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Recycling Is A Necessity!

Some weeks ago, media of many countries reported about the results of a study which was conducted by US-based Orb Media Inc., a team of journalists, structured as an US-based non-profit organization. Their investigation showed that plastic fibers were found in more than 80 percent of tap water samples – worldwide. According to the information, the highest amount of microplastics was found in the USA (94 percent of samples) and the least in Europe (72 percent of samples). "The only way to keep plastic out of the air, water



and soil is to radically rethink its design, uses, sale and disposal," Orb Media says and refers to ways to solve this problem, including circular economy and wasteto-energy.

Kate Bailey, project director of US-based Eco-Cycle Solutions, feels that recycling is the "awkward fifth wheel at the sustainability party". While sustainability, climate resilience and circular economy would continue to gain momentum, "the importance of recycling, and its relevance to all these issues, seems lost," she wrote into the company's blog. "Check out the agenda of any major environmental or sustainability conference and you'll be hard pressed to find a single session on recycling." She is convinced that recycling is essential for solving some of the greatest issues of our time: It is one of the best ways "to save energy in the extraction, processing and manufacturing of products and packaging" – and creates jobs.

But there is another development that could interfere with recycling: China, one of the largest economies of the world, has put an import ban on plastic scrap. This has caused a chain reaction of impacts on the plastic recycling industry, affecting not only the recyclers in China, but also other exporting countries. About 5 percent of Chinese recyclers would switch to recycling of domestic plastic waste which could be pursued only by large firms, another 5 percent were considering to move their operations to other parts of the world, information provided by the media said. "About 80 percent of recyclers have to remove themselves from the market", a Hong Kong based company cited a report.

China's import ban applies to recovered paper as well. As reported by the "South China Morning Post" in mid-September, Hong Kong's exporters warned of a wave of business closures in the next few months as they began a strike – which was initially planned to last for at least a week but ended five days earlier – over import restrictions in mainland China. According to the information, recovered paper piled up at three of the city's docks and the exporters' storages.

The People's Republic of China is certainly not against recycling, as Chinese enterprises invest abroad and purchase the latest technology (page 30 in this issue). There are also business opportunities in several parts of the world: in Estonia (page 4), Ukraine (page 18) and Indonesia (page 26), to name but a few. And you will find an overview of the East and Southeast Asian e-waste on page 23.

We hope you get a lot of new and useful information from reading this current magazine.

Yours Brigitte Weber (weber@msvgmbh.eu)

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Ukraine's Economic Growth Encourages Investments

The World Bank has improved its forecast for the growth of Ukraine's gross domestic product (GDP) in 2018 to 3.5 percent from 3 percent, the news agency interfax-Ukraine reported in June this year. The forecast for 2019 has been revised upwards to 4 percent from 3 percent.

"In Ukraine, government stabilization efforts, supported by international financial institutions and a bumper agricultural crop, led to a sharp rebound in growth to 2.3 percent, following a cumulative 15.8 percent contraction in 2014-15 in the wake of geopolitical tensions with Russia," the World Bank's report titled "Global Economic Prospects June 2017: A Fragile Recovery" was quoted. According to the information, the Bank also revised upwards the assessment of Ukrainian economic growth in 2016 to 2.3 percent (from 1 percent), having maintained the forecast for the current year at 2 percent. As the organization had stated in April this year, reforms to boost investor confidence and private sector competitiveness can help raise growth to 4 percent in the medium term.

The World Bank's current investment project portfolio in Ukraine amounts to about 2.8 billion US-Dollar. As reported, investments support the improvement of basic public services that directly benefit ordinary people in areas such as water supply, sanitation, heating, power, roads, social protection and healthcare as well as private sector development. Since Ukraine joined the World Bank in 1992, the Bank's commitments to the country have totaled over 10 billion US-Dollar in about 70 projects and programs.

Foreign firms invest in Ukraine

According to the German Association for the External Sector and Location Marketing - Germany Trade and Invest (GTAI), investors finally consider Ukrainian waste management, which has been neglected before, as business area. The British Association Farston Energy plans the construction of a sorting plant for waste and a facility for the production of biogas using organic waste (processing of 200,000 tons waste/year) in Dnipro for 50 Million US-Dollar. The Chinese Investor Grandblue plans the construction of an energetic waste incineration plant (320 tons/day). Moreover, the city administration of Kiev announced plans for several waste processing plants. The Croatian company Tehnix announced the construction of a waste processing plant in Tscherkassy (200 tons/day) as well.

Furthermore, various major water and wastewater projects are planned. Tscherniwzi and Charkiw are being considered for those projects.

Favorable conditions for business

The Ministry of Economic Development and Trade of Ukraine assures on its homepage (www.me.gov.ua) that its goal is to increase business activities. Further measures are the state-owned enterprise reform, fighting corruption and the reform of state procurement.

Interested parties can take a look at the homepage of the Ministry of Economic Development and Trade of Ukraine. On the homepage is a list of websites and agencies, which are coordinated by the ministry. Under the rubric "Investment and innovation policy" interested parties can find authorized contact persons under the heading of "Contact-points in regions for investors", which support investors. tors. www.me.gov.ua/Documents/ Detail?lang=en-GB&id=77b73608ea42-46ef-aefa-eab8377a7529&title= AuthorizedPersonsInTheRegionsForC onnectionAndSupportForInvestors

Furthermore, there is a public e-procurement system: ProZorro (\bigcirc https:// prozorro.gov.ua/en). It is a result of collaborations between the Ukrainian government, business sector and civil society.

Renewable Methanol Market Is Expected to Expand

According to an analysis, provided by US-based Future Market Insights, global sales of renewable methanol is estimated to be valued at 133.3 million US-Dollar by the end of 2016.

Renewable methanol is a second generation biofuel and is derived from renewable sources such as biomass, industrial waste, municipal waste and industrial CO₂. It is used as a transportation fuel after blending it with other chemicals. As reported, the main reason for the rise in demand is the implementation of regulations, especially in Europe and North America, that over 10 percent of the transport fuel should come from renewable sources by the end of 2020. On the basis of primary sources, the global renewable methanol market can be segmented into biomass, industrial waste, municipal waste and others; and on the basis of end-use application into formaldehyde, MTBE (Methyl Tertiary Butyl Ether), gasoline, dimethyl ether, solvents and others. The biomass primary source segment is expected to hold a significant share in the market and is estimated to register the compound annual growth rate (CAGR) of 7.0 percent in terms of value over the forecast period. The segment is expected to create an incremental opportunity of 53.7 million US-Dollar during 2016 to 2026, according to Future Market Insights. The MTBE end-use application segment is anticipated to register the CAGR of 8.1 percent in terms of value between 2016 and 2026. This segment is expected to gain traction over the forecast period due to an increasing demand for fuel blends from the automotive industry.

Business Chances

Biological Waste Treatment in Estonia

First Steps Are Taken

Estonia shows great advancement in complying with EU waste legislation. In 2002 the national waste treatment was composed of 97 percent landfilling and 3 percent recycling. According to latest OECD figures, the recycling rate including recycling and composting reached 31 percent. 150 former non-EU-conform landfill sites were reduced to 5 sanitary landfills under operation. Since 2008, Estonia has implemented circa 100 recycling centers nationwide, separate collection systems of selected recyclable materials in the larger cities and a well-functioning deposit system for bottles and cans.

BMW rate already over-fulfilled

Estonia's waste generation amounts to 473,000 tons; 434,000 tons i.e. 92 percent are treated. Meanwhile, the land scores a 59 percent incineration rate with energy recovery, 28 percent recycling and a landfilling rate below 10 percent. So besides thermal treatment the option to apply biological treatment from a sustainable source is given. Following the EU Landfill Directive, the amount of biodegradable municipal waste (BMW) in 1995 brought to landfill has to be reduced to 35 percent by 2020. As Estonia produced 317,000 tons of BMW in 1995, 117,000 tons recycled, 17,000 tons composted and 243,000 tons incinerated indicate that the country has already over-fulfilled the target. But the recycling rate of 50 percent of municipal solid waste has not yet been reached.

For the recovery of collected municipal solid waste, several plants have been installed in Estonia. Four plants with a total treatment capacity of 300,000 tons per year were brought into line in 2012. A MBT plant in Tallinn with 120,000 tons per year capacity, another MBT as part of the Talinn Recycling Center for 120,000 tons, an incineration plant in Talinn for 220,000 – 250,000 tons added, not to mention several, especially sorting plants dispersed over the country. The technical standard of the facilities is high, but the installation lacks of material. Instead of freshly mixed municipal waste, C&D and commingled waste was imported partly from Ireland to the Talinn MBT in August 2016. And the second Talinn MBT plant reaches an annual throughput of 24,000 tons – a fifth of its capacity.

Winter inhibits biological activity

Less than a quarter of Estonia – 45,000 hectare – is covered by semi-natural grassland. Because of preservation, it has to be kept short partly by mowing and baled. Due to the EU agriculture policy and the Estonian national legslation, currently for most of the bales there is no use. Besides that, this potential bio-waste as well as separately collected material can only partly be treated in composting plants. Biodegradable processes are sensitive to the ambient temperature, and in Estonia a long and cold winter period prevails inhibiting biological activity. Another potential sustainable energy source by biological treatment is the recovery of sewage sludge. The water treatment plants may work successfully, but the final handling of the digested sludge by open windrow composting was an issue. The winter temperatures forces the material to freeze and generated bad smell by de-freezing in spring. This can be changed by hygienisation prior to fermentation and open windrow composting with wood chips or peat after fermentation: The low biological activity eliminates smell problems, and the admixture of wood or peat improves the quality of the fertilizer. But the composted sludge is still classified as waste hampering farmers to use it. An unofficial draft of a law directing the application of end-of-waste criteria for sewage sludge might improve its utilization. So a certification system for compost could be available since 2016.

The EnReSS reseach network

In conclusion, Estonia is in the progress to establish integrated waste management. Since the operation of the Talinn waste incineration plant, the state-of-the-art equipped MBT plants are running under capacity or compensate the lacking input by importing waste. Caused by overcapacity, currently one of the five sanitary landfills is in the process of being closed. Provided that the incineration rate of municipal solid waste will remain higher than 50 percent, the recycling target is almost endangered. Potentials of biowaste are offered by the grasland meadows and by sewage sludge. They could be treated if the freezing problems of open composting processes could be solved. However, the greatest capabilities are given by the MBT plants if a material flow management could be realized or available resource efficient technologies were adapted.

The Department of Processing and Recycling at the German RWTH Aachen and the Institute of Forestry and Rural Energeering at the Estonian University of Life Science have founded the "Energy Recovery from Sustainable Sources in cold climate" (short: EnReSS reseach network). Their outlook for 2018: adapting a composting technology to Estonian conditions by small, flexible composting units with external heat supply. And – for material recovery – the separation of recyclables from municipal solid waste to improve recycling quota by installing a pilot plant for mechanical separation. The project is looking for interested technology providers or partners from different countries for the evaluation of technology transfer potential.

Straw Gives More Biogas

Researchers at the University of Borås have investigated the possibility to use straw products in the production of biogas.

For two years, Ilona Sárvári Horváth, associate professor at the University of Borås, together with other researchers from RISE and Sweden's agricultural university (SLU) in Uppsala have investigated how straw can be used in the production of biogas. Using this material in the biogas process is something that several actors have asked for: politicians, straw manufacturers as well as farmers.

According to Ilona Sárvári Horváth, straw as a substrate for biogas production can provide better profitability, both in the biogas sector and in agriculture. It "works best in a codigestion process, as it has high carbon content but low levels of trace elements, which inhibits degradation," the Swedish university reported. "In a co-digestion process, different materials are fed together into the chamber, and since different materials often have different compositions and structures, better nutritional balance may be achieved for the microorganisms that 'work' together in the biogas reactor." Among other things, the researchers have conducted anaerobic digestion experiments in labs for one year, both at the University of Borås and at RISE in Uppsala. "In the experiments, we have added straw to food waste in different proportions. At the university we investigated pellets and in Uppsala we investigated briquettes in a similar way. The results show that the biogas production gets better because straw has a higher dry matter content, which means that you can feed more material into the reactor that produces the gas. This makes you yield more gas per volume and time unit," Ilona Sárvári Horváth said. The project ended in August 2017 and was part of the Biogas2020 project, which includes approximately 30 actors from the academia, companies and municipalities from Sweden, Norway and Denmark, with the purpose of building a Scandinavian biogas platform.

The research on straw to biogas was partly financed by Biogas2020 and partly by the Swedish Energy Agency.

http://hb.se



India and European Union to Strengthen Cooperation

End of June this year, India and The European Union (EU) agreed to strengthen the cooperation in the areas of environment, resource efficiency and circular economy under the Resource Efficiency Initiative (EU-REI) for India.

"The necessity of moving to a resource efficient 'circular economy' wherein waste is reduced or becomes useful inputs in others, or renewable inputs replace non-renewable ones was discussed during the 8th EU-India Environment Forum," a press release said. The Forum in India has been organized by the Ministry of Environment, Forest and Climate Change (MOEFCC), EU Delegation in India with the support of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, The Energy and Resources Institute (TERI), Confederation of Indian Industry (CII) and consultants of Adelphi.

According to the information, the Environment Forum brought together policy-makers, industry associations, academia, research organizations, civil society and the "first national resource panel in the world – the Indian Resource Panel", to gather insights from Indian and EU experts on the benefits of resource efficiency (RE), resource productivity through policy coherence, secondary resource management, business models, eco-innovation and insights on economic instruments to foster resource efficiency.

"The Resource Efficiency Initiative (REI) project will be implemented on



behalf of the European Union by a consortium led by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, with The Energy and Resources Institute (TERI), Confederation of the Indian Industry (CII) and Adelphi," the New Delhi based Delegation of the European Union to India gave account. The project objectives would include assessment of India's current and future use of resources and develop a resource efficiency strategy for India in four sectors:

- mobility (emphasis on hybrid/electric vehicles);
- buildings and construction;
- renewable energy (focus on solar photovoltaic);
- plastic and e-waste management consistent with its overall policy framework.

There are also opportunities for companies and organizations as well as other parties: As reported, the project also "aims to foster business partnerships for knowledge and technology transfer between European and Indian industry, and raise awareness of best-practices in resource efficiency among businesses, the general public and government as well as non-government organizations".

Good planning and new technology

Addressing the Forum, A.N. Jha, Secretary (Ministry of Environment, Forest and Climate Change) said that the EU had demonstrated good planning, new technology and the involvement of stakeholders to transform the industrial and urban landscapes for the better and in a more sustainable way. He added that India was preparing its own campaign to develop a resource efficiency strategy. Experience sharing with European experts besides exchange of best practices would be of immense help in this regard.

Astrid Schomaker (Director for Global Sustainable Development, Environment Directorate-General, European Commission) said that market-based incentives and eco-innovation "will create new and exciting products, services and job opportunities in India".

EU Projects in India

Since 2005 India has become one of EU's ten strategic partners, depicting their commitment to the promotion of shared values. As reported by the Delegation of the European Union to India, the EU currently manages over 130 contracts in India, with an overall value of more than 400 million Euro. "These projects can be grouped into three main sectors: economic (economic opportunities and skills development), environment (environment, renewable energy, energy efficiency and climate change) and social (education, health and social justice/human rights)," the EU representatives inform.

