INNOVATIE NU

March 2023

08

THE FUTURE OF
CLEAN ENERGY

A MESSAGE FROM THE EDITORS

From a single household to large factories and entire cities, securing the energy required to power daily life is a question multiple governments, researchers, scientists, and company owners are constantly trying to solve. The energy transition means using a whole range of new clean technologies across the economy and the energetic supply chain. Clean energy helps decarbonise the manufacturing industry and provides economic and social benefits that go well beyond environmental security. Rapidly decarbonising industry calls for more pragmatic, agile, and ambitious sustainability goals.

When talking about the energetic transition, the manufacturing industry is at a crossroad. Will we accept the instability of outdated energetic systems with high environmental impact or embrace change and take the necessary steps towards clean energy use? In the past, using clean energy was optional. Today, it might be the only option to ensure there is a future for industry. The energetic transition to clean energy might represent the greatest transition of our times.

The climate crisis and other geopolitical conflicts have emphasized the need for an accessible, affordable, and inclusive alternative to fossil fuels. In the past decades, technological and scientific developments in energy storage solutions, scaling of renewable energy infrastructure, and rising demand have made clean energy the most reliable alternative. We aim to help that transition by connecting organizations, fostering the exchange of innovative ideas and new technological solutions.

As the name implies, fossil fuels belong in the past. It is time for industry to look ahead and prepare for change. The question becomes, will the manufacturing industry be able to keep up? We sure will try.

Let's power industry with clean and innovative solutions together.

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CONTENT

HOW CLEAN ENERGY IS SHAPING THE FUTURE OF EUROPE'S MANUFACTURERS

With rising global temperatures and new geopolitical realities, the transition to green energy is vital to the future of Europe's manufacturing sector.

> To stay relevant and thrive in an uncertain future, manufacturers must make sustainability a fundamental and inseparable part of everything they do.

Rising global temperatures, along with Russia's illegal invasion of Ukraine, have culminated in enormous disruption to Europe's energy system. However, while global warming is nothing new, the geopolitical reality has further highlighted the urgent need to reduce, and ultimately eliminate, dependence on the Russian fossil fuels that the EU had become overly reliant on. This comes at a time when we are all still reeling from the economic fallout of the pandemic, presenting fresh challenges to the manufacturing sector, along with most other industries.

Fewer sectors are as energy intensive as manufacturing. Not only has the ongoing crisis led to greatly increased energy prices – it has also put the entire sector under increased pressure to adopt more sustainable business models. Although energy prices have stabilised somewhat over the last year, gas-fired power plants still dictate the prices for wholesale energy in many European markets. As a consequence, this has pushed up the prices of raw materials and other commodities significantly. The responsibility to reverse that trend falls heavily to the manufacturing sector, especially over the longer term.

Why green energy is the key to becoming more competitive

Manufacturers face a legal, ethical, and social responsibility to do everything in their power to reduce their impact on the environment. Consumers are becoming warier of the impacts their commodities have on the planet. Business customers, who are increasingly concerned about corporate social responsibility (CSR),

are even more careful about who they do business with. At the same time, green energy and sustainability are core goals for the EU and its constituent nations. Combined, these factors make clear the role of green energy in staying competitive.

No longer can Europe depend on cheap offshore manufacturing in a world shaped by climate change and geopolitical disruption. The pressure to bring manufacturing back to a more local level is growing, but this also presents an opportunity. European manufacturers, in spite of, or perhaps because of, the ongoing energy crisis, now have the chance to play a central role in how we consume energy and reduce our environmental impact. As such, there are now many exciting new opportunities for manufacturers to set up shop in Europe and, in doing so, boost accountability, transparency, and quality control.

The renewable energy market in Europe is growing rapidly, steadily reducing the barriers to use by manufacturers. In Germany and the UK, for example, almost a third of all energy generated comes from renewable sources[1]. By 2020, renewable energy represented 22.1% of all energy consumed in the EU, which was two percentage points higher than that year's target[2]. The objective behind the European Green Deal is for Europe to become the world's first climate-neutral continent by 2050. Manufacturers play a vital role in making that happen.

