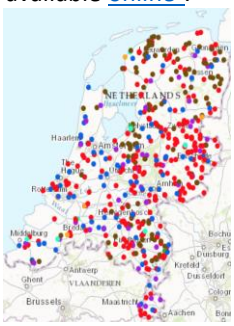
World Biogas Study Tour to the Netherlands
September 5th to 8th 2017
Compiled by Freek van Eijk, MD Acceleratio, Advisory Board Member WBA and study trip tour guide

The Dutch are known to be one of the best in waste management and have the ambition to become a circular economy hotspot. In the field of energy transition, they still have a long way to go.
What role is there for biogas in this transition? How do anaerobic digestion plants function within the context of treating urban, animal and sewage biodegradable waste streams? How can we translate the best practices and rich experiences to other countries? Those were items on the agenda of the study tour. The multinational group's members' range of experience offered valuable and thought-provoking insights into their areas of activity and responsibility.

The tour kicked of with a rich discussion at the Amsterdam base-camp with one of the most senior experts of the Netherlands Mr. Kees Kwant.
He set the scene by giving a good overview of present market and future Dutch ambitions.
In the WBA country review on the Netherlands[1] on the WBA website interested parties can find more information.

Biogas in the Netherlands
In The Netherlands there are currently 252 functioning digesters with 219MW installed electrical capacity and 11,905 Nm3/hr biomethane upgrading capacity (IEA Bioenergy, 2016). The Ministry of Economic Affairs (RVO) has made information on all the installations available online[2].



There are 25 biogas upgrading plants feeding bio methane into the gas grid or using it as vehicle fuel. The most common technology used for upgrading biogas to bio methane is membrane separation. Unlike many other countries, the percentage of energy in biogas utilised as heat is 56% while that as electricity is 33%. 8% of the energy is used as vehicle fuel which is amongst the highest in the world.
By 2020, the biogas sector in the Netherlands has the potential to produce 1.2 billion m^3 of biogas or 0.75 billion m^3 of bio methane, increasing to 3.7 billion and 2.2 billion m^3 respectively by 2030 (Green Gas Forum, 2014), with significant growth expected in biogas from manure, sewage sludge, grass and seaweed.
There is a potential to produce 975 MW of total energy using biogas in the Netherlands solely from its current waste streams: livestock manure (cows, pigs and poultry), sewage and food waste. 3TWhe electricity from these waste streams can meet the annual electricity requirement of over 440,000 people (6713 kWh per capita, World Bank (2014)).
Seaweed – By 2030, the Dutch Green Gas Forum aims to be able to realise a potential biogas production of about 800 million nm^3 from the anaerobic digestion of seaweed (Green Gas Forum, 2014).

Interesting at the visit to the municipal waste management company **Meerlanden** was to see that biogas is part of a bigger circular economy focus. Their trucks drive on bio-methane, they deliver heat to green houses nearby as well as a quality compost.

[1] http://www.worldbiogasassociation.org/wp-content/uploads/2017/07/WBA-netherlands-4ppa4_v1.pdf
[2] http://ez.maps.arcgis.com/apps/webappviewer/index.html?id=c9e9bfcb647448ce97ad0fbb8f05f7c7

The Meerlanden: waste, the most important resource for new products
The Meerlanden is a public company working for 30 municipalities and 4000 private customers in the Western part of the Netherslands
We collaborate with governments, companies and households to transform our linear society into a circular one. A society in which waste is the most important resource for new products and renewable energy. And, in which we offer jobs to people of all walks of life.
For example, after drop-off at our recycling centers or pick-up at households and companies, we upcycle organic waste by processing it into five new biobased products at our unique Green Energy Factory. We produce heat, carbon dioxide and compost for the horticultural industry. Green gas for sustainable mobility, including our own fleet. And water to clean public roads. And this is just the beginning.
How to turn components of organic waste into resources for chemical and food industries is our current research project. This way we continue to unlock the circular economy potential.
For more information: www.meerlanden.nl/circulareconomy.