According to the EU delegation, there are no new bilateral allocations for the 2014-2020 period and projects funded from the previous allocation are currently being finalized. However, thematic and regional cooperation, as well as grant allocations through the Global Fund, continue as before. As reported, the sources of funding vary from the Development Cooperation Instrument (DCI), the global and country-based allocations under the European Instrument for Democracy and Human Rights (EIDHR), the Industrialized Countries Instrument (ICI), to the Partnership Instrument (PI). "Funding is delivered through various means of implementation, such as sector-specific budget support, grants or services."

hoto: pixabay

Future Market Opportunities for Problematic PET Bottles

According to a report by Plastic Technologies, Inc., (PTI) an opportunity to create a market for non-colored problematic PET bottles may be available that does not exist today.

"However, rigorous performance testing would need to be done to understand how the incorporation of these PET bottles might impact an amber recycle stream," Plastic Technologies, Inc.*) underlined. "The goal is to find a way to allow clear, but problematic bottles, that yellow when recycled to benefit an amber recycling stream. It's possible that yellowing can be offset by blending them with amber colored bottles to yield an acceptable amber color for reuse," Frank Schloss, Ph.D., Plastic Technologies, Inc., is quoted.

If the relatively low volume of PET used for amber carbonated soft drink, beer and pharmaceutical PET packaging usage increases, items returned for recycling may reach a level significant enough to warrant their own stream, the company is convinced. Additionally, brand owners would be under pressure to demonstrate that these packages can be sustainably re-



used in the production of new amber recycle-content bottles.

As reported, the use of PET to produce bottles and containers for oxygen sensitive products as well as carbonated beverages is limited to some degree by its barrier properties. "These limitations can be overcome through the use of oxygen scavengers, multilayer structures and plasma coatings," the company informed. "But unfortunately, other than some plasma coating options, these barrier solutions also present recycling difficulties. The oxygen scavenger and multilayer barrier bottles present PET reclaimers with issues that cause the rPET materials to yellow after melt reprocessing."

For more information on the report visit **t** www.plastictechnologies. com/company/resource-library/ white-papers.aspx

^{*)} According to their own statements, Plastic Technologies, Inc. (PTI) is recognized worldwide as one of the preferred sources for preform and package design, package development, rapid prototyping, pre-production prototyping, and material evaluation engineering for the plastic packaging industry.



Invitation to Collaborate

US-based Healthcare Plastics Recycling Council (HPRC) invites organizations which recycle plastics or manufacture healthcare products or packaging materials to join the consortium and to work with industry-leading peers and develop real-world tools and projects to explore various approaches to healthcare plastics recycling across the full value chain.

According to HPRC, membership brings the obvious benefit of being part of the solution to a growing problem: Healthcare facilities in the United States generate approximately 14,000 tons of waste per day and an estimated 20 to 25 percent of that can be attributed to plastic packaging and products. The membership makes a good business sense as well. Benefits include:

- Collaboration with peers in a noncompetitive setting.
- Alignment with the company's corporate goals.
- Enhancements for the organization's customer service.
- Access to valuable customer insights.
- Opportunities for thought leadership in the industry.

HPRC is a private, technical consortium of industry peers across healthcare, recycling and waste management industries seeking to improve the recyclability of plastic products and packaging within healthcare. Founded in 2010, it engages in pioneering projects designed to help boost plastics recycling efforts in clinical settings of hospitals.

Chicago Regional Project

In 2015 and 2016, the Healthcare Plastics Recycling Council and Plastics Industry Association (Plastics) facili-



tated a cooperative regional recycling program in the Chicago area. According to the information, with a few exceptions, plastics used in the healthcare industry are single use materials representing a linear "take-make-dispose" economy. In response to current widespread low recycling rates, HPRC and Plastics asked the question: Is it possible to radically increase the amount of clinical healthcare plastics managed as technical materials in a circular "make-use-return" economy? To answer this question, the two organizations designed and implemented a multi-hospital plastics recycling project in the Chicago area. Focused on non-infectious plastic packaging and products collected from clinical areas of the hospitals, the project sought to demonstrate a viable business model for the recycling of healthcare plastics on a regional basis.

"One of the barriers preventing individual hospital programs from achieving economic viability is that the quantity of materials generated often does not represent sufficient commodity value necessary to attract the attention of recyclers. In bringing together multiple hospitals in the same geographic area, the Chicago regional project hoped to overcome this barrier – to demonstrate that these plastic materials have value, that they can be effectively collected from hospital clinical areas, and that they can be collected in sufficient quanti-

> ties to surpass the economic tipping point such that recycling of these materials represents a good business opportunity for recyclers," HPRC gave account.

Participating hospitals collected a variety of healthcare plastics (primarily from main operating rooms and ambulatory surgery centers) which were then transported by waste haulers to material recovery facilities (MRFs) for processing or transferred to specialized plastics recyclers. HPRC and Plastics planned to identify key success criteria for a regional cooperative like this, define market requirements, and detail best practices so that the model could be replicated in other geographies and markets.

"The project saw success around defining the relative quantities of material types and understanding the complexity of sorting the materials once comingled. As documented in similar studies, sterilization wrap represented the highest volume of material collected, and, as part of this project, the material properties of sterilization wrap were evaluated as a viable substitute or supplement for virgin resins in product manufacturing. Other flexible packaging materials such as film plastics, as well as rigid plastic packaging, were also collected in considerable and consistent quantities," the organizations wrote in the executive summary. "In addition to exploring mechanical recycling opportunities for these various plastic materials, the team also tested the potential to demonstrate value through energy conversion and chemical recycling. Both trials were successful, suggesting when mechanical recycling options are not available for these healthcare plastics, value can still be realized through other recovery processes."

Overall the project, a first step into exploring the possibilities of regional collaboration, has yielded a number of practical actions that both hospitals and recyclers can take to facilitate increased healthcare plastics recycling, they commented. More information about this project is available at https://media.wix.com/ugd/49d 7a0_29a95878b30a4df78ba818b4c7 1d0fc7.pdf.

www.hprc.org

Armenia Will Realize an EU-Compliant Facility for Solid Waste

Supporting Armenia's effort to become greener, the Eastern Europe Energy Efficiency and Environment Partnership fund (E5P) is co-financing the construction of a new landfill for solid waste for municipalities in the Kotayk and the Gegharkunik regions with a 2 million Euro grant.

The European Bank for Reconstruction and Development (EBRD), which manages this fund, and Armenia's Ministry of Finance signed the relevant agreement in late June. As reported, the grant will support the construction of a new landfill with modern solid-waste management processes, covering the collection and disposal of municipal solid waste. Work on the project started in December 2014 when the EBRD committed a 3.5 million Euro loan, which was complemented by a 3.5 million Euro grant provided by the EU Neighbourhood Investment Facility. The project was expanded in 2016 with an additional 2 million Euro sovereign loan from the EBRD. According to the information, it covers all seven municipalities in the Kotayk region (Hrazdan, Abovyan, Nor Hachn, Byureghavan, Charentsavan, Eghvard, Tsakhadzor) and all five



municipalities in the Gegharkunik region (Sevan, Vardenis, Gavar, Martuni, Chambarak).

The landfill is the EBRD's first solid waste project in Armenia. The E5P grant of 2 million Euro will complement the additional 2 million Euro EBRD loan and co-finance transfer stations, waste collection and transfer trucks, waste containers and other specialized equipment. The total project cost is 11 million Euro.

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The E5P is a multi-donor fund operating in the Eastern Partnership countries of Armenia, Georgia, Moldova and Ukraine. The European Union (EU) is the largest overall contributor to E5P, with committed funds of 70 million Euro. Armenia is also a contributor to E5P, with committed funds of 1 million Euro. The main objective of the initiative is to use grants to leverage loans from international financial institutions for municipal energy efficiency and environmental projects such as the rehabilitation of water and wastewater systems, solid waste management, street lighting and the insulation of public buildings.





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RECYCLING SYSTEMS

Newsflash

USA: Recycled Plastics Can Be Used in Packaging for Foods

The US Food & Drug Administration (FDA) has no objection regarding the suitability of Envision's product – made from US sourced recycled food packaging – when used at levels up to 100 percent in packaging for fatty foods and spirits. According to the company, the authority's permit makes EcoPrime "the only post-consumer recycled HDPE resin for which FDA has granted a favorable review for use in packaging all food types up to retort temperature conditions". The recycled and recyclable HDPE resin can be readily integrated into existing manufacturing processes for the packaging of food and beverages as well as for beauty, cosmetic and personal care products, while immediately elevating a brand's integrity of its packaging and product, Envision Plastics assures. Envision Plastics was

established in 2001. Since then, the company has produced over 750 million pounds of recycled resin. In June 2014, it was acquired by Consolidated Container Company, a developer and manufacturer of rigid plastic packaging solutions in North America, and continues to operate as a distinct business within the CCC family.

www.envisionplastics.com

Constellium Extended Recycling Capacities

The Netherlands-based provider of aluminum products and solutions, Constellium N.V., has installed a new recycling furnace at its Muscle Shoals (Alabama) facility in an effort to expand recycling capabilities in North America. According to the company, the furnace is expected to increase the total recycling output by 170 million pounds, or about 5.2 billion additional used beverage cans per year. "The Muscle Shoals facility will then be expected to recycle the equivalent of nearly 20 billion cans per year – almost one-fifth of the cans sold in the United States," Constellium pointed out.

www.constellium.com

Tenova to Deliver a New Consteel System

Tenova Inc. (USA) has been contracted by Charter Steel – one of the leading American suppliers of carbon and alloy steel bar, rod and wire products – to design and supply a Consteel system to integrate with their existing EAF (Electric Arc Furnace) at its Saukville, Wisconsin works. According to the provider, the system increases steelmaking productivity and reduces energy consumption. Furthermore, it will feature the latest innovative design and automation technology associated with the continuous scrap preheating and feeding technology to the EAF. The Consteel design for Charter Steel utilizes a "double-conveyor feed system" to overcome the challenges of the existing melt shop layout. The installation is scheduled for the second half of 2018.

www.tenova.com

Kuwait: Company Promotes Sustainability by Introducing Recycling Initiative

In August, Kuwaiti Equate Petrochemical Company announced its partnership with Kuwaiti recycling company Omniya in an aim to reduce waste by promoting the recycling of plastic water bottles in Kuwait. According to the information, Equate has developed a sustainability strategy "to be fulfilled by 2025, which is aligned with the UN Sustainable Development Goals and the Kuwait National Development Plan 2035". The partnerships with different stakeholders were key elements to achieve this strategy. According to Equate Sustainability Committee, the alliance with Omniya – which started

Photo: Equate Petrochemical Company



a plastic recycling project in Kuwait and operates a recycling factory marks a strategic local partnership to ensure a positive impact on the environment. This joint initiative commenced in the beginning of 2017 by placing PET recycling containers at Equate's headquarters and industrial complex to encourage all employees to participate in the recycling efforts. Additionally, the company sponsored the purchase of a truck to pick-up recycled material throughout Kuwait, as well as 10 recycling bottle booths distributed across the country to encourage the public to recycle plastic bottles.

www.equate.com

Scandinavian Enviro Systems Makes Progress

The Swedish company Scandinavian Enviro Systems has extended the Memorandums of Understanding (MoU) with Chinese tire manufacturer Guangzhou Vanlead Group Co. Ltd and Chilean investor Genera4 S.A.

According to Thomas Sörensson, Managing Director of Enviro, this means that the work with establishing recycling plants in both countries continues. The ambition to establish a plant in Guangzhou with project launch in 2017 would remain.

The Chinese project

The MoU with Vanlead, signed on March 29th, has meanwhile been extended to meet the state-owned company's procurement process. At the same time, the cooperation between the two parties continues at an unchanged rate. "Together we have decided on the location of the plant and conducted detailed discussions on site," Sörensson informed. Scandinavian Enviro Systems had signed two separate MoUs with Chinese tire manufacturer Vanlead Group, one for establishing a recycling plant in China and one with the objective to set up a joint venture to market Enviro's patented technology across the entire Chinese market.

The Chinese Group is a state-owned industrial enterprise in Guangzhou. Founded in 2001, it specializes in the fields of rubber tire, salt chemical and fine chemical with distinct regional and industrial advantage. "Vanlead has a large number of subsidiaries, one of them being tire manufacturer South China Tire & Rubber Co, the first large-scale state-owned enterprise to introduce professional technology to produce full-series radial tires in China. One of South China Tire & Rubber's brands is Wanli Tire which, with annual capacity of 16 million tires and 2,100 employees, is the largest radial tire manufacturer in Southern China and one of the largest radial tire exporters in the country," Scandinavian Enviro Systems pointed out.

As reported, Vanlead Group's tire production represents a strategic area both domestically and internationally. The company is said to be one of the world's largest tire manufacturers. It exports tires to Europe, the United States and other parts of the world. The aim is to expand production capacity, improve economy of scale, enhance competitiveness and become a domestic leading and world-famous rubber and tire enterprise.

The Chilean project

According to the provided information, Scandinavian Enviro Systems has had continued contact with the Chilean market for several years and the MoU with Genera4 S.A. was signed on November 10th, 2016. "Enviro's recycled carbon black is industrially accepted and has been tested by several Chilean rubber manufacturers as well as international tire producers," the Swedish company stated. "Chile's new Recycling and Extended Producer Liability Law means that the need for our type of solution is increasing for both, tire producers, mining companies and the authorities. The extension with Genera4 S.A. is an expected part of our continued cooperation to establish a recycling plant in the country," Thomas Sörensson is cited. The extension of respective MoU will last three months with the possibility for further extensions if necessary.

The Basic Design is completed

As reported, the Basic Design, developed by Scandinavian Enviro Systems in cooperation with Swedish engineering and consulting company ÅF, has been completed. In addition to technical and economic analysis, the purpose of the project has been to provide documentation that meets the guidelines and regulations for this type of recycling facilities for tire disposal in Europe and Chile and in many other international markets.

The collaboration with ÅF is now entering a new phase when the Basic Design project is complete and the completed reports can be presented to potential recycle plant customers, Enviro Systems underlined. "Basic Design is an advanced template design that includes the fundamentals for developing good calculations covering all aspects of finance, technology and installation. Customer dialogue can therefore focus more on local conditions and quickly identify solutions for effective implementation."

www.envirosystems.se



The Basic Design for complete recycling plants is ready





A Circular Economy Handbook for Business and Supply Chains

If you are looking for inspiration to implement the circular economy, you can find many examples in this book, written by Catherine Weetman and published by Kogan Page.

According to the publisher, "A Circular Economy Handbook for Business and Supply Chains" is a comprehensive handbook that provides a guide to the circular econ-

omy, helping the reader create futurefit, sustainable strategies. Real examples across a range of market sectors could help businesses, students and policymakers to understand the theory and fast-developing practice of circular economy. To help the reader generate ideas, the book provides a holistic framework for the design and supply chain and supporting business models and includes tools the reader can use to get started.

Whilst growing global consumption presents fantastic business opportunities, the current linear systems (take some materials, make a product, use it and then throw it away) are not fit for purpose, the publisher points out. The circular economy unlocks this problem by decoupling resources from consumption. Engaged businesses are rethinking product design, material choices, business models and supply chains.

Some examples

In food and agricultural sectors companies are rethinking production methods to recover value from both ingredients and process inputs. Examples of cascaded use, particularly for food ingredients, include orangepeels, informed the author. "The Green Chemistry department at University of York set up the Orange Peel Exploitation Company, a research project involving other universities from Brazil and Spain." Dairy producers Arla Food Ingredients and Danone create new protein products using whey from the yoghurt process. And Sugarich, according to its own information the UK leader in reprocessing surplus food products, uses waste such as breakfast cereals, including manufacturing waste or out-of-code stock, to create animal food that is traceable from farm to supply.