Overcoming the resource dependency challenge

In spite of the clear need for clean energy in manufacturing, both established and emerging challenges remain. One of the most complicated to overcome is the need to avoid replacing dependency on fossil fuels with a dependency on imported raw materials. It is an unfortunate reality that the transition to green energy often ends up being little more than a displacement activity. For example, China dominates 80% of the global supply for rare earth materials, which are vital in high-end technology, including clean energy systems[3].

While the responsibility to extract rare earth materials locally and more sustainably falls to the mining and processing sector, manufacturers still have a part to play. For example, the circular economy places an emphasis on reuse, recycling, and elimination of unsustainable business models like planned obsolescence – all of which contribute to increased consumption of raw materials. However, modern, streamlined manufacturing can reduce materials consumption by minimising waste.

> **The transition to renewable energy sources is vital for lessening the dramatic environmental impact of manufacturing.**

Additive manufacturing is an especially promising development, since it facilitates the creation of complex products from high-quality data and more economical materials. The better the data, the higher the precision throughout the manufacturing process, and that means reduced wastage. Additive manufacturing can also reduce the need for manual labour, therefore freeing up budgets for allocating to green energy initiatives. Furthermore, the reduced costs that come with additive manufacturing and automation also means reduced prices for buyers, thus giving companies the opportunity to price their products more competitively.

The clock is ticking

In March 2022, the European Commission set a goal to completely eliminate its reliance on Russian fossil fuels by 2027. Part of that plan involves helping manufacturers and other firms accelerate their transition to renewable energy.

To bring manufacturing back to Europe, and to do so in a sustainable manner, which does not simply mean shifting the problem somewhere else, the Commission has also promised greater financial incentives, while imposing controls on solar panels, wind turbines, and other renewable technologies imported from outside the bloc.

The European Commission's 'Clean Tech Europe' initiative is a new platform with the goal of replacing 170 billion cubic metres of Russian gas with 480 gigawatts of wind power and 420 gigawatts of solar power by 2030[4]. With the help of clean, home-grown renewables, the hope is that the EU will be able to invest in the factories and infrastructure that will help establish a clean and self-sufficient energy industrial base.

Currently, the most energy-intensive sectors, which include iron and steel, chemical, oil and gas, non-ferrous materials, non-metallic materials, and paper and pulp, collectively account for more than three quarters of all industrial energy consumption[5]. The transition to renewable energy sources is vital for lessening the dramatic environmental impact of manufacturing. That said, barriers including lack of expertise and limited financial incentives make these changes easier said than done.

To stay relevant and thrive in an uncertain future, manufacturers must make sustainability a fundamental and inseparable part of everything they do. Clean energy plays a vital role in that. Diversifying manufacturing power sources by investing in wind, solar, and other renewable technologies, might seem like a major investment, but it is also an investment in the future of industry and the planet itself. ■