Glen Lancaste, Thyson Technology: *This was a really excellent site to visit. Gert-Jan KLaase took lots of his time to show us everything. "Our interests involve gas quality measurements for grid injection and following yesterday's tour we now understand the requirements for the Dutch market"*

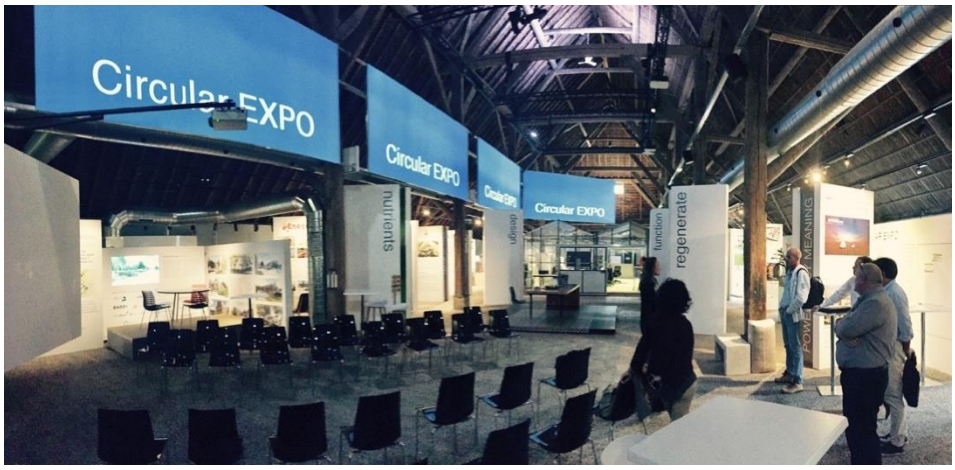
The visit of the WasteTransformers at a vibrant rivitalised industrial site of the Amsterdam Westerparc showed that biomass can be economical at small scale in the hands of an entrepreneur like CEO Lara van Druten.

We are The Waste Transformers
Inspired by the Circular Economy
The Waste Transformers create decentralized, nutrient and energy hubs by converting residual waste streams into energy, whilst recovering (on-site) the natural resources and water in the waste. We empower local communities to leverage their waste to power positive change. Using smart business models, we do this in a way that is financially attractive today. It is a small-scale, high impact approach that is revolutionizing the way we deal with waste.
The Waste Transformers was started in 2012 by Lara van Druten. Lara had one goal: to create a flourishing business that inspires others to change the way that they deal with waste and to establish a business model able to balance financial, social and environmental returns. Today, the Waste Transformers are the recognised partner of choice for those with the ambition and courage to realize real, circular economies around waste.
For more information www.thewastetransformers.com/

Glen Lancaster, Thyson Technology: *This was a very interesting visit to a small scale generation site right in the heart of Amsterdam . Lots of innovation involved to bring a low-cost solution to the market. Clearly Lara and her team have found a winning formula which has a global reach.*

On the way to the Wastetransformers the tour passed by the Circular Economy Expo, close to Schiphol Airport. Here the Dutch present their best examples. The government wants to hald resource and fuel use by 2030 and be fully circular in 2050.

Circular Expo
The Circular EXPO takes visitors on a journey through the circular innovations of the Netherlands, with the aim to inspire national and international stakeholders and accelerate the transition towards a circular economy. Over 25 organisations are on display with their iconic projects. Thanks to the modular build up, the newest innovations and developments in the field of circular economy can be added to the exhibition over the course of 18 months. Accordingly, winning designs of the Circular Challenge and a virtual reality experience will be added to the Circular EXPO. On the outdoor area of the Circular EXPO the world famous ICEhouseTM, designed by architect William McDonough, has been installed. Previously, ICEhouseTM served as the reception area during the World Economic Forum in Davos. The Circular EXPO is located in Schiphol Trade Park, just steps away from Schiphol Airport, and where Valley currently is being developed. This completely circular office park will be the place where global circular knowledge, developments and businesses come together. The Circular EXPO has been opened by State Secretary Dijksma of the Ministry of Infrastructure & Environment.