In the fashion and textiles industry there are also initiatives in regard to circular economy: Japan-based Teijin Fibers developed its "Eco Circle" closed-loop chemical recycling processes in 2002 to refine old polyester into recycled raw material equivalent to the new material (made from petroleum). As reported, Teijin claims the technology reduces energy consumption and CO, emissions compared to making new polyester and has now 150 participating companies worldwide. "Other organizations are recycling different materials to create yarns and textiles," Catherine Weetman wrote.

European fire brigades use fire hoses made from a multilayer material. England-based design duo Elvis & Kresse uses the deep red color and tough, flexible as well as hardwearing material of old hoses. "In costing separation the layers, they realized that the hose itself had 'provenance' and a great story: saving lives. They wanted to go further than giving the old hose a new 'useful' life, instead aiming to transform it into something practical and desirable, 'something you would want even if it was not recycled, even without the ethics'. The aim is to create classic and timeless designs with high-quality craftsmanship to ensure the new products will last for as long as the reclaimed materials", the reader is notified. "The products, including belts, wallets and bags, feature linings from upcycled materials such as parachute silk or wedding tablecloths."

There is even furniture printed from recycled materials: A Dutch student "was designing furniture for his graduation project. Inspired by an old 3D printer, he reprogrammed an industrial robot from a Chinese production to 3D print furniture using materials recycled from old refrigerators," the author reported. "By 2014, the awardwinning designer had expanded the range of furniture and materials, all 100 percent recycled from old plastic toys, videotapes and discarded computer equipment, among other plastic and synthetic wastes."

According to the publisher, "A Circular Economy Handbook for Business and Supply Chains" is a "must-read for anyone who wants to apply the circular economy today". Online resources are also available: PowerPoint slides of figures and tables from every chapter created by the author. For further information visit: Twww.koganpage. com/product/supply-chains-for-a-circular-economy-9780749476755

Global Plastic Decking Market

Indian company Market Research Future has published a new report on "Global Plastic Decking Market Research Report – Forecast to 2022". According to the provided information, it contains company information, geographical data and market segmentation by material (HDPE, PP, PVC and LDPE), by composite, by end-use and by region. The global plastic decking market size was valued at around 2 billion US-Dollar in 2015 and is expected to cross 5 billion US-Dollar at a compound annual growth rate of approximately 11 percent by 2022. As reported, the key drivers for the growth of this market are rapid urbanization, rising construction activities in the emerging nations, replacement of traditional materials with other composite decking products and large-scale investments. Plastic decking is widely used in residential and non-residential buildings. "North-America contributes highest to the market, majorly due to increasing demand for low maintenance building products," the provider stated. Request a Sample Report \textcircled www.marketresearchfuture.com/sample_request/1872

Fashion and Overconsumption

This year's winter ad campaign of British designer Stella McCartney features not only the newest fashion. Shot in a Scottish landfill site, the images explore the issues of waste and consumption as well.



As stated on Stella McCartney's homepage, the new campaign in collaboration with artist Urs Fischer and photographer Harley Weir explores the issue of waste and consumption. "The idea we had with this campaign is to portray who we want to be and how we carry ourselves, our attitude and collective path", the designer commented. "Our man-made constructed environments are disconnected and unaware of other life and the planet which is why there is waste." The planet would have a waste and consumption problem due to "single use" and "disposable" items that are wreaking havoc to the environment. Most of these items were made of plastic which ends up in landfills. "We are now producing nearly 300 million tons of plastic every year, half of which is for single use. More than 8 million tons of plastic is dumped into our oceans every year."

Since launching in 2001, the Stella Mc-Cartney brand has been rooted in its commitments to being a responsible and modern company, the website informs. As a vegetarian brand, it does not use leather, fur, skins or feather in any product for both, ethical and environmental reasons. "53 percent of the womenswear collections come from sustainable materials including sustainable viscose, regenerated cashmere, organic cotton and denim, recycled nylon, sustainable wood and cork, and eco alter nappa", the company assures.

According to US-based public relations and marketing company Cone Communications, the brand has announced plans to use Parley for the Oceans' recycled plastic yarn and Aquafil's Econyl fiber, made from 100 percent regenerated nylon waste, in its line of shoes, accessories and outerwear.

www.stellamccartney.com

Digital Marketplace for Organic Waste in France

Suez, a French-based global expert in the waste and water sector, has launched "Organix" – according to the business group, "the first digital marketplace for organic waste" in France.

As reported, this platform can connect producers of organic waste (food industry manufacturers, cooperatives, etc.) and methanation unit operators, who transform them into energy. "They can manage transactions in a simple and secure manner while Suez provides logistics and transportation," the information says. The group also ensures the quality of the materials with an audit of the producers and a flows diagnosis. "Already available in some French regions (Brittany, Normandy and Pays de la Loire), 'Organix' will cover the entire territory by the end of the year and will gradually be enhanced with new functionalities," Suez assures.

The new digital marketplace works like an auction platform – organic

waste can be sold similar to those used for common consumer goods:

- The producer of organic materials makes an offer with details of the quality and the nature of its flows.
- The waste-to-energy operator can accept the offer, in which case the transaction is validated immediately, or he can make an offer as part of the auction system.
- When the auction closes, the producer accepts or rejects the best offer made to him.

Optimizing the connection

According to the French group of companies, "Organix" represents a genuine breakthrough from the existing trading system and meets two needs. "On the one hand, producers

of organic waste do not always find the right recovery channel, while, on the other, operators of methanation units sometimes have difficulties with their supplies of organic materials due to inconsistent quality, unreliable sources, regulatory compliance and traceability," Suez points out. By optimizing the connection between these actors, this platform would encourage and facilitate waste recovery and the production of new organic and energy resources at a local level, for the benefit of circular economy and the regional energy transition. With this new offer the aroup would confirm its ambition to become the leader in smart and digital services for recycling and recovery.

www.organix.suez.fr

Canadian Company Examines Battery Recycling Opportunities

American Manganese Inc. (AMI) reported in July this year that it has successfully completed the recycling of 100 percent of Cathode Materials (Cobalt [Co], Nickel [Ni], Manganese [Mn], Aluminum [Al]) and 92 percent of Lithium from its US Patent Pending recycling application. The company also produced rechargeable Lithium Ion Cobalt and Lithium Nickel Manganese button cell batteries from its recycled cathode material.

According to the provided information, the price of cobalt rose from 35.02 US-Dollar per kilogram in January to 58.50 US-Dollar per kilogram in July. "Cobalt is currently under severe supply side pressure and is expected to remain undersupplied," Larry W. Reaugh, President and Chief Executive Officer of American Manganese Inc., was quoted. "According to the Cobalt Development Institute the battery industry consumes 41 percent of global cobalt supply (2015). Over the next ten years that usage is expected to increase to above 65 percent. 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."

The management of American Manganese has been studying ways to capitalize on the company's technologies working toward developing positive cash flows. "One such opportunity may exist in recycling unused cathodes," the firm said. "Industry sources have shown that up to 10 percent of manufactured cathodes are rejected for use. The rejected cathodes, termed 'scrap', consist of the aluminum foil backing and the cathode metal powder which we believe can be recycled into usable cathode material using AMI's patentpending process. The company has been offered these scraps (at a cost) by recyclers."

In 2018 AMI intends to build and begin operating a pilot plant to prove continuous recovery of cathode material, with the ability to scale up and design a full-scale recycling plant. According to the company, construction of a hydrometallurgical plant capable of recycling scraps would have the following advantages over recycling spent lithium-ion batteries:

 Up to 4,000 tons/year of cobalt, with a current market value of over 230 million US-Dollar, could be recycled annually.

- Other valuable cathode metals such as Ni, Al, Li and Mn would also be recycled from the various cathode chemistries.
- Capital and labor required for the initial plant would be lower as no disassembly of batteries is required.
- Recycling cathode metals leave a much smaller footprint than a traditional mining plant for recovering metals from ores.
- AMI's closed loop process conserves water and does not release toxic waste streams into the environment.
- The process would be demonstrated on a commercial scale, so that full-scale industrial facilities can be engineered and costed out.
- AMI has yet to determine the location of the process plant, as it could be sited anywhere in the world where EV battery manufacturing is occurring.

www.americanmanganeseinc.com

United Arab Emirates: Joint Venture to Develop a Waste-To-Energy Plant

Bee'ah, the leading environmental management company in the United Arab Emirates, and Masdar, Abu Dhabi's renewable energy company, have formally established the joint venture Emirates Waste to Energy Company (EWEC) in order to develop waste-toenergy plants across the region. As reported, the first project will be the Sharjah Multi-Fuel Waste-to-Energy Facility. The plant will be the first in the region and will treat, within its first phase, more than 300,000 tons of municipal solid waste (MSW) each year. The Sharjah Multi-Fuel Wasteto-Energy Facility has a power capacity of around 30 megawatts (MW). In addition to recovering materials for recycling, the new plant will incinerate up to 37.5 tons of solid waste per hour.



For this facility, the target is to achieve zero waste. At present, the emirate diverts 70 percent of its waste away from landfill. "With the completion of this new facility, Sharjah will soon become the first city in the Middle East to achieve the target of 100 percent diversion of waste from landfill," Bee'ah is convinced. According to the company, the plant has been designed to meet the strictest environmental standards, complying with the European Union's Best Available Techniques which are widely recognized as setting the worldwide standard.

www.beeah.ae

Global Investment Firm Completes Acquisition of Recycling and Waste Business

In the beginning of September, Atar Capital has completed the acquisition of Recycling and Waste Solutions (RWS), a division of the HAVI Group. Financial terms of the transaction were not disclosed.

"RWS was launched in 2012 with the goal of providing true 'closed loop' solutions and complementing HAVI's global supply chain offerings," the buyer informed. "Based in Chadds Ford, Pennsylvania, RWS develops and manages recycling, waste and sustainability programs for regional and multi-national companies throughout North America." As reported, BNP Paribas acted as the exclusive advisor to HAVI on the sale, and Dykema Gossett acted as outside legal counsel to Atar Capital.

Atar Capital is a global private investment company. Its principals have collectively completed over sixty private equity transactions across eighteen countries worldwide. The investment firm puts money in both performing and underperforming lower middle market businesses that exhibit potential for revitalization, operational performance improvement, and growth. It specializes in corporate divestitures, complex carve-outs, and turn-around situations across a wide range of industries and geographic markets with a focus on North America and Western Europe.

www.atarcapital.com

Northam Diversifies into the Recycling Market

South African Northam Platinum Limited has announced that it has entered into binding transaction agreements pursuant to which it will acquire platinum group metals (PGM) recycling equipment located in Pennsylvania (USA) as well as immoveable property comprising land and buildings for this equipment.

As reported, the aggregate consideration payable by Northam in respect of the transactions amounts to approximately 10.7 million US-Dollar. The PGM recycling equipment will be acquired from A-1 Specialized Services Inc., a recycler of PGMs from automotive catalysts. It comprises, inter alia, multiple ceramic catalytic converter processing lines and ancillary equipment, including sampling and separation systems, transportation and a materials handling fleet. The premises consist of approximately 30 acres of land as well as buildings mea-



suring about 300,000 square feet used for warehousing, manufacturing and office space. According to Northam, the transactions afford the firm as an integrated primary and secondary producer and give the company the opportunity to expand and diversify its business interests into PGM recycling. The company would be able to participate in the growing demand for recycled PGMs from autocatalysts and maintain as well as develop a strategic footprint in North America.

www.northam.co.za





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A New Biogas Plant for Greece

Swiss-based Hitachi Zosen Inova AG will deliver two steel digesters to Greece.

The project in the Epirus Region marks an initial step by Greece towards the energetic exploitation of organic waste, the company underlined. As reported, the two PF1500 Kompogas digesters are the core modules of the system and will process 38,700 tons of pre-sorted organic waste under anaerobic conditions in order to produce biogas in the future. The yield of 5.4 million Nm³ (normal cubic meters) of biogas per year would be converted to deliver 11,500 megawatt hours per year (MWh/a) of electricity, which will be fed into the grid.

Hitachi Zosen Inova (HZI) has concluded a service and support contract with its Greek partner Terna Energy; it is to build the project, which is co-financed by the EU, as part of a



public-private partnership with the Epirus Region, and wants to operate the plant for the next 25 years.

"The Epirus Region is to be the location of Greece's first dry anaerobic digestion plant, which will in future handle 105,000 tons of municipal solid waste a year," Hitachi Zosen Inova reported. "The organic fraction will be removed in the sorting line of the new Mechanical-Biological Treatment (MBT) plant and then processed in the anaerobic digestion system."

www.hz-inova.com

Advertorial:

Avoiding System Shutdown – Reduce Costs for Wear Protection

The diversity of recyclable materials is a constant source of high wear and tear costs in recycling plants. An efficient utilization of the system is the objective.

Particularly sharp-edged materials, such as metal and iron parts, considerably shorten the service life, in particular of the separation belts. The surface is repeatedly affected. Those results in serious damage can lead to a system shutdown. Belt changes are expensive and labour-intensive.

The Plastics Technology division of the German-based Lutze Group, with 60 years of experience in conveying technology, has been developed into a system supplier in wear and tear issues. The combination of conveyor technology and wear and tear especially requires a high degree of expertise in order to offer innovative ideas as a special solution in a branch-specific manner. This is precisely where Lutze provides an approach to extend the belt system service life. The magnetic separation belt is sprayed with polyurethane, including the cross-



belt. The stability of the cross-sections, which is heavily burdened by the constant material-drop, is thus increased as well. The challenge in this application is to create the connection between rubber and polyurethane. Polyurethane features – via its flexibil-

sections, hence creating a homoge-

neous layer on the original conveyor

ity – a much higher cutting resistance, as well as a higher resistance to chemicals and oils. Organic oils from food residues especially attack the rubber cover plate, making them swell and can even lead to decomposition.

Based on the damages, as well as the primarily conveyed materials, a consultation on site by the service personnel can determine the needed layer-thickness. The processing of magnetic separation belts in classical recycling plants, iron foundries as well as the belts in shredders and mobile crushing and screening plants, are vastly different.

www.lutze-conveying.com

Australia: A New "Super MRF" Plant for Perth

It is estimated, that Perth's population will reach 3 million by 2020. Then the city's households and businesses will be producing more waste than ever before.

This is one of the reasons why Australian Cleanaway Waste Management Ltd. has opened a new 50 tons per hour Single Stream Materials Recovery Facility (MRF) in Western Australia. Designed, manufactured and installed by US-based Bulk Handling Systems (BHS) the multi-million-dollar facility, known as the Perth MRF, is able to process 250,000 tons per year - enough capacity to sort all of the city's residential recyclables, the operator is convinced. According to Cleanaway, the Perth MRF is the most advanced recycling facility in the Southern Hemisphere, the technology provider underlined. "The system applies an abundance of recovery technologies to achieve high rates of throughput while maximizing the recovery and purity of recycled commodities," the American company gave account. "BHS Tri-Disc™ screens are the core of the sorting process, screening out glass and producing clean paper and container streams. The Debris Roll Screens are employed



early in the process to quickly break and remove the high volumes of glass that are typical in Australia, which is then purified by two Nihot Single Drum Separators. NRT optical sorters are employed in both recovery and quality control applications throughout the plant. Two new ColorPlus-R optical sorters, able to analyze the color of opaque objects, remove small cardboard from the news stream." To achieve Cleanaway's high standards of over 97 percent recovery of plastic containers whilst meeting purity rates in excess of 98.5 percent, six SpydIR optical units target fiber and polymers to produce PET, HDPE and mixed plastics."

www.bhsequip.com

The World's First Recycling Mall in Sweden Is a Model of Success

ReTuna Återbruksgalleria is the world's first recycling mall, revolutionizing shopping in a climate-smart way. Old items are given a new life through repairing and upcycling. Everything sold is recycled or reused or has been organically or sustainably produced. And the business concept is working: In 2016 the mall had 8.1 million SEK (0.8 million Euro) in sales for recycled products.