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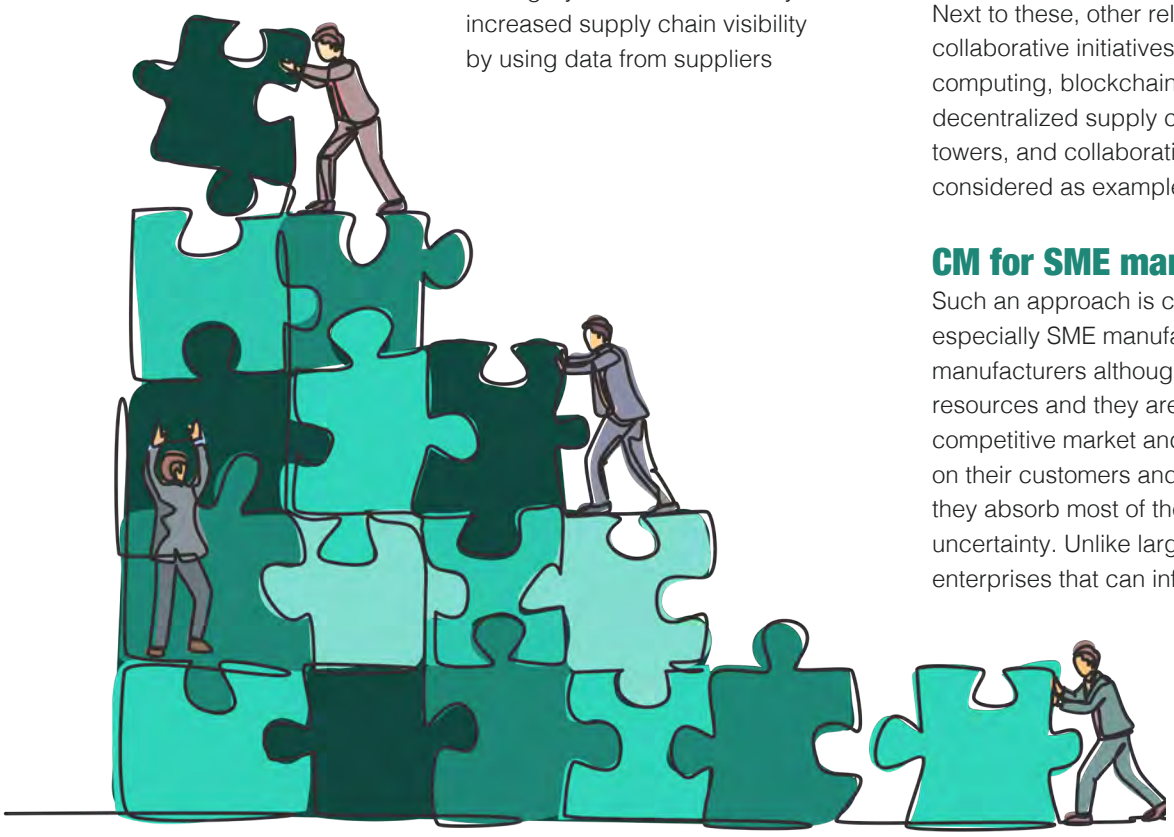
COLLABORATIVE MANUFACTURING

Collaborative manufacturing (CM) is an approach in which manufacturers work together with their business partners to create value for their business. The idea is that manufacturers, collaborating with customers and suppliers but also with machine builders, product designers, software developers, and integrators, all co-design and co-create their products and business and manufacturing processes. CM creates several benefits for manufacturers. It reduces cost, energy use and waste, and increases efficiency and customer responsiveness. Working with new partners, also with other companies in the same supply chain level in industry clusters, CM can provide access to new markets. In addition to increased communication, collaborative effort and knowledge exchange improve the competitiveness of the manufacturers.

CM and supply chains

CM is also crucial for global supply chains as it increases responsiveness and agility. This is achieved by increased supply chain visibility by using data from suppliers and customers. From a broader perspective, collaborating with other companies increases diversification and alternatives in the supply chain and enhances flexibility, one of the biggest current challenges of global supply chains. In that way, this increases competitiveness as well as the resilience and sustainability of our supply chains.

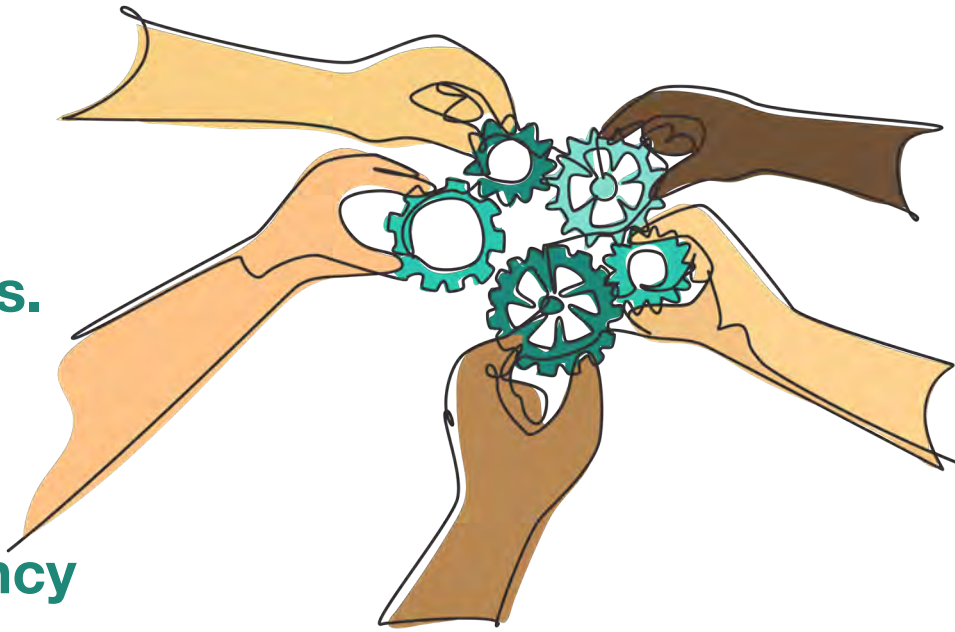
Examples of CM are plentiful such as industrial clusters, supply chain integration and collaboration, joint projects initiatives and consortiums. Next to these, other related collaborative initiatives such as cloud computing, blockchain, open AI, decentralized supply chain control towers, and collaborative robots can be considered as examples of CM.