The installation of listed company Renewi-Orgaworld is probably the largest private industrial digester in north western Europe. They however still treat their digester with care as a fragile living organism. Our excellent hosts, Klaas van den Berg, managing director Orgaworld and Henk Neve, say: *'We are very proud of our facility in Amsterdam which we have been able to optimise over the years. Our small team delivers a great performance*

Takuya Matsubara, Epower Corporation:
"This is the largest biogas power plant I've ever seen. It is surprising that a plant in this scale, digesting different types of organic waste from number of different places every day, can be operated by 4-5 people. Orgaworld's integrated waste management facilities offer comprehensive waste solutions to its customers, and is a goal to us."

Renewi-Orgaworld Greenmills plant
The unique and extremely efficient Renewi-Orgaworld Greenmills plant was launched in 2010 and processes nearly 120,000 tons of unpackaged supermarket food and other organic waste - including 350,000 m^3 of polluted waste water. The incoming organic waste is digested in large tanks. This releases biogas. The biogas is converted into steam, heat and green energy. These products are partially used by Greenmills and the rest is released to the power network. Our green certificates are delivered to our clients or sold as green energy to the market. The residual product left over from the processes is transformed into high-quality fertilizer using our 'own' heat.
More information: http://www.orgaworld.com/more-about-our-business/our-locations/amsterdam-greenmills

That biogas applications are great at the scale of agricultural cooperation's became clear at B-Four Agro in Warmenhuizen. They supply the biggest grocery of the Netherlands with lettuce. Their organic waste, upgraded to grid quality by DMT, provides green gas for **1500** households. Petra Wassenaar and her collegue from DMR

Green gas from green waste
B-Four Agro is a company that grows different kind of lettuce for different supermarkets in the Netherlands. With the building of 'B4-Energy' it aims to produce two million Nm3 green gas per year. In due time 1,500 Dutch households in the area can benefit from it. B four-Agro consist of an anaerobic digester and an upgrading plant on its property in Warmenhuizen. For input and feedstock the digester will use 16,000 tons of biomass per year, coming from agricultural waste streams from B-Four Agro and agricultural companies in the area. After digesting, which takes about twenty days, the biogas will be upgraded by a CarborexMS biogas upgrading system to pure biomethane. This green gas will be injected in the localgrid to provide households as well as greenhouses and the B-Four Agro culture systems at the end of 2016. Nice detail: 'Warmenhuizen' stands for 'warm houses'.DMT is a market leader in biogas upgrading with membrane technology, and we deliver innovative technologies for desulphurization, water treatment and resource recovery.

More information: www.dmt-et.com

Sara De Angelis from Ancitel: "*It was very interesting to visit this site. I was impressed by the high quality technology and the innovative membrane system. The DMT staff was very welcoming and helpful to show us how the system works and to answer any of our questions. I hope I have the opportunity to recommend this solution in Italy as soon as possible".*

Just when we thought we understood the technicalities of biogas Marieke van der Werf, former Dutch MoP, representing Groen Gas Nederland presented us with a larger picture. She provided us with deep insights in the complexity of the regulatory field in the essential biogas focus areas of for example energy transition, mobility, waste management and agro-food. To shape our market we need to create a shared inspirational vision, and convey an attractive message, substantiated by facts and figures if we want to get the much needed support from the regulators. Biogas is a small player at present, but one that can win local support and scale up rapidly.

Stefan Arnswald from Swissbiogas.com: "*The study tour offered a diverse and highly interesting cross section of the Dutch biogas industry. The very open discussions and presentation on-site allowed for probing questions and clearly enhance one's understanding of biogas production, the renewable industry and its governing legal framework. A five-star tour which can only be recommended".*

Sara De Angelis from Ancitel: "*During this tour I had the opportunity to see very different systems for both technology and size. I understood the importance of the analysis to determine the most suitable solution for each case, and the need to implement modular systems that can adapt to the variations in waste quantities. I have had the pleasure of meeting highly qualified people and with great passion for their work. Special thanks to Freek who proved to be very knowledgeable and helpful to the needs of the group. I highly recommend this tour!"*