonnes per hour (tph) the facility is the largest in the Middle East, processing in excess of 500,000 tonnes of MSW annually. The retrofit, conducted by Eugene, Oregon-based Bulk Handling Systems (BHS), has transformed Bee'ah's MRF into the most advanced in the region, reaffirming the company's commitment to pushing the boundaries of environmental innovation.

"In years' past, our trommel based system was creating uneven size fractions and contamination through mixing. We were unable to effectively separate organic material from dry commodities, and were very dependent on manual sorting," explains Daker El-Rabaya, Bee'ah's managing director of waste processing and treatment.

The new system features recovery and recycling technology from BHS and its subsidiaries Nihot and National Recovery Technologies (NRT). El-Rabaya says that it's a big improvement and increases Bee'ah's capacity while automatically creating material fractions that were previously unattainable.

The plant's old trommel screens were replaced with two new BHS Tri-Disc screens, which have greatly improved screening efficiency, reduced power consumption, and allowed for better use of space. The new system has increased throughput, recovery of organic material and the recovery of other commodities including plastic containers. Plastic film recovery has doubled thanks to the FiberPure system, a combination of NRT optical and Nihot air technology.

"Screen and air technology effectively remove organics and inert materials early in the process to present segregated fibre and container line fractions," he says. "The technology has introduced Bee'ah to a new level of performance; we are very pleased with the results."

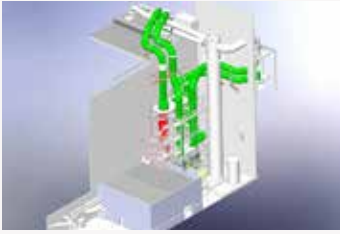
In addition to the new MRF, Bee'ah recently confirmed plans to team up with Abu Dhabi's based renewable energy company Masdar to build a 300,000 tonne per year waste to energy plant in Sharjah.

"Bee'ah is an innovative company, proactively adapting to new technology. The company's commitment to recovery and processing excellence is a benchmark for others to follow," says BHS CEO Steve Miller. "The system was already among the largest in the world, and is now among the most advanced." —

"WE ARE OPTICALLY TARGETING BOTH CONTAINERS AND FILM TO PRODUCE MARKETABLE PRODUCTS FROM A CHALLENGING MATERIAL STREAM."