CM for SME manufacturers

Such an approach is crucial for especially SME manufacturers. SME manufacturers although have limited resources and they are under high competitive market and heavily depend on their customers and suppliers, they absorb most of the supply chain uncertainty. Unlike large business enterprises that can influence their

> **CM creates several benefits for manufacturers. It reduces cost, energy use and waste, and increases efficiency and customer responsiveness.**



supply chain, they have very little influence. Therefore, for SMEs, CM can be quite functional. They can also create further value if they collaborate with their competitors.

An example of a CM is the recent AMP project called COLMAN, an acronym for collaborative manufacturing. In this project, Fraunhofer Innovation Platform, the University of Twente and Global Electronics, an SME manufacturer providing PCB solutions to its customers work together to develop a proof-of-concept demonstrator tool that a typical SME can work together with its suppliers and customers. The tool uses supply chain information from different suppliers and provides a platform to define and communicate alternative solutions in the supply chain with its customers. The demonstrator, when it is developed, will identify, select, negotiate and offer alternative components/materials designs to their customers preferably at an early stage of the customer order process. The demonstrator will be developed together with partners and tested using real cases. The tool is different from search tools in the market finding alternative suppliers as it also provides a platform to communicate alternatives with the customer but with people from different disciplines and with different interests such as designers, supply chain planners and engineers. After the proof-of-concept tool is tested, depending on the interests of partners, the tool can be extended to a larger scale where supply chain partners at the same level can collaborate in an industrial cluster setting. The ultimate goal of the tool is to reduce lead times, and costs of products, and increase customer responsiveness and satisfaction.

The future of CM

CM has tremendous potential. However, despite its benefits, CM is still a new concept and it has several challenges. It requires secure and trustable technology and infrastructure to enable collaboration. It also requires the development of trust between partners. Although it improves competition, these collaborative efforts can be hindered as this can be viewed as a risk of sharing competitive advantages with competitors. As in every business collaboration, it needs new business models to share benefits as well as regulations that define the rules of the collaboration. Furthermore, CM is a big change for many companies and it requires new skills and organizational culture. These are future challenges that are waiting for industry and academia. ■

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Source

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MARKETING TO THE GREEN CONSUMER

> **European consumers are leaders of this green adoption, with three quarters of EU citizens preferring sustainable products.**

Today's consumers are generally better informed and more discerning about the products they buy, and they inherently are more aware of their environmental impact.

There has never been a better time to launch a sustainable, environmentally friendly product. Today's customers are empowered with greater transparency and a broader range of choices. Such empowerment offers the possibility to deliberately purchase greener products, which is a growing trend.

European consumers are leaders of this green adoption, with three quarters of EU citizens preferring sustainable products[1]. However, there is a contradiction in that whilst many consumers express an interest in greener products, their final purchase decisions often remain based on other factors, such as pricing.

While pricing is naturally a primary factor in deciding a customer's choice, it is not the only consideration; savvy marketers can find ways to close the gap between intent and execution. Therefore, marketing plays a key role in convincing consumers to buy more sustainable products. These consumers are called Green Consumers.

What is the Green Consumer?

The Green Consumer is a consumer who consciously makes a point to prioritise the purchase of sustainable and environmentally conscious goods. These could, for example, be items which save energy or have been manufactured with recycled materials.