The mall, about 100 kilometer west of the Swedish capital city Stockholm, opened its doors in August 2015. It is easy for visitors to sort materials they are discarding into the containers and then drop off reusable toys, furniture, clothes, decorative items and electronic devices in the mall's depot, called "Returen". In the depot, the staff performs an initial culling of what is usable and what is not. The items are then distributed to the recycling shops in the mall. Then the shop



staff performs a second culling, where they choose what they want to repair, fix up, convert, refine – and ultimately sell. In this way, the materials are given a new life. In addition to offering sustainable shopping and serving as a public educator in relation to environmental issues, ReTuna Återbruksgalleria has generated over 50 new jobs. The concept is now spreading.

www.retuna.se



Yet Dependent on Investments

More than 4,000 landfills, a level of waste processing between 5 and 8 percent, about 15 waste separation lines, 2 waste incineration plants and no waste processing plant: This is how the State Agency for Investment and National Projects of Ukraine (Invest Ukraine) characterized the status of Ukraine's waste management branch in late December 2011 in a commercial.

But the advertising YouTube clip showed optimism as well, presenting a "Strategy 2020": The collection rate of solid wastes in cities was intended to rise from 70 to 100 percent and in villages from 10 to 70 percent. The recycling rate was planned to double or triple, the separation rate to increase from 10 to 100 percent and the level of solid waste processing from single-figure to 50 or 70 percent. The burying of unprocessed waste would decrease from 95 percent to zero, the burying rate from 95 to 30 percent. Additionally 20 new waste processing plants were foreseen and the number of landfills lowered to 3,000.

At a development stage

In fact, at that time the Ukrainian market was at a development stage. Invest Ukraine and consulting firm Deloitte certified "many niches and opportunities for introducing new players and strengthening the positions of existing ones". And – in spite of most of Ukraine's industries lacking investments – "international investors are highly interested". So the authors believed "that foreign investments will be very successful and promote economic growth if a favorable investment climate is created in Ukraine".

Waste potential existed. The 12 million tons of municipal solid waste per year consisted of 37 percent food waste, 25 percent paper and cardboard, 7 percent plastic, 5 percent glass and 4 percent metals. The Ministry of Regional Development and Construction spoke of approximately 2.5 million tons of paper and cardboard, 400,000 tons of ferrous, 25,000 tons of non-ferrous metals and 400,000 tons of plastic in the form of waste in 2011. And a study under the United Nations Development Programme in the same year estimated that the economic effect from the operation of a waste processing and incineration complex could result in 180 million Ukranian Griwna (UAH) for paper and cardboard, 225 million UAH for metals, 40 million UAH for glass, 740 million UAH for polymers, 80 million UAH for

textile and 35 million UAH for heat or energy – in total 1.3 billion UAH (formerly 120 million Euro, today about 50 million US-Dollar).

An obsolete treatment infrastructure

However, the infrastructure was undersized. The paper by Invest Ukraine and Deloitte defines 770 registered and 3,000 unauthorized landfills. But a comprehensive study by the International Finance Corporation based on official estimates speaks of 6,700 active landfills. Over 15 percent of them were overloaded and 21 percent failed to meet sanitary requirements; possibilities to expand active landfills were largely limited. And not to forget the number of 30,000 unauthorized dumps. According to the Ukrainian State Sanitary Inspectorate, 85 percent to 90 percent of all landfill sites fail to meet even the most basic of environmental safety standards. Waste collection was realized by more than 1,000 enterprises, most of them either providing services of collection and transportation of waste or involved in waste sorting with low-tech equipment.

In 9 Ukrainian cities waste sorting lines were in operation, and in 19 more towns such facilities were under construction. Aside from 3 percent of household waste separately collected and recycled, 4 percent went to the two incineration plants in Kyiv and Dnipropetrovsk. Meanwhile, only one of former four incineration plants – located in Kyiv – is operational; its service life of 25 years is over, the equipment out of date and the boiler not fully loaded because of high costs compared to disposal. In total, the nongovernmental Bleyzer Foundation saw an "obsolete and congested waste treatment infrastructure", but judged: "The composition of MSW streams in Ukraine does allow for the profitable recovery of recyclable materials." Or, as news agency Inter Press Service expressed, "Ukraine has no modern waste recycling plants".

Disposal or recovery system?

To change that situation, waste management went under examination. The International Finance Corporation (IFC) for example published a study on "Opportunities for Ukraine" in 2012, showing two future alternatives: a fully sanitary treatment and disposal system for MSW, established by 2025 at a cost of 13 billion Euro; or a recovery oriented waste management system with a target rate of up to 40 percent, achievable by 2025, requiring 13 billion Euro investment, reducing new landfill capacity by up to 30 percent and generating 300 million Euro in revenues from the sale of recovered materials and energy. But the IFC also remarked the multiple lines of responsibility, the various entities, individual agreements and the missing of any single entity "to channel, enforce and monitor a regional waste management strategy". Necessary measures should include a market coordination and a tariff setting mechanism, waste recovery incentives, mechanisms for private sector engagement and financing as well as greater public awareness rising.

Ukraine decided upon the recovery version, following the announced long-term goal for the sector to reach EU-ac-

cepted waste recycling standards, partially already binding under the EU-Ukraine Association Agreement. Several things have changed since. The Government intended the implementation of a number of legislative initiatives in order to reform and harmonize domestic standards with the relevant EU directives. The nationwide "Clean City" project planned the construction of waste processing plants in 10 regions of Ukraine on terms of public-private partnership: Their expected combined processing capacity of over 2.5 million tons per year should double the amount of waste that the Ukraine incinerated or recycled by 2014.

Affected by the "armed conflict"

Funds of 224.62 million UAH were directed to the development of the waste management sector in 2013, mostly invested in upgrading the park of special vehicles and the container park. In 2012, German experts expected a cumulative market volume for MBT plants of approximately 92 million Euros for new construction and four millions for maintenance. But they had to admit that currently not a single MBT plant was under operation but e.g. in 2014 a big MBT plant, with a capacity of 140,000 tons per year projected by a German company and financed by the German KfW-Bank, would be commissioned. In November 2013 political protests started at the Maidan, in Februar 2014 an interim government took over, whose displacement was answered by Russia with occupation and annexation; since then the Eastern Ukraine is dominated by an "armed conflict", affecting the economy and policy of the whole nation. Waste problems got less important. Merely one "Background Paper on Financing Waste Management in Ukraine" was launched in 2014 by the Ukrainian Regional Environmental Center.

Infrastructure projects

In August 2016, the Ministry of Regional Development and Construction and Business Sweden delivered a market insight in Ukrainian solid waste management. It reported still 94 percent of solid waste brought to landfills, a third of them not certified. 2.73 percent goes to one incineration plant, three separate incinerators and 20 sorting lines. And 3.2 percent are treated by one recycling plant, 12 biogas systems and 523 cities with collection points for recyclable materials (523 out of 27,500 cities i.e. 2 percent). Two thirds of the landfills are standard; the rest is said to be overloaded, does not meet standards or is illegal; nearly 20 percent new deposit areas are needed. 1,200 waste collection vehicles are "relatively new", 2,200 "obsolete" and "depreciated". The financing for solid waste is supplied mostly by local budgets (5,85 million Euro), by state budget (1,59 million Euro) and other sources (1,64 million Euro). However, this funding could be extended by 38 million Euro for a solid waste plant construction in Kharkiv planned under the "Second Urban Infrastructure Project" by the World Bank and a framework loan of 400 million Euro for the "Ukraine Municipal Infrastructure Project" including the solid waste sector, signed by the European Investment Bank.

Today the recycling industry comprises of 1,000 enterprises for collecting and disposing municipal solid waste – 75

Markets

percent in private-public-partnerships and 25 percent in private hands. Among them Veolia Ukraine, ABE-Lviv, Remondis` layer Umwelt, SITA and A.S.A. concerning waste recovery. An expert on waste recovery from ABE-Lviv company – Andriy Slonski – commented in 2013 that Ukrainian recycling enterprises process only three waste streams: PET bottles, glass and paper. This has changed little since: Some of the firms also process aluminium. Recycling – says the aforementioned Background Paper – is performed in Ukraine for paper, glass bottles, metals, fluorescent bulbs and, since more recently, plastics. "This works both in the ,B2B' mode and via purchase from citizens at recycling points or from scavengers collecting materials from waste containers."

A positively changing and exciting market

A new study by German ReTech Partnership balances a backlog in in the sorting sector and in the number of me-

chanical-biological treatment facilities. And recommends best business opportunities in sanitation and reconstruction of existing landfills, in capturing landfill gas and utilization for energy and in the construction of new modern and sanitary deposit sites. ISWA, the International Solid Waste Association, would not agree with that. In view of new laws implemented in 2016, the association believes in a positively changing and exciting market situation in the Ukraine. In spite of or better: because of low national recycling rates at 5 to 7 percent, the country must increase waste recovery to reach European Standards as per agreement with the EU. What Ukraine mostly needs are 58,700 separation containers, the building of 45 waste recycling plants and the purchase of 658 waste collection vehicles. That is why the World Bank in 2016 called for investments into the Ukrainian waste management industry to the tune of 14.2 billion Euro: for modernization and construction of collection and transportation, recycling and landfill facilities.

Rwanda: E-Waste Project Is Expected to Create Many Jobs

As reported by the newspaper The New Times, in March this year Rwanda has started an electronic waste dismantling and refurbishing plant in Bugesera Industrial Zone (Eastern Province, Rwanda).

"The project is under the national e-waste management strategy that seeks to support the establishment of sustainable recycling industries as part of the country's green development agenda," The New Times reported in August this year. "It is currently being operated by the Ministry of Trade, Industry and East African Community Affairs." According to the information provided, the project's capacity is more than 10,000 tons of electronic and solid waste per year.

Approved in December 2016, the project started in spring this year. "The initiative will promote environmental protection in the country by refurbishing and recycling old materials such as computers, TV screens, plastics and metals among others. Furthermore, it will create jobs and new business opportunities," the newspaper cited Olivier Mbera, the e-waste program manager at the Ministry. "The project is still being run by government, but we are seeking private firms to operate it under a public-private partnership scheme."

100 tons of electronic and solid waste have been collected from the banks, universities and other institutions targeting the plant. Over 30 percent of the dismantled and refurbished materials are plastic, while 50 percent are



metals, including copper. According to the information, there is a market for dismantled and refurbished materials, locally and in the region.

Specific needs identified

According to a study in 2011 – funded by the Rwanda Management Authority (REMA) under the Ministry of Environment, Lands and Forest – e-waste management in Rwanda did not exist at the time. The survey on EEEs and the expected amount of e-waste to be generated in the country revealed that there is an annual growth at nearly 6 percent. The study also indicated that Rwanda has an annual e-waste generation potential of between 10,000 and 15,000 tons. According to the news agency APA – Agence Presse Africaine, the facility seeks to offer a solution for electronic and electrical waste while preventing a negative impact of electronic waste on the health or the environment once the equipment has become junk.

The Finnish Road Map to Circular Economy

At the first World Circular Economy Forum 2017 (WCEF) in June this year, the host country Finland shared its own inspiration as there are plans to turn the vision of the country's circular economy road map into reality and deliver concrete benefits across all sectors of business and society.

"Leading the cycle – Finnish road map to a circular economy 2016-2025" outlines the steps to sustainable success, the Finnish Innovation Fund Sitra feels confident. This national road map was drafted under the direction of Sitra in co-operation with the country's Ministry of the Environment, the Ministry of Agriculture and Forestry, the Ministry of Economic Affairs and Employment, the business sector and other key stakeholders. Finland would have a real opportunity to create sustainable well-being and a successful carbon-neutral circular economy over the next 5 to 10 years, the Finnish Innovation Fund is convinced. A circular economy would maximize the use of materials and retain their value in the loop for as long as possible: Rather than offering products, the foundation for earnings would be services and intelligence-based digital solutions.

As reported, "Finland's national circular economy road map is beginning to create new solutions for Finland to offer a world challenged by climate change, dwindling natural resources and urbanization". The first circular economy solutions were based on areas where Finland is traditionally



strong, thus making it possible to offer tens of thousands of new jobs and generating billions of euros. Estimates say that this type of management would generate 2 to 3 billion Euro in additional value each year by 2030. The Club of Rome is optimistic that over 75,000 new jobs will be created.

"The change requires co-operation across sectoral and industrial boundaries," Sitra wrote. "In many cases, the most attractive opportunities for new operating methods, for services made possible by digitization and for extending the circulation of materials can be found somewhere in the middle." According to Sitra Director Mari Pantsar, the effectiveness of new solutions "ultimately stems from the fact that they can be expanded and duplicated both elsewhere in Finland and around the world". The Minister of Agriculture and the Environment Kimmo Tiilikainen hopes that the circular economy will boost Finland's economic growth and competitiveness, Sitra gave account. According to him, the circular economy road map brings together a large number of

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Finland: Recycling Strengthened – More Waste is Burnt

According to the latest waste statistics, published on the 20th of December last year, Finland's quantity of municipal waste has been 2.4 to 2.8 million tons per year after the turn of the millennium.

As reported, in 2015 nearly 90 percent of municipal waste was recovered – "so in this area the circular economy is coming to an end". Nearly one-half of all municipal waste was burnt in Finland's seven incineration and coincineration plants. One of the reasons is the growth in waste incineration. Mixed waste is turning into mere energy waste and separately collected waste into recycled material.

In 2015, Finland took a substantial stride towards top countries in recycling of separately collected municipal waste. The recycling quantities of electrical and electronic waste, glass and metal waste increased. "The most influencing factor was, however, the specification of the quantity and recycling of fiber packaging waste generated in the field of trade," the statistics said. On the other hand, the disposal of waste in the bank on landfill sites has become rarer. In 2015, only good one tenth of municipal waste went to landfills.

outstanding pilots. In addition to key projects, some examples of pilots following the road map include:

- an initiative to recover waste heat;
- Central Finland's investment in the use of biogas for transport;
- Helsinki Region's plans to switch to high-blend biofuels;
- a joint VTT and Aalto University research project on new cellulosebased materials;
- plans in the Lappeenranta region to switch from using imported fossil fuels to domestic renewable energy for its transport needs;
- City of Turku plans to pilot a zerowaste region;
- a joint project of the forestry sector and Tekes (the Finnish Funding Agency for Technology and Innovation, a part of Finnish Ministry of Employment and the Economy)

regarding the utilization of forestry by-products;

 a Finnish Technology Industries and University of Jyväskylä project to improve the efficiency of mobile phone and tablet collection.

Based on Finland's traditional strengths

The first steps toward a circular economy reportedly will be taken by means of five focus areas, which are based on Finland's traditional strengths. "In the first focus area, regional co-operation brings sustainable local food to everyday life: Public institutional kitchens not only use locally produced food that promote nutrient cycling, they also allow producers and processors to introduce new consumer-oriented products through their co-operation," Sitra informed. In the second focus area, for example, valuable and rare materials primarily taken from electrical and electronic scrap are recovered for re-use. In the third focus area, Finland is intended to become a global host nation for the circular economy (in June 2017, Sitra had hold the international circular economy conference in Helsinki). In the fourth focus area, export concepts involving lowcarbon and intelligent transportation are created. "In the fifth focus area, forestry bio-products will be taken from laboratories for extensive testing; new products obtained from the forest that replace fossil fuels require extensive testing outside the laboratory in order to be commercialized," the Finnish Innovation Fund Sitra outlined the content of the circular economy road map.