Daker El-Rabaya
Bee'ah's Managing Director of
Waste Processing and Treatment



Upgrade of several Waste-to-Energy plants in Scandinavia



Waste-to-Energy and Anaerobic Digestion, Sri Lanka



Biomass to Energy Guide prepared for IFC



African Stockpile programme – obsolete pesticides. Mali, Tunisia, Morocco

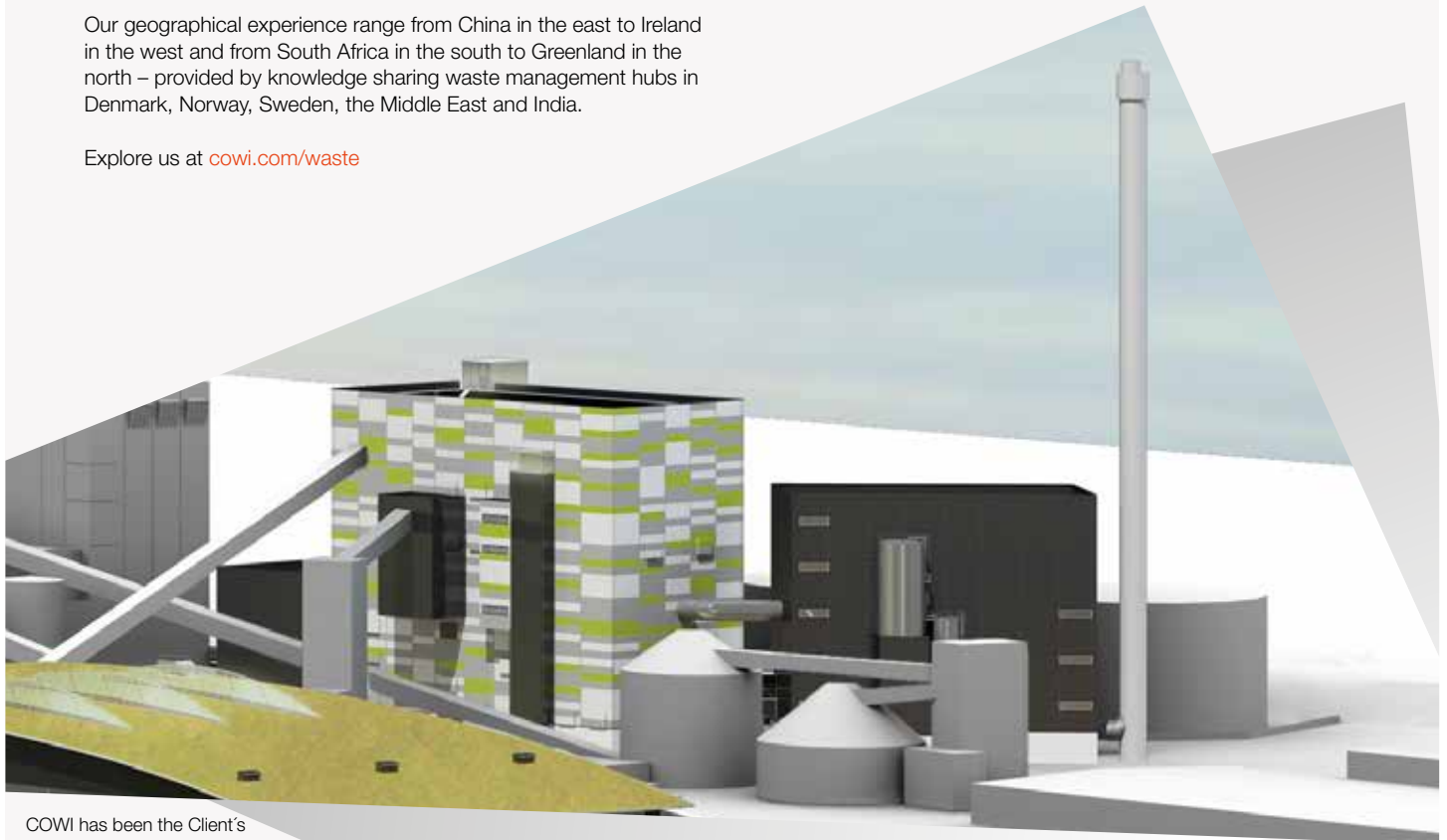
WHY WASTE RESOURCES AND ENERGY?

COWI combines our **global experience** based on cutting edge innovative and sustainable methods to create unique local solutions.

This is how COWI provides world class waste management and waste-to-energy solutions that includes all aspects of waste management – with a passion for resources and energy!

Our geographical experience range from China in the east to Ireland in the west and from South Africa in the south to Greenland in the north – provided by knowledge sharing waste management hubs in Denmark, Norway, Sweden, the Middle East and India.

Explore us at cowi.com/waste



COWI has been the Client's Advisor at the construction of the world largest fluidized bed boiler for RDF in Västerås in Sweden. The plant was successfully commissioned in 2014.

You'd have to be Sherlock



to find any waste left

Babcock & Wilcox Vølund's DynaGrate® is one of the most advanced combustion grates available to service the waste-to-energy and biomass markets. Its design is based on more than 40 years of R&D and provides excellent fuel flexibility and performance, with the added benefit of low operational and maintenance costs. Designed to process ever changing waste streams, it can efficiently combust all types of untreated waste, so you will find it difficult to find any waste left after the combustion process.

B&W Vølund has a significant amount of operational experience with the DynaGrate®. In addition to the significant savings on maintenance costs, customers will also benefit from operational hours in excess of 8000 per annum, a minimum of 18 months between major stops, and there being no need to undertake any pre-treatment of the fuel. These are all significant cost benefits for your project.

There's much more to be said. Find out by contacting us at sales@volund.dk or visit volund.dk

BABCOCK & WILCOX VØLUND

TEL +45 7614 3400 | SALES@VOLUND.DK | VOLUND.DK

B&W
vølund