This type of consumer behaviour is seen across all demographics, from millennials and Gen Z who have set the trend for more eco-conscious habits, to older generations who are gradually following suit in order to meet the growing environmental expectations. Furthermore, a substantial minority of people now exclusively buys sustainable products, with most making conscious decisions to purchase these types of items as a matter of preference.

What does the Green Consumer want?

Among EU consumers, over half of all adults actively seeks for more environmentally friendly products[2]. For them, environmental impact is a major driver for purchasing decisions. At the same time, there remains a widespread lack of trust in producers' claims concerning their environmental and sustainability performance. For B2B buyers, who are increasingly concerned about meeting their environmental, social governance (ESG) goals, the need for transparency and accountability is even greater.

Anxiety around climate change and sustainability is growing steadily. Consumers are growing ever warier about which producers they buy from. As such, the green consumer is deeply suspicious of the sort of hyperbolic

claims that are widely used in so-called greenwashing campaigns.

For marketers, this means the disruptive advertising of old is no longer effective. Instead, they need to focus on trust, transparency, and authority. For marketers, that means publishing advertising collaterals in which environmental and sustainability claims are backed up by hard evidence and demonstrable industry expertise. In an era of widespread 'doom-mongering', it is especially encouraging when brands can tell positive stories about what they are doing to help the environment – provided, of course, those stories are true and authentic. To that end, marketing to the green consumer also involves actions like seeking official certifications for sustainability, clearly communicating a product's environmental benefits, and adopting more eco-friendly marketing strategies themselves.

What does this mean for manufacturers?

The manufacturing sector accounts for the largest share of annual energy and raw material consumption, which makes the sustainability challenge orders of magnitude greater than for other industries. This applies in both traditional retail and direct-to-consumer retail, but particularly in the former, due to the greater complexity of supply chains.

By now, most manufacturers have stringent ESG policies in place and actively seek broadly recognised certifications, if they have not done so already. Ecolabels, of which there are hundreds around the world, play an important role in marketing communications, as they are provided by third parties after unbiased assessments. For example, the Rainforest Alliance logo and seal are widely recognised for validating a product or brand's agricultural sustainability, while the EU organic products label can be used for food products that contain at least 95% organic agricultural ingredients.

No matter where an organisation is in the supply chain, appealing to the green consumer has never been more important. Manufacturers selling directly to consumers can leverage social influence to promote products that involve sustainable manufacturing processes. The same applies, perhaps to an even greater extent, to manufacturers that sell to distributors and retailers. The only differences are the channels and communications used. Most retailers and distributors do want to sell green products, simply because they deliver greater returns.

Provided the products they are marketing are actually sustainable, manufacturing marketers should formulate transparent marketing strategies. Above all, they should avoid greenwashing tactics, such as using spurious and unregulated terms like 'green', 'natural', or 'chemical-free', and instead focus on clear, fact-driven marketing. This strengthens the willingness for consumers to buy such products and thus increases sales.

What are the benefits of marketing to the Green Consumer?

Marketing to the Green Consumer is a forward-thinking strategy, not least because consumers are becoming more and more environmentally aware. Driven by rising awareness and a fast-evolving regulatory environment, consumers are increasingly likely to search for sustainable goods. For example, the last five years have seen a 71% rise in search queries for sustainable products[3].

With green marketing, manufacturers, retailers, and distributors can appeal to a burgeoning new audience segment, improve their credibility, and greatly increase their chances of long-term success. Furthermore, green marketing is part of a greater goal in that it helps encourage more sustainable practices among businesses and consumers alike. The most important thing to remember, however, is that companies 'walk the walk' and avoid engaging in greenwashing.■