Norway Takes the Path to Circular Economy

On the 21st of June 2017, the Norwegian government presented a White Paper on waste policies in a circular economy with an emphasis on increasing reuse and recycling to the Norwegian Parliament.

According to the Norwegian Ministry for Climate and Environment, waste is no longer first and foremost a problem, it is also a resource. "Recycling and measures to reduce waste are important elements in our waste policies," the Minister for Climate and Environment, Vidar Helgesen, was quoted.

Measures to combat marine litter

Marine litter and pollution from microplastics are growing environmental problems that require efforts on a local, national and global level, the ministry pointed out. "Measures to reduce marine litter are therefore of high importance to reduce microplastics in the environment." The Norwegian Government also intends to reduce emissions of microplastics from key land-based sources in Norway and strengthen the cleanup efforts of plastics from along the Norwegian coastline. The Norwegian Government recently decided to establish a National Centre at Lofoten/ Vesterålen that will hold a central role

in the clean-up effort. A grant scheme for local authorities that want to implement measures to reduce marine litter and microplastics will be introduced as well.

As reported, the White Paper also outlines Norway's strategy to strengthen international commitment to combat marine litter through cooperations in the Nordic region, the EU, other regional fora and through the UN. The Plastic Strategy will be translated into English.

East & Southeast Asian E-Waste Monitored

The use and amount of electric and electronic devices is growing steadily, and so does the resulting waste of this equipment. Such as the supply chains of these products, their reverse chains at end-of-life are growing and getting more and more international.

East & Southeast Asia is no exemption, but as a key region in the production of electronics and electrical equipment is getting increasingly involved in both formal and informal recycling, secondhand use and disposal. But there are national differences, according to the "Regional E-Waste Monitor: East & Southeast Asia", compiled by the United Nations University and funded by the Japanese Ministry of the Environment.

There are two groups of national jurisdiction: The first including Singapore, Hong Kong, Japan, Korea and Taiwan with an average e-waste generation rate higher than 10 kg/capita, and the second including the rest falling below this rate. The study also distinguishes four types of implementing e-waste regulations: the "advanced mechanism", the "voluntary initiative" as well as the jurisdiction "in transmission" and the "informal initiative".

The "Advanced Mechanism"

Japan shows a high per capita e-waste arising of 17.3 kg/ inhabitant in 2014 and is one of the largest generators of e-waste in the region with a projection of 2.3 million tons in 2016. Having enacted specific e-waste legislation, Japan regulates transboundary movements of hazardous and non-hazardous recyclables by the Basel Law and a Waste Management Law. Taiwan has the third highest per capita waste arising in the region of 18.6 kg/inhabitant in 2014 and estimated 436,000 tons generated in 2014. 13 categories of recyclable waste are regulated, and a so-called "4-in-1 Recycling Program" is an incentive for the informal waste collecting and recycling sector to improve resource recovery and basic environmental protections. South Korea reached an e-waste arising to nearly 16 kg/capita in 2014 and over 800,000 tons in general. A relatively low recycling rate is intended to be equalized by a new legislation with extended producer responsibility as central principle and including environmental issues, hazardous substances and appropriate waste treatment.

The study characterizes these three e-waste regulation systems as strong legal framework based on an established and functional infrastructure assuring high environmental health and safety standards.

The "Voluntary Initiative"

The second type ist represented by Singapore and Hong Kong. Singapore's e-waste production is expected to grow to nearly 21 kg per inhabitant by 2018; the generation is estimated to about 60,000 tons per year. Without a specific legislation for that kind of waste – locally even classifi-

able as non-hazardous solid waste –, various options for the implementation of a management framework were reflected. The National Environment Agency has launched a national voluntary partnership with interested stakeholders.

Concerning Hong Kong, UNU estimates an e-waste generation of approximately 156,000 tons in 2014, but also officially a recovery rate of approximately 80 percent is reported. As a hub, Hong Kong internationally trades regulated e-waste either as secondhand goods or as waste. Although a specific e-waste legislation is missed, intiatives for voluntary programs were raised and a draft legislation for WEEE management including extended producer responsibility was to be implemented in 2016. The re-export of e-waste to Hong Kong is prevented by an enhanced import control. On the other hand, Hong Kong also acts as a base for re-export of e-waste from other countries to China.

In this type of system – in the absence of a legal framework – the private sector (mostly international manufacturers and recyclers) takes the initiative to implement programs for e-waste. As they are entirely voluntary, the system's participants usually operate based on commercial imperatives rather than regulatory requirements.

Systems "In Transition"

China, the Philippines, Malaysia and Vietnam: all of them have a so-called "recent" e-waste legislation and are in a transitionary phase with a mix of formal and informal elements. China, for instance, has seen a dramatic increase in quantities: E-waste being disposed of domestically in China rose from 9.91 million units in 2001 to 109.80 million units in 2013, whereas WEEE treated increased from 25.84 million units in 2012 to 70 million units in 2014. The generation of e-waste is estimated by nearly 6 million tons, not to mention the 1.5 to 3.3 million tons imported every year. The e-waste recycling system traditionally offered work for widespread informal e-waste collectors and recyclers. As formal recyclers with higher treatment costs were unable



to compete on price, the government gave incentives to strengthen the formal sector. So until July 2014, 106 facilities have been authorized for funding under the incentive scheme, partly with additional help from foreign recycling companies.

Malaysia's e-waste generation is estimated by UNU at approximately 250,000 tons of e-waste per year and at a rate of 7.8 kg per inhabitant. The country has neither an e-waste-specific legislation nor a legally obligatory takeback system; the waste is sold to private collectors. But the multinationals dominating the electro(nic) production market launched campaigns and pilot programs for awareness-raising on e-waste-disposal.

The e-waste amount at the Philippines is estimated at approximately 125,000 tons and a rate of 1.35 kg per inhabitant per year. The country has not yet ratified the Basel Ban Amendment. A partnership with Japan allows the import of chemical, hospital and municipal wastes into the Philippines, but illegal imports mainly from industrialized countries like the United States, Korea, Thailand and Japan are likely to occur. The lack of proper disposal facilities and infrastructure enables the dumping of large quantities in open pits or exported to other countries for further metal recovery.

With a generation of 115,000 tons of e-waste and a rate of 1.34 kg per inhabitant per year, Vietnam has one of the lowest rates in the region. Currently the recycling system practices cherry-picking of only materials of known value. Allegedly the recycled material is exported to China, the rest mostly dumped into the environment. A dedicated ewaste management is strongly needed.

The "Informal Initiative"

The last type of "informal initiative" countries contains of Cambodia, Indonesia and Thailand – comparable in the need to establish legal frameworks for e-waste management. In Campodia, the informal sector collects and sells the usable e-waste. Unusable residues are disposed of, burned or discarded. In Indonesia, an effective control of illegal imports and any regulation for managing locally generated e-waste generated is collected and processed by the informal sector with hazardous dismantling techniques. According to the study, these countries feature an active informal sector with an established network for collection and import of end-of-life products and their recycling.

Measures remain a challenge

The study summarizes that all above mentioned – and only sketchy characterized – countries control e-waste transboundary shipments either by Basel Convention or own national regulations. They all have control measures concerning the import of e-waste, while some of them restrict the import of second-hand electronics and others prohibit it. However, in common "enforcement of these measures remains a significant challenge in these countries and many others around the globe", the study finalizes. Political measures including legal frameworks are surely an instrument to increase e-waste management. But no policy can be realized without financial support, either by governmental funding, by public-private partnership or by private investors. So the study not only suggests that in several of the East & Southeast Asia countries the insufficient capturing and analysing of statistical e-waste data and the maintaining of a national inventory is due to a lack of investment. And that these countries have made previous attempts, often supported by international development agencies, to establish such inventories of e-waste. But the study also points out to China where foreign recycling companies invested in facilities – often with stateof-the-art equipment for processing e-waste. Likewise the Philippines, where partly international recycling companies funded treatment, storage and disposal and introduced international standards on environmentally sound management for hazardous wastes. Or Malaysia – "with an open economy that welcomes trade and investments".

The full "Regional E-waste Monitor: East and Southeast Asia" is available under Shttp://ewastemonitor.info/pdf/ Regional-E-Waste-Monitor.pdf

Global E-Waste Management Market

Zion Market Research has published a new report titled "E-Waste Management Market by Type (Trashed and Recycled), by Source (Household Appliances, IT & Telecommunications, Consumer Electronics and Others): Global Industry Perspective, Comprehensive Analysis and Forecast, 2015 – 2021". According to the report, distributed by Market Research Store, the global demand for e-waste management was valued at 17.0 billion US-Dollar in 2015 and is expected to reach 58.0 billion US-Dollar in 2021, growing at a compound annual growth rate (CAGR) of 22.7 percent between 2016 and 2021. In terms of volume, the global e-waste management market stood at 86.40 million tons in 2015. The informal name for electronic products approaching the end of their useful life is nothing but e-waste. It includes the components such as discarded computers, stereos, refrigerators, fax machines, televisions, electric fans, VCRs, cellphones and batteries. Several of these products can be reutilized and recycled so that they are less harmful to the ecosystem. Recycled and trashed are the main two types of global e-waste management market. Trashed was the dominated type of global e-waste management market in 2015. It accounted over 55.0 percent shares of the entire consumption volume and further it is also expected to remain the dominant segment over the coming years due to the high penetration of advancing technology across the globe. A sample report can be requested at \bigcirc http://bit.ly/2clrvy0.



Markets

Approximately 70 percent of the 64 million tons of solid waste generated in Indonesia each year is sent to substantially unsanitary landfills. According to researchers and media, the recycling rate is about 2 percent (in urban regions: 7.5 percent). This situation is set to change.

Indonesia: Priority Is on Waste-To-Energy

"Waste management has always posed an issue in the country", Brurce Muhammad Mecca, junior researcher at the Indonesian Institute for Energy Economics, wrote in "The Jakarta Post" at the beginning of February this year. As reported, two years ago Jakarta - Indonesia's capital and most populous city (more than 9.5 million inhabitants) - had produced 7,500 tons of waste each day and dumped 6,700 tons at the Bantar Gebang dumpsite in Bekasi, West Java, which is said to reach its capacity by 2019. "In February 2005, the Leuwi Gajah dumpsite in Cimahi, West Java, experienced a landslide that buried 71 houses and killed 143 people. In Bandung, West Java, a waste-fired power plant project has run up against many legal problems and is predicted to be canceled", the author described the situation. "The government seems to have a lot of homework to do before making the Indonesia Waste-Free 2020 dream a reality."

"Aware of this problem, the government has picked Waste to Energy (WTE) technology to help tackle the complex waste issue", Brurce Muhammad Mecca informed in February. According to the author, the Indonesian government has introduced many policies from the president and ministries down to local authorities to accelerate the application of waste-to-energy facilities in seven cities: Jakarta, Tangerang, Bandung, Surabaya, Surakarta, Makassar and Semarang. "The top executive order is Presidential Regulation (Perpres) No. 18/2016 on the acceleration of the development of waste-based power plants or incineration. However, this regulation was annulled by the Supreme Court a few weeks ago, following a request by various civic groups stating that incinerators were dangerous for health and the environment. It is actually a known fact that incinerators can cause serious damage due to their hazardous residue and toxic fumes, if not managed properly. Despite the Supreme Court's move, the government is staying the course."

As reported by "The Jakarta Post" in 2015, the Indonesian Directorate General for New Renewable Energy and Energy Conservation of the Energy and Mineral Resources Ministry, with support from the EU-Indonesia Trade Cooperation Facility (TCF), was preparing a waste-to-energy (WTE) guidebook (published at \textcircled www.euind-tcf.com) providing a way to realize WTE projects in Indonesia. The guidebook was part of a project jointly implemented by the ministry

Waste-Free Indonesia by 2020

"In the National Mid-Term Development Plan for 2015-2019, the Government of Indonesia has set ambitious targets of reducing landfilling by 20 percent out of 124.6 million tons in 5 years in 380 cities", the Danish company Babcock & Wilcox Vølund A/S quoted the Indonesian goal. The reduction efforts would consist of extended producer responsibility, 3R (reuse, reduce and recycle), increasing the number and capacity of recycling centers as well as waste banks. "The mid-term plan also sets a target of 75 percent managed waste or 97.8 million in 5 years in 380 cities. This target is to be achieved through better separation at sources, composting, urban farming and waste to energy."

Recently the Government of Indonesia has launched a campaign of "Waste-Free Indonesia by 2020" and has also announced that marine plastic waste must be reduced with 70 percent from now to 2025, the company reported.

and the TFC, a four-year EU-supported project (which was completed in 2016) partnering with Indonesian government organizations to enhance economic development through trade and investment.

Danish-Indonesian collaboration

According to the Ministry of Foreign Affairs of Denmark, Indonesia is the country that dumps the second-most plastic into the oceans, after China. A new Danish-Indonesian collaboration has been convoked in order to change this situation; the ministry has launched a new inter-agency cooperation for water and waste in Indonesia. "In this way we can help to reduce the discharge of waste into the world's oceans, while also enabling Danish companies to earn money from Indonesian waste," the Danish Minister for Development Cooperation Ulla Tørnæs was quoted, who was visiting Indonesia in May this year.

The new cooperation focuses on waste management, recycling and the conversion of waste into energy. As reported, Danish authorities shall inspire and exchange experiences with the Indonesians on waste policy and management, as well as public regulations such as charging for plastic bags and recycling and deposit systems. In Indonesia, Danish solutions would be appreciated.

According to the information provided by the ministry, Danish companies such as Desmi, Dong Energy, Rambøll, Grundfos, Babcock & Wilcox Vølund and the Danish Environmental Protection Agency have already been to Jakarta and presented solutions to the problem of plastic pollution to the local authorities and the World Bank. Furthermore, Danish companies have been involved in pilot studies as part of Denmark's environmental program, which aims at replacing coal with household waste and converting landfill gas into electricity. "The inter-agency cooperation involves Denmark sending a Danish growth consultant with expert knowledge in the field of water and waste to the Danish embassy in Jakarta to initiate a close collaboration between the Ministry of Environment and Food in Denmark and the Danish Environmental Protection Agency and their Indonesian counterparts", the ministry announced in May this year.

Invest in Indonesia

There are many reasons and opportunities to invest in Indonesia. According to US-based sources, the environmental technologies market – including goods and services – is estimated at nearly 7 billion US-Dollar. Indonesia's Investment Coordinating Board (BKPM = Badan Koordinasi Penanaman Modal) is the country's investment one-stop service in which 22 ministries/institutions are integrated.

Interested companies can get detailed data at www3.bkpm.go.id/en/investing-in-indonesia/bkpmmain-services

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Since 2001 China began to install sanitary landfills in large and coastal cities, dumps were to be closed. From 2006 on, small and middle towns as well as developed counties got sanitary landfills and leachate treated plants.

The rural areas were neglected. The Five-Year-Plan for 2011 – 2015 defines the development of an circular economy as an important strategic renouncement including "encouragement of resource protection" and "strong improvement of the circular economy". Until the end of 2020, the most important cities are forced to realize a "separation rate" of over 90 percent and a recycling and disposal rate of 35 percent including separately collected biologically degradable waste.

25 billion Euro to be invested

In 2015, the cities on the Chinese continent produced 191.4 million tons of municipal solid waste, of which 98 percent were treated "non-hazardous". At the same time the nearly 1.600 counties collected 66.6 million tons and treated 71.6 percent. Non-hazardous treatment in China is the synonym for dumping and incineration. So in the last twelve years the number of landfills climbed from about 450 to 650, incineration plants increased from 50 to 225, while biological treatment plants seam to have halved. Nevertheless, the MSW generation in the megacities rose slightly during the last 15 years, the rural production partly decreased, whereas the waste generation in the municipalities increased distinctly. Anyway the number of controlled disposal sites more than doubled and the percentage of incineration plants in waste treatment grew from 3 percent to more than 30 percent.

In the Peoples Republic of China 890 municipal waste treatment plants in cities and 1,187 in counties were in operating state in 2015. 67 cities did not run a correct treatment plant. The average treatment facility's capacity reached 500 tons per day at landfilling and 769 tons per day for incineration. The 30 biological treatment plants resort to 324 tons per day. For rural areas, the figures show a treatment rate of 30 percent in small towns and less than 10 percent in villages; the waste is mostly dumped. Enhancement of capacities to 360,000 tons per day for cities and 130,000 tons per day for counties are planned to reach an incineration rate for municipal waste by 50 and partly 60 percent. According to the figures, 192.4 billion Chines Renminbi Yuan (CNY) respectively approx. 25 billion Euro will be invested in municipal waste treatment plants until 2020. At the end of the 13th Five-Year-Plan, a total treatment capacity for organic waste of 40,000 tons per day by investments of 13.6 billion Chines Renminbi Yuan (CNY; 1.76 billion Euro) – is requested in 2020.

New treatment strategy proposed

In metropolitan areas valuable materials as well as municipal waste are collected separately and disposed. But for the collection and treatment of residual waste in rural areas further action is required. Currently 32 percent of domestic waste in China is – due to a high biogenic and moisture content – unefficiently incinerated, while 68 percent of waste ends untreated in sanitary landfills causing emissions. A proposal for a new strategy by German RETech Partnership suggests the segregation of a 25 percent bio-waste for anaerobic digestion and/or composting, mostly ending in compost products. Small parts are mass loss and recovery of recyclables. The residual 75 percent mixed waste could be treated by incineration and mechanical-biologically, resulting predominantly in energy recovery and sanitary landfilling. The benefits of this system lie in the reduction of the biogenetic parts making incineration more efficient. The division of bio waste collection and mechanical-biological treatment reduces waste volumes for landfill and increases both material and energetic disposal. And finally the waste will be stabilized before landfilling and thus minimizes emissions.

Tuning between political and bureaucratic layers needed

The implementation of the system does not only need a detailled analysis of volume and composition of the local waste, as they differ in the contents of kitchen waste, water, recyclable material and hazardous ingredients. It also needs an excellent tuning between the different ministries of Environmental Protection, of Housing and Urban-Rural Development, of Industry and Information Technology, and of Agriculture and a distinct coordination of the bureaucratic layers of provinces, municipalities, prefectures, counties, townships and villages. And it depends on the cooperation of conventional and informal sectors. Collection, treatment and utilization of separately collected compost and digestate should be ruled by law and substituted by a ban on landfilling of untreated municipal waste. China already works on rules concerning the quality of the material including concentrations of pollutants and impurities as well as restrictions on yield quantity. The volumes currently collected are small, but their separate collection is logistically possible and has been practiced in the past.

In search of suitable procedures and locations

The use of biogenic waste from residual household waste is only possible to a very limited extent. This so-called compost-like-output should be examined for further use in and on soil or for sanitary landfilling as a stabilized organic fraction. Regulations are needed regarding the quality of the material and of their treatment plants. MBA technology might be the best by reason of flexibility and adaption to the specific local and judicial requirements. It is able to separate the material for either recycling or energy recovery or to render it inert. Below the line, the separate collection of waste connected with a landfill ban of untreated waste and energy-efficient recovery plants would be the basis for a sustainable waste management in China. Difficulties result from searching the most suitable treatment procedures and the most suitable location for appropriate plants. According to experts, numerous pilot projects of separate collection have been started. Composting of green waste is possible, and marketing possibilities are available. Sudden relief is needed for gathering the restaurant waste in China's cities. Mechanical-biological treatment could be an option for decentralized solutions and a supplement of waste incineration plants.

The full article on "Disposal of biogenic waste fraction in RP China" can be found in Waste-to-Resource 2017, ed. Matthias Kühle-Weidemeier, Katrin Büscher, Göttingen 2017, ISBN 978-3-7369-9533-8 or eISBN 978-3-7369-8533-9

Kenya Bans Plastic Bags

On the 28th of August this year, Kenya implemented a national plastic shopping bags ban, international media reported.

According to the provided information, the law makes it illegal to use, import and manufacture plastic bags. Exemptions exist for those producing plastic bags used for industrial purposes.

The violation of the ban will cost a maximum fine of 38,000 US-Dollar or a four-year jail term, the news agency Associated Press is cited; the minimum fine would be 19,000 Dollar or a year's imprisonment. The bags harm the environment, block sewers and do not decompose, the Kenyan government pointed out. Some 100 million plastic bags were handed out every year in Kenya by supermarkets alone, the UN Environmental Program had informed.

Bans in other African countries

In Tunisia, such a ban came into effect on the 1st of March this year. It requires all supermarket chains to stop distributing the bags.

Similar bans exist in other African countries like Botswana, Eritrea, Mauritania, Morocco, Rwanda, South Africa and Uganda, but practical results are still lacking, Deutsche Welle reported. Among African countries, that have adopted or announced such bans, are also Cameroon, Guinea-Bissau, Mali, Tanzania, Ethiopia and Malawi.



Markets

Photo: alswart / fotolia.com

China: Ready for Foreign Investors?

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Chen Guangbiao is the founder of Chinese Jiangsu Huangpu Recycling Resources Co., Ltd. The company procured him an asset of estimated 600 million Euro. In the Western World Chen Guangbiao became known announcing in December 2013 to buy the New York Times – alternatively CNN, Washington Post oder Wall Street Journal. News agency Reuters cited him with the remark: "There's nothing that can't be bought for the right price."

t seems that other Chinese entrepreneurs or manager followed the motto as well in case of investments or acquisitions of recycling companies all around Europe. Some examples may confirm that.

The Netherlands: In August 2013, Power Assets, Cheung Kong Infrastructure Holdings Ltd. and Li Ka Shing Foundation Ltd. acquired Dutch Enviro Energy paying 9.7 billion HK-Dollar. Dutch Enviro Energy operates 5 waste treatment plants and owns AVR, the largest EfW company in the Netherlands.

Portugal: In November 2013, Chinese group Beijing Enterprises Water was said to study the privatization of Portuguese company Empresa Geral de Fomento (EGF), a subsidiary of water group Águas de Portugal for the solid urban waste sector.

A new record for Merger & Acquisition

Germany: In February 2015, after rounds of fierce competitions, Beijing Enterprises Holdings successfully acquired 100 percent equity interest in Energy from Waste (EEW) at a consideration of 1.438 billion Euro. EEW operated 18 energy-from-waste plants and held a leading position in the energy-from-waste sector in Germany with approximately 18 percent market share. Italy: In December 2015, the Chinese construction machinery giant Zoomlion invested 67 million Euro for a share of 57 percent of Italy's waste-disposal company Ladurner in Bolzano. Ladurner manages 30 plant projects in Europe for the treatment of solid waste and the production of renewable energy from biomass.

Sweden: In January 2016, waste water treatment company Purac was sold to SDIC & Beijing Drainage Investment Fund, a fund majority-owned by the Beijing Drainage Group. Purac had developed into a leading contractor within water and wastewater treatment and biogas production in Scandinavia and China.

For more than one billion Euro

Poland: In June 2016, state owned China Everbright International expanded into Europe with the 123 million Euro acquisition of a major Polish waste management firm Novago. Novago is said to be the largest independent waste treatment company in Poland, including six technologically advanced production sites and a RDF production to supply alternative fuels to cement plants across Poland.

Spain: In September 2016, Spanish group ACS sold waste treatment firm Urbaser for more than 1 billion Euro to Firion Investments, a firm controlled by the Chinese Group China Tianying. Urbaser's activities range from waste collection to waste treatment plants in Spain, Portugal, France, Italy, the UK, Morocco, the United Arab Emirates, Mexico and other South American countries.

The Netherlands: In November 2016, three Chinese investors showed interest in the acquisition of Dutch waste management group Attero. Attero – processing 40 percent of Dutch household waste and describing itself as a leading player in creating energy from waste – finally forgot about the planned sale.

To obtain control over most profitable segments

Germany: In December 2016, Chiho-Tiande Investments Limited had taken over the capital stock of German Scholz Holding GmbH at a price of 1 Euro. The new subsidiary was at that time a leading European scrap recycler present in several Middle and Eastern European states, USA and Mexico and ranked among the biggest global recycling companies for ferrous and non-ferrous metals. And regarding Eastern Europe, "for China, the region represents a gateway to larger European markets," the Financial Times cited Cui Hongjian, director of European studies at the China Institute of International Studies.

A study on "Made in China" by the Mercator Institute for China Studies in late 2016 pronounced that Chinese high-tech investments in Europe need to be interpreted "as building blocks of an overarching political program. It aims to systematically acquire cutting-edge technology and generate large-scale technology transfer. In the long term, China wants to obtain control over the most profitable segments of global supply chains and production networks."

Open space in China's market

Of course, China offers opportunities to invest foreign capital as well, as the countries' need of municipal waste management has become paramount and especially the demand for relevant waste-to-energy equipment following the 13th Five-Year Plan is increasing: The worldwide contract volume of incineration-capacity in 2014-2016 comprised of 83 percent by China and comparatively little 8 percent by Europe, according to management consults A. Vaccanti & Partner. As experts formulated, the development status especially of China's domestic e-recycling industry opens "space in the market that foreign involvement is well placed to fill". However, foreign investors servicing firm Dezan Shira & Associates warned in their "China Briefing" that clients "looking to capitalize on China's environmental leadership must have a thorough understanding of where opportunities exist, and how to make secure investments".

According to the current online industry marketplace environmental-expert.com, there are 200 foreign companies providing solid waste management, service, supply or monitoring that are based here, represented by own office or acting as a distributor in China. And more than 1,900 companies in the same branch are serving China from abroad. Presumably the figures are much higher. However, a reliable overview is not possible even because of the different and various operational types.

Not a market for beginners

Foreign direct investment is possible if a company from abroad is allowed to act as a wholly-foreign owned enterprise (WFOEs). The registration process is determined by several obstacles and hurdles and contains risks, for example in finding a reliable Chinese consulting firm for the WFOE registration process. China law blog Harris | Bricken has some experience in the field and advises: "There are some excellent China company formation companies and there are some where you are all but guaranteed to waste your money." And Hans Sanzenbacher, Managing Director of Polytechnik Deutschland GmbH, underlined: "China is not a market for beginners ... One needs strong human and financial resources to tap into the market. And the coordination process is also much longer." In the case that the know-how of a certain branch is wanted, for example used electronic manufacturers or recyclers – if approved by the Ministry of Science and Technology, the Ministry of Commerce and the State Administration of Taxation and under several other conditions - can enjoy several tax benefits and get the opportunity to make money in e-waste recycling. The same applies for foreign investors into China's waste water treatment technology as it this desperately needed.

The competitive struggle from Chinese businesses even now must not be underestimated. As waste-to-energy companies are sought-for, foreign firms like Babcock & Wilcox, MVVEnergy, Suez Environnement, Veolia, Viridor and Wheelabrator ranked amongst the 25 leading w-t-e companies in China in 2015. On the other hand, the Chinese solid waste management in 2011 was mainly controlled by domestic companies. Even the two "foreign" enterprises among the biggest nine were the Dalian Dongtai Industrial Waste Treatment Co., Ltd., a 90 percent-owned subsidiary of China Industrial Waste Management Inc, and the USA-based Covanta Holding Corporation that held minority interests in two waste-to-energy facilities of China's Chongqing Sanfeng Environmental Industry Co., a subsidiary of the Chongqing Iron & Steel Group Ltd.

Entering into strategic engineering agreement

Indirect investing is possible as well by licensing or franchising the technology to the Chinese waste market. Hence, U.K.-based electronics waste management firm E-Waste Systems Inc. did so by entering into a strategic engineering agreement with one of the largest electronics recyclers and technology firms in China: Loyalty Equipment Making. According to PR Newswire, a distributor of press releases, the initial value of the deal in 2013 was worth 800,000 US-Dollar, plus royalties and a minimum 5,000,000 US-Dollar sales commitment. In addition to the license agreement, the deal included an investment of 650,000 US-Dollar in E-Waste Systems, bringing technology, regulatory knowledge, industry experience and market knowledge to the deal. E-Waste Systems-CEO Martin Nielson is cited with the words: "The transactions includes access to all of Loyalty's technologies and agreements for joint branding initiatives nationally and internationally, raising our standing in the industry and establishing EWSI as the industry's largest globally integrated e-waste recycling brand." And he was thrilled to enter the market in China and further with this deal: "This master license advances our global footprint as the leading eWaste pure play public company and is extremely important to secure our eWaste brand globally."

Joint ventures and special arrangements

The deal of Berlin based disposal group Alba with a Chinese investment fund under the lead of the entrepreneurial family Deng was called a joint venture. The signed participation agreement in October 2016 includes Deng - owner of Chengdu Techcent Environment - participating by 60 percent in the China business and the service division of Alba. The German group received an investment sum estimated at more than 300 million Euro. Alba CEO Axel Schweitzer denied that the transaction could be interpreted as destruction of his concern. The Manager Magazine was told: "It is our target to combine the strength of both partners: Techcent's strength on the Chinese domestic market with our cutting-edge sorting technology. Or our leading role in recycling services with the expansion force of Techcent." Such arrangements with a Chinese investor Yi Sun, director of Ernest & Young's China Business Services, refer to as strokes of luck for European firms: They offer "partly high financial resources, a better access to the Chinese market and future perspectives."

A special arrangement for German medium enterprises has been created by the ZhongDe Metal Group GmbH. The Metal Eco City (MEC) is designed and founded as Sino-German interface to deliver a start-up support to foreign businesses and to open access to the German market for Chinese undertaker. The MEC offers a showroom for a year for free to the business to investigate the economic possibilities without time pressure and guarantees intellectual property rights. The MEC Management supports the initial, contract and operative establishing stages; legal professionals can be mediated. Until the 30th of July 2017, MEC's Business Inkubator delivered young German startups a special package including office and production space, internet and telephone for free as well as support for authority ways.

Improving influence

It can easily be summed up that China applies double standards in waste management investment in Europe and at home. In Europe, the Chinese strongly invest selectively in objects chosen by no means randomly. The acquisition of German EEW for example was the largest overseas acquisition related to waste treatment businesses by Chinese enterprises and created a new record for Merger & Acquisition in the history of Chinese enterprises in Germany. And the acquisition of Poland's Novago counted for the largest Chinese takeover of an environmental company in Central and Eastern Europe and was interpreted as "a solid foundation for future expansion" in that region, according to Everbright International CEO Chen Xiaoping. The more or less hidden aim: to get European know-how and improve the influence in the solid waste business sector. In contrast, foreign investment in China maybe encouraged, but is only wanted and admitted, if the branch possesses currently asked know-how and the investor fulfills several domestic conditions in absence of domestic competitors. If not, the foreign professional's offer is dominated, blocked or hampered by domestic companies. Involving in such brunches may even lead to loss of proprietary technology and knowledge. A German Chamber of Commerce flash survey brought to light that two thirds of all responding German companies experienced obstacles in the legal or regulatory framework for their company in China in 2016 mainly caused by non-transparent regulatory processes and procedures, different interpretations of existing laws as well as insufficient prior information. And one in four companies indicated that they could not enforce intellectual property rights. Licensing issues and market access constraints were problematic for more than one in five companies.

"Europe is an 'abundant buffet' for Peking", complained Jörg Wuttke, German director of the European Chamber of Commerce in China. "But for us, China only reserves some plates and a soup, and basta." China's Foreign Minister Wang Yi knows, that the environment for investment should be improved. "However, China's doors will widen for foreign investors on and on."