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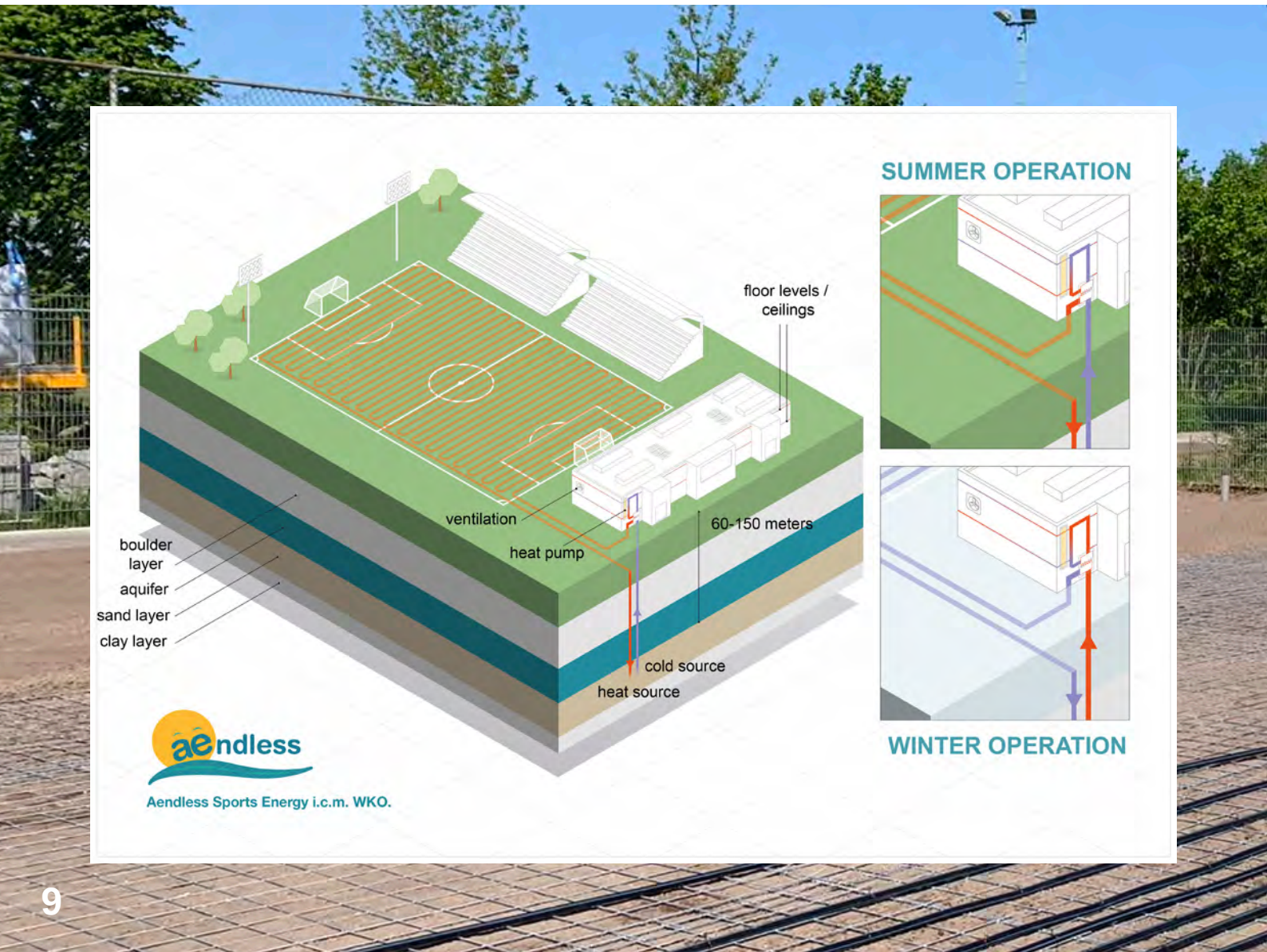
SPORTS COMPLEXES

AS A

SOURCE OF ENERGY

Aendless Energy focuses on multiple uses of assets in outdoor spaces. In our transition towards a society without fossil fuels, it is becoming increasingly clear to stakeholders that the energy consumption of homes and other real estate must be based on a mix of local and decentralised energy.

By adding heat extraction functionality to existing or planned objects in outdoor areas, scarce space is optimally used, offering multiple advantages for users and managers. This technique has been around for some time for asphalt pavements. In 2022, a trial was successfully completed in Zwolle, applying the ***same principle to synthetic grass sports fields.***



Everyone knows asphalt gets very hot in summer. Despite the fact that this technology has been around for almost 20 years, not everyone knows that this heat can be used to provide buildings with energy, in the form of heat, during winter. The technology has other benefits, such as extending the lifespan of asphalt pavements by approximately 25% and contributing to less heat stress in built environments.