Adelaide Installs Combined First Solar and Methane Power Plant

It is believed to be a first in Australia: the new combined solar and methane power plant in South Australia. The installation will channel thermal energy from solar panels and methane gas from decomposed garbage through a shared turbine inter-connector. A generator will then convert the two sources of energy into electricity to be fed into the local grid. Chief Executive Adam Faulkner commented on the innovation: "It's a two-pronged attack for turning our trash into treasure."

The plant, managed by the Northern Adelaide Waste Management Authority, is planned to start exporting electricity in September. The gas produced from rotting garbage will act as the plant's base-load power and will produce about 11,000 megawatt hours of electricity each year to power about 1,800 homes. The site's 5,000 square meter sized solar panel farm is expected to produce about 2,000 megawatt hours of electricity each year, powering around 300 homes.



NAWMA Chief Executive Adam Faulkner at the new solar and methane farm

NAWMA and the local energy companies got together a couple of years ago. "That's when we put our heads together and thought, if the gas side of the equation has been proven to work, let's turn our minds to the unused portion of land next to the landfill site and use it as a solar farm", Faulkner explained. South Australia has a goal of 50 percent renewables by 2025 and plans to make Adelaide the world's first carbon neutral city by 2025. The state has become a hub for renewable energy recently, following Elon Musk's announcement last month that Tesla will build the world's biggest lithium- ion battery in South Australia before the end of the year.

www.nawma.sa.gov.au/



New Ways of Consuming Feature New Ways of Waste Behavior

The volume and composition of post-consumer and business wastes has changed beyond recognition through the postwar era, and continues to change in response to the growing shift towards online shopping, increasingly sophisticated home delivery options, smart domestic appliances, and even tailored, ready-to-cook meals delivered to the door.

These new ways of consuming, caused by advances in digital technology, will innovate waste behavior and resource management, says a new CIWM Presidential Report.

The report "Digital technology and consumer trends: Future scenarios for waste and resource management" identifies several strengthening trends, at least in the UK. Consumers are showing a greater predisposition for online shopping. Home delivery of products has grown rapidly, by increasing convenient 'click & collect' and sooner or later expanding into the grocery sector with just-in-time logistics. And the interactive technology of the Internet of things enters the home and will change the buying mode.

On the other hand, reverse logistics from consumers may become more important, involving not only electrical goods but also bulky items like carpets and sofas and even food packaging. This could change the way in which residents cooperate with household wastes services delivered by the local authority: Recyclable materials could be given back directly into the product supply chain - potentially without affecting the waste management sector. According to the report, this change in responsibility could force brands and manufacturers to put more attention on resource efficiency and design for recyclability.



The first scenario shows an increasing grocery home delivery market with top-upshoppinglocallypredominates. Retailers give up the double-tracked system of stores and front-of-house staff picking and set on warehouse style back-of-house picking or smaller local stores. In Scenario 2 the "Internet of things ramps up" by improved online services provided by retailers: Automated orders of goods and services strengthen the delivery efficiency and reduce food waste significantly. The last scenario is called "Servicisation of groceries and packaging", which means selling an outcome rather than a product. Servicisation is thought for post-Brexit "brave-new-world" producers that intensivize prevention of waste, forcing take-back systems or even the ownership of packaging and end-of-life products.

The paper ends with three principal conclusions:

- Consumer behaviors and expectations are on course to change significantly, supported by technological and digital innovations.
- The next decade and beyond is likely to see a shift in responsibility for, and influence on, wastes and resources towards manufacturers, suppliers and brands.
- Both of these trends will influence the types and volumes of waste for which the public and private sector waste industry has to plan, change supply chain relationships and present new opportunities to improve resource efficiency.

The time ist right to think this over, says CIWM President Margaret Bates. "The EU, national and local governments are exploring what policy frameworks, technologies, planning structures, services and infrastructure will be needed to recover more value from waste and deliver essential industrial feedstocks for the future as part of a more 'circular' materials economy."

The CIWM Presidential Report on "Digital technology and consumer trends" can be downloaded under www.ciwm-journal.co.uk/downloads/ Presidential-Report-2016-2017.pdf

Veolia Plans First Waste to Energy Facility in Latin America

Veolia will design, build, and operate the first Waste to Energy facility in Latin America in Mexico City. With a capacity twice that of the largest facility in France, this unit will treat around 1.6 million metric tons of house-hold waste a year. The inhabitants of Mexico City generate 13,000 metric tons of waste of which two-thirds is landfilled. The new waste to energy facility will convert about one-third of the city's household waste into green energy. The 965,000 MWh of electricity produced each year by the plant will be used directly by the Mexico City Subway Metro. The plant's construction is due to begin in 2017 and will last 3 years. Operations are scheduled to start in 2020. The 30 year operation and maintenance contract of this facility will represent an estimated cumulative revenue of 886 million Euros for Veolia. The new plant will jointly be built and operated by Veolia through its subsidiary Proactiva Medio Ambiente Mexico S.A. de C.V. and leading global and Mexican companies. Already active for 25 years in Mexico, Veolia serves 13 million people in the country and employs 3,000. Veolia treats 2.3 million metric tons of waste a year and provides 800,000 people with a waste collection service.

Refrigerators: New Plant Concepts Detect Blowing Agents

The share of halogen-free refrigerants and blowing agents is increasing in the disposal of cooling devices.

In Europe, since 1996 no refrigerators have been produced with halogencontaining refrigerants and blowing agents (CFCs). Accordingly, the share of alternative refrigerants and blowing agents is rapidly increasing during disposal. In most German waste disposal plants, the share of halogen-free refrigerators has already increased to more than 50 percent. In southern European countries, this share is already over 70 percent. Within the next 5 years, this share can rise to 90 percent. Conversely, it is expected that 5-10 percent of halogenated (CFC) end-oflife refrigerators have to be disposed during many years to come.

Selective treatment of end-of-life refrigerators

Especially in the field of corpus treatment (step II), it makes sense to think about new plant concepts, since the treatment of refrigerators with halogen-free blowing agents will be more expensive in conventional plants than the treatment of the halogencontaining refrigerators. This is due to the combustibility of the alternative, halogen-free blowing agents (pentanes).



Analytical detection of blowing agents in polyurethane foam

URT Umwelt- und Recyclingtechnik GmbH has been working on concepts for reducing operating costs for years. The core technology is the unequivocal selection between halogen-free and halogen-containing insulation foams. This is the basis for a later selective treatment of the refrigerators. For this purpose, openings are made on the corpus and on each door of the respective end-oflife refrigerator and gas samples are taken, which are subsequently analyzed automatically.

Direct burning of halogen-free blowing agents

Usually, blowing agents are recovered and liquefied at refrigeration equipment plants. The CENELEC standard was the first regulation that described a step III treatment in EN 50574. This is the direct burning of blowing agents from the polyurethane foam. Direct combustion of halogen-free blowing agents is significantly simpler than the combustion of halogen-containing blowing agents from polyurethane foams. Due to high suction quantities for detection of blowing agents the explosion limit can fall down significantly by dilution. The use of nitrogen for explosion suppression is then no longer necessary. The high exhaust volumes reduce diffuse losses of blowing agents. Emission regulations at the plants and in the exhaust air can be definitely under-run.

Reference plant in Germany

A cooling device recycling facility, which is operating according to this plant concept, has already been installed for the company ALBA Electronics Recycling GmbH in the first quarter of 2017.

An existing plant is continuing as well as the disposal of CFC-containing refrigerators. The new plant of the company URT Umwelt- und Recyclingtechnik GmbH is intended for halogen-free end-of-life refrigerators.

www.urt-recycling.com



Recovery of Cellulose from Waste Water

End of June this year, the official inauguration of "the world's first cellulose production facility" – which means a "breakthrough in recovery and reuse of recycled cellulose from sewage" – took place at Geestmerambacht (The Netherlands).

Approximately 70 experts from all over Europe, all active in the value chain, witnessed the inauguration of the Cellvation plant. It is one of six pilot systems hosted by SMART-Plant (Scale-up of low-carbon footprint Material Recovery Techniques in existing wastewater treatment plants). The project "will scale-up in real environment eco-innovative and energy-efficient solutions to renovate existing wastewater treatment plants and close the circular value chain by applying low-carbon techniques to recover materials that are otherwise lost," the homepage (
http://smartplant.eu/) says. "7+2 pilot systems will be optimized for more than 2 years in real environment in 5 municipal water treatment plants, including also 2 post-processing facilities."

As reported, CirTec B.V. (until recently BWA B.V.) and its partners had demonstrated, that, by using Cellvation, it

According to the information, **Cell-vation** is a development of CirTec BV and KNN Cellulose BV, both active in the water sector and in the circular commodity market. As successful, complementary entrepreneurs they bring Cellvation jointly to the (international) market. The project at WwTP Geestmerambacht is an initiative of CirTec BV and part of the Horizon2020 action SMART-Plant.



is technically possible to extract clean, marketable cellulose from sewage and make it available as a raw material. "Examples are the 'Vazena' project (Dutch acronym for "From Cellulosic Screening to Asphalt"), a demonstration project where a bicycle path is made of asphalt in which recycled cellulose has been processed, and 'Zeefgoud' (screened gold), a project in which cellulose is produced as a raw material for other products," the company points out on its homepage. The Cellvation installation at the Waste Water Treatment Plant (WwTP) Geestmerambacht is to produce about 400 kilograms of pure cellulose a day. "Part of this cellulose is exported to England where it is used as a raw material to produce bio-composite," the Dutch company informed in June. "The remaining cellulose is used for the production and development of other products."

www.cirtec.nl/en/

New Solution for Monitoring Liquid-Based Processes

At the 8th World Conference on Sampling and Blending (WCSB8) in Perth (Western Australia), PANalytical, an international supplier of analytical X-ray instrumentation and software, has announced the new Epsilon Xflow system.

As reported, this new on-line solution is made for the continuous analysis of the elemental composition of any liquid, providing real-time feedback from a production process.

The Epsilon Xflow can be incorporated in many different process streams in a wide range of industries such as mining and metals or the production of petrochemicals, polymers or food, PANalytical gave account. "Predefined conditions can be closely monitored, enabling an immediate reaction to any change, in this way avoiding waste and unnecessary expenses." For example in the petrochemical industry the system could analyze sulfur in fuel even at concentrations lower than 10 mg/kg at many stages of the production process. At the same time low concentrations of vanadium and nickel, which may be harmful to the refinement process, can be determined. "Industries will be able to closely check their waste water for hazardous compounds; a task becoming increasingly important with the obligation to comply with stringent environmental regulations," the company emphasized.

According to the information, the analytical core of Epsilon Xflow employs proven energy dispersive X-ray fluorescence (EDXRF) technology, which is robust and non-destructive with low detection limits and highly accurate and reproducible analysis results. Elements from Sodium up to Americium at concentrations from a few ppm to 100 percent can be analyzed. "Almost any liquid can pass through the flow cell across the detector which has a leakage protector in place," the provider says. "The system can be tailored to any customer's needs with optional sample conditioning and common interfaces to manufacturing execution systems."

About PANalytical

PANalytical employs over 1,000 people worldwide; the company's headquarters are in Almelo, the Netherlands. Its customers can be found in virtually every industry segment, from building materials to pharmaceuticals and from metals and mining to nanomaterials. The combination of its software and instrumentation, based on X-ray diffraction (XRD), X-ray scattering, X-ray fluorescence (XRF) and near-infrared (NIR) spectroscopy as well as pulsed fast thermal neutron activation (PFTNA), provides the company's customers with information on their materials and is applied in scientific research and industrial process and quality control.

PANalytical also provides a variety of instruments and tailored solutions to satisfy regulated activities and support environmental investigations and research alike. Typical applications include waste material analysis, biomass elemental analysis, soil and sludge elemental analysis (heavy metals) and asbestos mineral identification and quantification.

www.panalytical.com

New Method to Treat Plastic Waste

The first systems to use anaerobic digestion technology in order to turn waste plastics into energy and fertilizer are being developed in South Australia.

According to the information provided by \bigcirc www.theleadsouthaustralia. com.au, the plastic to energy technology had so far successfully been applied to polyethylene, polypropylene, polystyrene and expanded polystyrene. However, the anaerobic digestion process varied upon disposal feedstock and depended also upon temperature and system set up.

"The POET system prepares waste plastic in a way that microbial digestion can take place quickly and I think that's really the key to making it a commercial opportunity," the inventor David Thompson was cited. "I have already got inquiries from overseas including a large consortium in South America that is really quite interested to get involved and take the technology over there."

POET Systems expects to have its first two machines – each capable of processing 20 tons of plastic a week – operating commercially in about 12 months. The first two POET machines (POET is an acronym for Polymer – Organic – Energy – Treatment) will be built at wastewater treatment plants in regional areas of the Australian state of Victoria. The same microbes will treat plastic and water simultaneously. The microbes then die and leave behind liquid and solid biomass, which can be used as fertilizer and biogas, separated into methane and carbon dioxide.

Thompson, who is based in the South Australian capital Adelaide, said the methane could be used to create heat and energy, possibly to power the wastewater plant, while there was also potential for the carbon dioxide to be captured and reused. "So basically the plastics go into an anaerobic situation in wastewater where the microbes digest the plastic and create energy," he is cited. "This client in Victoria is big on wastewater treatment plants and after thinking about his methodology - there is over 550 wastewater treatment plants in Australia and at least half of those would have anaerobic digestion facilities attached so it is a good opportunity to go down that path." Thompson plans to lodge provisional patent docu-



ments for the technology in the coming weeks. He said the system did not impact on existing recycling practices as it targeted plastics destined for landfill and would add a new revenue stream for companies in the waste industry. "People in the waste industry have already invested heavily in infrastructure so they know how to do the business. If this gives them an additional opportunity to make money and take on a segment which has not been handled before then I am happy with that."

Australian Technologies Competition

POET Systems is a 2017 semi-finalist in the Australian Technologies Competition, which assesses, mentors and promotes companies providing a uniquely Australian take on the future and is open to technologies that have global potential in a range of industries. Winners will be announced at Technology Showcases in Melbourne and Sydney in October and November.

The short list says that "POET Systems' plastic-to-energy technology allows for treatment and processing of plastics through Anaerobic Digestion using microbial transformation of the hydrocarbons to non-toxic fertilizers".

New Method for Cleansing Waste Products and Reusing Resources

Finnish-based Fortum Group has developed – through its recycling and waste solutions unit – a new method called the Multi-Purpose On-site Phase Separator (MOPS).



According to the information, the technology removes pollutants from strongly contaminated soil, hazardous waste and waste incineration residues "in an effective way with minimal harm to the environment". At the same time MOPS would decontaminate waste, residues and valuable resources for further use. The technology "is an on-site solution treating the waste in interaction with the customer by using for instance the company's own wastewater". Fortum Waste Solutions - which operated under its former name Ekokem - is one of Europe's leading companies regarding the treatment of strongly contaminated soil. As reported, the company is constantly looking to improve existing treatment methods or develop new methods. The new technology is considered as a solution for a modern, high-technology treatment process which can be used in relation to many

different input materials, takes place close to source, has a short process time and uses substantially less water than conventional methods.

"The MOPS technology has already been tested on a smaller scale," Fortum Waste Solutions pointed out. "Among other things, it turned out to be effective in relation to separating mercury and isolating salts and metals to an extent of purity making the treated fraction reusable. We therefore expect the technology to contribute essentially to reducing the consumption of raw materials and strengthening the sustainability profile relating to waste treatment processes." Fortum Waste Solutions has applied to the The Danish Environmental Protection Agency's fund for green innovation - MUDP - for financial support to be able to implement the concept in relation to specific fractions. The idea is to use the MUDP subsidies for conducting a pilot test of the technology. The allocation of means is decided in September (the outcome was unknown at the time of writing). The pilot project would use and develop the MOPS technology in practice during 2018-2019. The three specific focus areas are as follows:

- Decontamination of strongly contaminated soil from "Groyne 42" in Thyborøn – the primary contamination source is mercury.
- Recovery of the fly ash from incineration plants. The ash is a residue with a big content of different salts and metals.
- Recovery of phosphorus from water treatment plant sludges. Decontamination of polluted sludges that would otherwise require incineration or deposit.

http://wastesolutions.fortum.com

Ekokem Became Fortum

Since April this year, the brand of the Finnish company Ekokem has changed to Fortum. Both companies have teamed up in 2016 to form a major Nordic circular economy company. Following the successful integration of Ekokem's operations, the company also became Fortum. As part of the Fortum Group the former Ekokem Group establishes the recycling and waste solutions unit, the company informed. It provides environmental management and material efficiency services in the Nordics which include recycling, reutilization, and final disposal solutions as well as soil remediation and environmental construction services. Fortum is a leading clean-energy company that provides its customers with electricity, heating and cooling as well as solutions to improve resource efficiency. The group employs some 8,000 professionals in the Nordic and Baltic countries, Russia, Poland and India. In 2016, sales were 3.6 billion Euro.

Spain: Bulk Bag Discharger Speeds Operation

A Spanish plastics company was able to reduce manual handling using a Bulk Bag Discharger.

The company collects, sorts and recycles plastic scrap, which involves compounding and pelletizing of resins using a mineral additive in powder form. Previously, operators manually dumped 25 kg sacks of the mineral powder (particle size of 10 μ m) into a hopper from which the material gravity fed into an extruder along with the recycled material. The process was slow, laborious and dusty.

"Now, the powder is discharged automatically from 700 kg bulk bags and conveyed to the extruder pneumatically at high rates, with less labor and little or no dust using a bulk bag discharger and a pneumatic conveying system from Flexicon," the provider underlines.

The process

Once a forklift positions a bulk bag alongside the Bulk-Out model BFH-C-X bulk bag discharger, a hoist and trolley suspended from a cantilevered I-beam lift the bag into position on the discharger frame. The clean side of the bag spout attaches to the clean side of a Tele-Tube telescoping tube by means of a Spout-Lock clamp ring. The tube maintains constant downward tension on the bag as it empties and elongates, promoting material flow into the 226 liter hopper and containing dust.

A Flow Flexer agitation device raises and lowers edges of the bulk bag to promote the flow of mineral powder into the hopper, which is fitted with an agitator to promote the flow



of material into a rotary valve at the pneumatic conveyor's inlet. A Power-Cincher flow-control valve cinches the bag spout concentrically, allowing partially empty bags to be tied off and removed with no leakage. The 75 millimeters diameter, 38 meters long stainless steel conveying line of the Pneumati-Con pneumatic system delivers up to 1,000 kilograms per hour of the material to a filter-receiver and the hopper above the extruder. The mineral powder is separated from the air stream by a filter-receiver that includes a 220 liters capacity receiving hopper. Four air-jet fluidizers in the bottom of the hopper promote the flow of material as a volumetric feeder meters it into the extruder.

System operation is under PLC control, including timed filter cleaning, starting and stopping the pneumatic conveyor based on level sensor readings, and opening as well as closing of valves.

Flexicon's Bulk-Out bulk bag dischargers – also referred to as bulk bag unloaders, FIBC unloaders and FIBC dischargers – are offered in numerous frame configurations. All dischargers are offered with a broad range of accessories (many patented). "A range of integral flow promotion devices is available, as are dedicated bulk bag conditioners that loosen bulk solid materials that have solidified during storage and shipment, enabling bulk bag unloaders to discharge the material through bag spouts," the provider points out.

www.flexiconeurope.de

Spanish Facility Uses New Shredder

Spanish waste management company Madegan has commissioned a new shredding system that will enable the family-run business to process up to 20,000 tons of waste per year. The new machine is to boost the capacity and flexibility of its Madrid facility. Following an extensive three year research project, Madegan headed to Austria to visit the global shredder manufacturer Untha and procured



the XR mobil-e – a new shredder that has quickly become renowned for its ability to efficiently process a variety of wastes. When fully operational, the shredder will allow Madegan to process a number of waste streams down to a homogenous particle size of 30-40mm. Supplied on tracks and with an in-built conveyor, it can easily be moved around the Madrid site and plugged back in.

More Energy from Waste

Significant energy savings made at Allington waste-to-energy plant were helping the waste management company FCC Environment (UK) Limited to achieve BS 50001 certification.

FCC Environment's Allington Quarry site near Maidstone (Kent, UK) has been operational as an Energy-from-Waste (EfW) integrated waste management facility since 2008. Under FCC subsidiary Kent Enviropower it takes general waste otherwise destined for landfill and burns it to create steam to generate useful electricity for nearby homes and businesses.

FCC was looking for ways of making energy savings and carbon reductions as part of this EfW process and was also working towards the ISO 50001 energy management standard. The company asked German-based technology provider Siemens to do a retrofit upgrade on one of the site's three furnaces. At Allington, waste is incinerated at temperatures of over 850 °C in a controlled combustion process of a fluidized bed, from which the hot gases are passed through a boiler to create steam which can be used to generate electricity within a district heating system (combined heat and power). Gases created during combustion are treated before being filtered and are continually monitored and recorded to ensure they stay within emission limits set within an environmental permit. Metal recovered from the bottom ash during combustion is recycled and the remaining ash can be used as a substitute aggregate.

Fan adjustments to optimize energy use

At the Allington site is a secondary air fan on each of the three furnace lines, helping to push additional air into the furnace which supports a better burn of the different types of waste being incinerated; this also reduces potential emissions. Siemens focused on the secondary air fan area of line 2, which had a fixed speed drive with damper. The damper was being modulated (open and closed), depending on the waste being burnt.

This secondary air fan was linked to a new Siemens variable speed drive (VSD) and modified the existing AC induction motor. It was controlled via the existing DCS and operating process to provide a reference signal to raise or lower the air flow needed to produce a clean burn, subject to the waste being combusted. By doing this, just enough air to the furnace could be managed, making the application more efficient, considerably cutting wasted energy, and at the same time achieving as well as supporting the emission levels needed for this wasteto-energy power plant. As reported, since installation and commissioning of the line, the required KWs have reduced substantially, currently saving FCC Environment in excess of 48,000 British Pounds per year and reducing operating CO₂ value by 645 tons.

The energy savings made at Allington through these process improvements have also helped FCC to achieve the ISO 50001 international energy management standard, cutting energy consumption, reducing carbon emissions and meeting government reduction targets.

Siemens was also able to help FCC Environment on one of its other sites to improve its emission abatement technology in line with environmental requirements. At Nottingham Siemens' laser gas analyser technology was installed to measure emissions during the burn process, enabling FCC to take pre-emptive actions on gas cleaning procedures by introducing abatement or neutralizing media.

www.siemens.com



Brazil: Energy from Eucalyptus

According to Austrian-based machine provider Lindner-Recyclingtech GmbH, the generation of refuse derived fuel (RDF) from eucalyptus bark in Brazil is a market with great potential.

Udo Siebert, sales and service partner of Lindner Recyclingtech in Brazil, is convinced that Lindner's all-rounder Urraco 75 is the best machine to shred eucalyptus bark, which pulp and paper mills as well as wood panel producers in Brazil use to generate RDF to supply their own energy. When the Brazilian government banned the landfilling of eucalyptus bark two years ago, the demand for machines from the Urraco series rose. As reported, two global leaders in pulp production and one renowned wood panel producer already use the tried-and-tested Lindner universal shredder in their plants: Eldorado Brasil in Tres Lagoas, Fibria in Aracruz and Fibraplac in Glorinha.

The bark with low calorific value is shredded and then mixed with wood chips and other inert material, turning it into fuel with high calorific value that can then be used directly to generate energy in the producers' plant kilns. All three Brazilian companies selected the mobile shredder Urraco 75 by Lindner with a 350 PS-strong AdBlue SCR diesel engine complying



with Latin America's emission standards, Lindner-Recyclingtech gave account. "The two-shaft shredder's design-inherent classic crushing process involving low shaft speeds minimizes dust formation at the same time," the provider emphasized. "The intelligent system with two tilting hoppers which can be inclined by as much as 80 degrees promotes an optimum supply of feed material to the shafts. Depending on the shaft employed, the Urraco powerfully shreds - without damaging the material - wood, biomass, root wood, paper rolls, domestic and commercial waste, mixed construction waste, concrete sleepers, bulky waste, electronic and lightweight scrap, aluminum profiles, car bodies, and much more."

According to the information, the clients in Brazil who produce RDF from eucalyptus bark are pleased with the shredder's low wear and tear and low fuel consumption of 0.8 to 0.9 liters of diesel per ton of bark. Up to 300 tons of bark are processed daily in the producers' plants. The Urraco 75 operates on average six hours a day and shreds the material to a grain size of 120 millimeters. The hourly output is 30 tons.

www.l-rt.com

UK: Fercell Offers a New Shredder

UK-based technology provider Fercell Engineering Limited has expanded its product range. The new addition to the Weima family of single-shaft industrial shredders, the WL600 (aka Willy), is suitable for shredding wood and timber waste.

WL600 Fact File:

- Durable single-shaft shredder
- Any type of wood waste
- 15 or 18.5 kw output
- 600 mm working width
- WL rotor with 14 knives
- Suitable for small and medium-sized wood processing companies
- Shreds any type of wood-based materials including chipboard, MDF, solid wood and even extremely hard wood

According to the provider, input material is shredded between the rotor knives and a fixed counter knife. The ram is equipped with wiping strips that prevent unwanted material feed between the ram and the machine casing. Produced chips can be discharged from the machine using an air extraction system or screw conveyor.

www.fercell.com

New Electric Drive Cat 988K XE Wheel Loader

As the manufacturer, Caterpillar, points out, this new electric drive loader delivers 25 percent greater overall efficiency and up to 10 percent more productivity in load-and-carry applications than the conventional 988K loader.

The new Cat 988K XE is "the first wheel loader offered by Caterpillar with a high-efficiency electric drive

system", the company underlined. "This new large wheel loader joins the industry leader 988K and the re-



cently launched 986K wheel loaders to provide customers with the most cost-effective loader for each application. Delivering high-production in all loading applications, the 988K XE is recommended for demanding job sites where fuel efficiency makes a difference in the machine's total cost of operation."

The new Cat 988K XE loader offers a range of bucket capacities from 4.7 to 13 cubic meters. Rated standard and high lift payload for the loader reaches 11.3 metric tons when working with face material and 14.5 metric tons with loose material. Cat Advansys Series Ground Engaging Tools (GET) protect bucket components and reduce operating costs, so operations can get the most out of machine performance.

www.cat.com

Photo: Caterpillar

Trelleborg Gives Tough Jobs a Soft Ride

The Swedish-based tire manufacturer Trelleborg Wheel Systems has introduced the Brawler HPS Soft Ride, a new solid tire designed and developed specifically for the waste management and recycling industries, onto the market.

According to Trelleborg, this re-engineered version of the Brawler solid tire offers radically improved operator comfort and equipment-life through reduced vibration, while retaining the signature Brawler life performance in the harshest of applications. The Soft Ride tire features a new cushion rubber compound that significantly increases deflection and shock absorption. "Combined with the Brawler ultra-cut-resistant tread compound this makes for a solid tire that is very tough, yet much less stiff", the company says. "At the bottom line, this means all the benefits of a premium quality solid tire, plus a much more comfortable ride for operators, no loss of load-index, and increased efficiency even at higher operating speeds."

www.trelleborg.com/wheels



The Brawler HPS Soft Ride, a new solid tire designed and developed specifically for the waste management and recycling industries

Recycling GO 2017

October, 24 – 26, 2017, Gorinchem (The Netherlands)

From the 24th to 26th of October the seventh edition of the Dutch Recycling trade fair will take place in Evenementenhal Gorinchem. This year, the event will focus on circular economy. According to the organizers, "Recycling 2017" goes beyond that and responds to the trends and developments of the current economy and to vital government issues, in which addressing and promoting a circular economy is the main goal. "Promoting a circular economy creates opportunities in the market," Evenementenhal Gorinchem assures. The trade show will focus on collecting, processing and recycling of potentially new raw materials used within the circular economy.

http://booking.evenementenhal. nl/en/recycling-go-2017/gorinchem

International Conference on Recycling and Waste Management

March, 05 – 06, 2018, London (United Kingdom)

Allied Academies invites interested participants across the world to join the 5th International Conference on Recycling and Waste Management which is going to be held during March 5th to 6th, 2018 in London.

According to the organizers, the Recycling Congress 2018 is a trending event which brings together international academic scientists, young researchers and students making the congress a perfect platform to share experience, gain and evaluate emerging technologies in recycling and waste management across the globe. Initiation of cross-border cooperations between scientists and institutions will be also facilitated. The main theme of the Conference is "Exploring New Horizons and Sustainable Technologies for Recycling and Waste Management". The 5th International Conference on Recycling and Waste Management will focus on the most recent databases, curation and research done in every last region of the recycling and waste management, Allied Academics emphasized. The target audience encompasses associations, industries, entrepreneurs and researchers in the waste management and recycling sector as well as environmental academia's ecologists, training institutes, chemical and environmental engineers.

http://recycling.alliedacademies. com/



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Save the Planet

March, 27 – 29, 2018, Sofia (Bulgaria)

"Save the Planet – Waste Management & Recycling Exhibition and Conference for South-East Europe", which is scheduled to be held in March next year, is organized by Via Expo in Sofia, Bulgaria. According to the Bulgarian promoter, it focuses on the development of the South-East European market. "In line with priority objectives for waste policy in the EU there is a progress in the sustainable waste management," the organizer assures, pointing out potential opportunities for the implementation of advanced

Save the PLANET Waste Management & Recycling

technologies and practices. To this event municipality representatives, key industry players from the production, commercial and public sectors will be personally invited. "The great business environment creates synergy effects from which exhibitors, visitors, speakers and attendees can benefit: to get up-to-date information, to position products in a new market in a cost efficient way and to find local distributors and partners," the exhibition company describes the advantages of participation. Since 2017 the organizer Via Expo provides a new service – virtual exhibition, acting one year after the event which ensures additional visibility and promotion of the participants. As reported, the exhibition core areas include waste collection and transport; waste treatment; landfill; treatment of contaminated soil; composting; recycling; processing of air emissions in incinerators and services. Among the Conference highlights will be circular economy and bio waste.

www.viaexpo.com

Indo Waste 2018

June, 27 – 29, 2018, Surabaya (Indonesia)

Indonesia's Number one waste technology and solution industry event – Indo Waste 2018 Expo & Forum – will take place at Grand City Convex, Surabaya – Indonesia, from 27–29 June 2018. According to the organizers, more than 4,000 professionals and trade buyers will congregate at this exhibition. As reported, the expo will

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be attended by over 250 exhibitors from 30 countries including pavilions from America, China, India, Sweden, Korea, Malaysia, Singapore, the Netherlands, Denmark and Taiwan. During this event the companies and associations will showcase the latest issues from curbside collection to hazardous waste disposal, from municipal recycling programs to modern landfill operations. It is supported by the Indonesian Ministry of Environment, Ministry of Trade, Ministry of Industry, Association of Hazardous Waste Management in Indonesia, The Indonesian Netherlands Association and Indonesian Exhibition Companies Association. The WWW.indowaste.com

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