The double use of public space is not limited to asphalt. For example, Aendless Energy has been looking at several other objects in the outdoor space that can be used twice in the transition to a sustainable, gas-free energy supply. Our focus soon settled on artificial grass sports fields, which also get very hot in the summer, making them an ideal mechanism for the capture and collection of heat. The fact that they are usually large areas in close proximity to energy consumers is an added bonus.

There are other benefits. Heat extraction under the field can cause the temperature just above the field to drop by up to 15 degrees. Test set-up results have now proven this. This cooling effect is beneficial for more comfortable sports on these fields and may even contribute to injury prevention. The beneficial effect on (inner-city) heat stress is also an advantage.

Co-operation

In Zwolle, in 2022, a test set-up was created, made possible in part by the Province of Overijssel, the municipality of Zwolle and Sport Innovator. Not only have they contributed financial resources, but also provided a pilot location and made their expertise available.

Antea Sport also joined in, supporting the design, construction and monitoring of the field, while ensuring the sports technical requirements were met. The University of Twente joined as a knowledge institute, ensuring the validation of measurement data. They have drawn up a model in which adjustments to the system can be calculated according to the expected energy output. Different types of field structures or turf are required because different sports have differing requirements. The current trial has been done for a football field.

Test field

Aendless Energy constructed a 15m x 20m artificial grass test field at Marslanden Sports Park to test a number of techniques. In addition to measuring the degree and output of energy, we also looked at how athletes in practice experience the damping

> **In the future, sports complexes and other social real estate, with the consensus of all involved parties, can be used as a local source of energy with enormous potential.**

and suspension of the field. Weather data and field surface temperatures were also monitored. The data collected during this period has been modellized by the University of Twente to calculate the energy output on the basis of standard annual averages (and included any deviation from the relevant period).

The outcome of the trial was that the energy output of an artificial turf field looks very positive, greatly exceeding our expectations. Based on the four different structures that have been applied to this field, the objective is now to create a larger format field in 2023, using the most optimal structure in terms of energy output and sports technical properties. This will also be linked to an energy consumer in order to gain better insight into the total functioning of the system.

Many stakeholders

In addition to the technical challenges, practical solutions are primarily a matter of organization. Who makes the investment and who bears the risk? Who owns the installation? Who sets the rates? Who pays for the 'backup' needed to store summer heat for use in winter? It is clear that many stakeholders are involved in future upscaling where public space is used twice as an energy source, therefore efforts must be made at policy level to ensure energy transition and the use of alternative sources becomes a fully-functioning reality.

The pilot project was an excellent example of co-operation between public and private parties. Bringing together and freeing various stakeholders to work as a team is one of the reasons that Roelofs and Strukton Civiel founded Aendless Energy in 2021. In order to keep the participation as easy as possible for all parties involved, Aendless Energy offers the possibility to help with the financing of projects.

Sports complexes as a source of energy

In the future, sports complexes and other social real estate, with the consensus of all involved parties, can be used as a local source of energy with enormous potential. For example, parking lots can be equipped with asphalt collectors and carports with PV(T) panels. The vast expanses of artificial turf fields and (where construction allows) the roofs of the buildings like grandstands and locker-rooms can also be equipped with PV(T) panels to provide a mix of the required energy.

Aendless's goal is to create and work in local collectives, where transparency and participation are key words and everyone benefits. ■

For more info see **www.aendless.nl**

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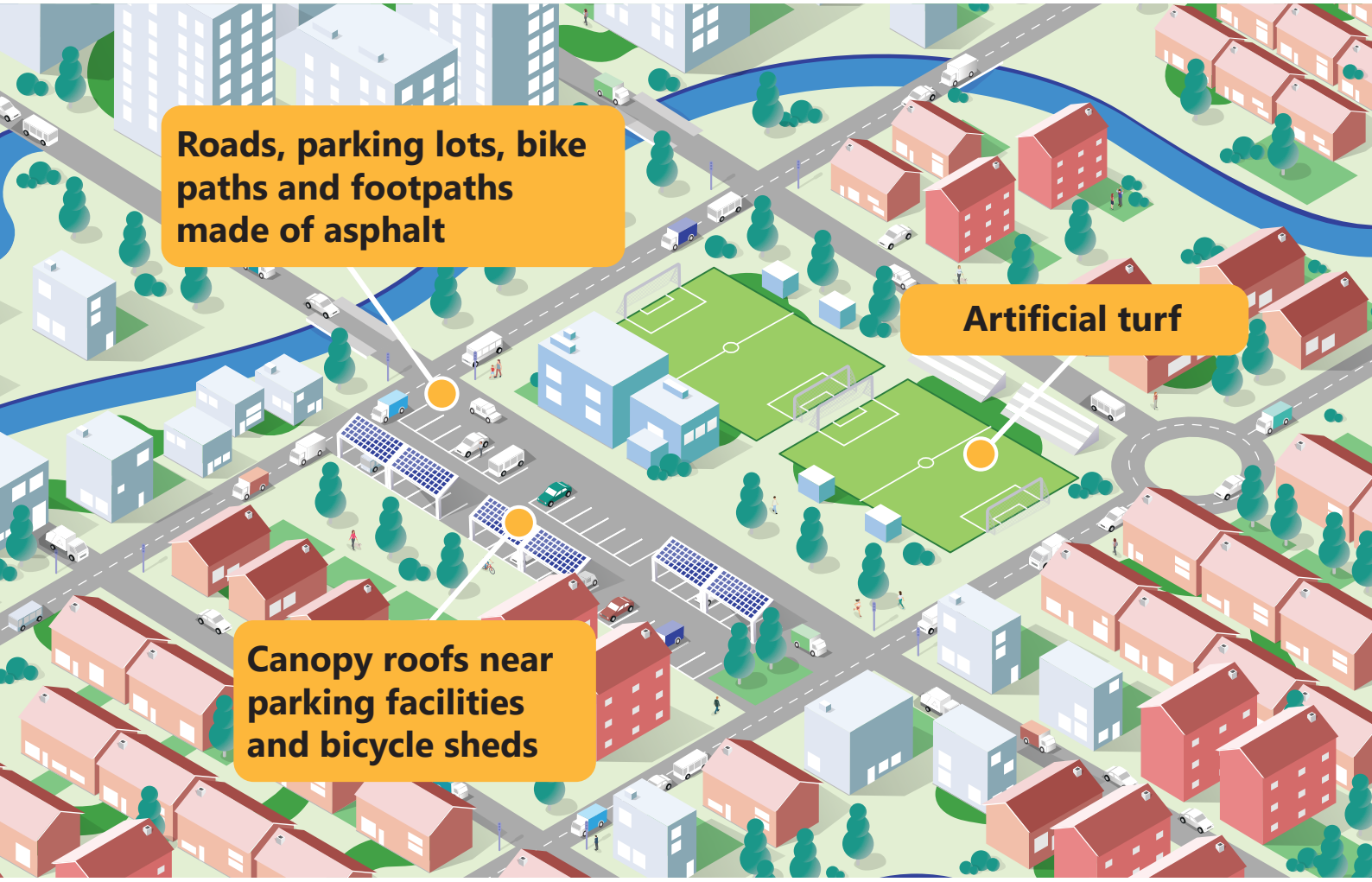
The outdoor space: a source of energy!



Pavement and artificial grass provide vast potential for gaining energy through multiple uses:

- Combined with storage for seasonal coverage
- Silent and without nuisance
- Long term (price) stability
- Full support, management and pre-financing are possible

For more information: www.aendless.nl

THE CORNERSTONE OF SUSTAINABILITY:

DESIGNING A SUSTAINABILITY PROGRAM FOR THE MANUFACTURING INDUSTRY

Introduction

In a planet of 8 billion people the threat of climate change in a post-pandemic era has only heightened awareness of Earth's limited resources and how its delicate systems can easily be disrupted by human influence[1]. The topic of sustainability has become a critical influence for strategic corporate policies all over the world. A business will struggle to survive in the current market without addressing sustainability in their operations.

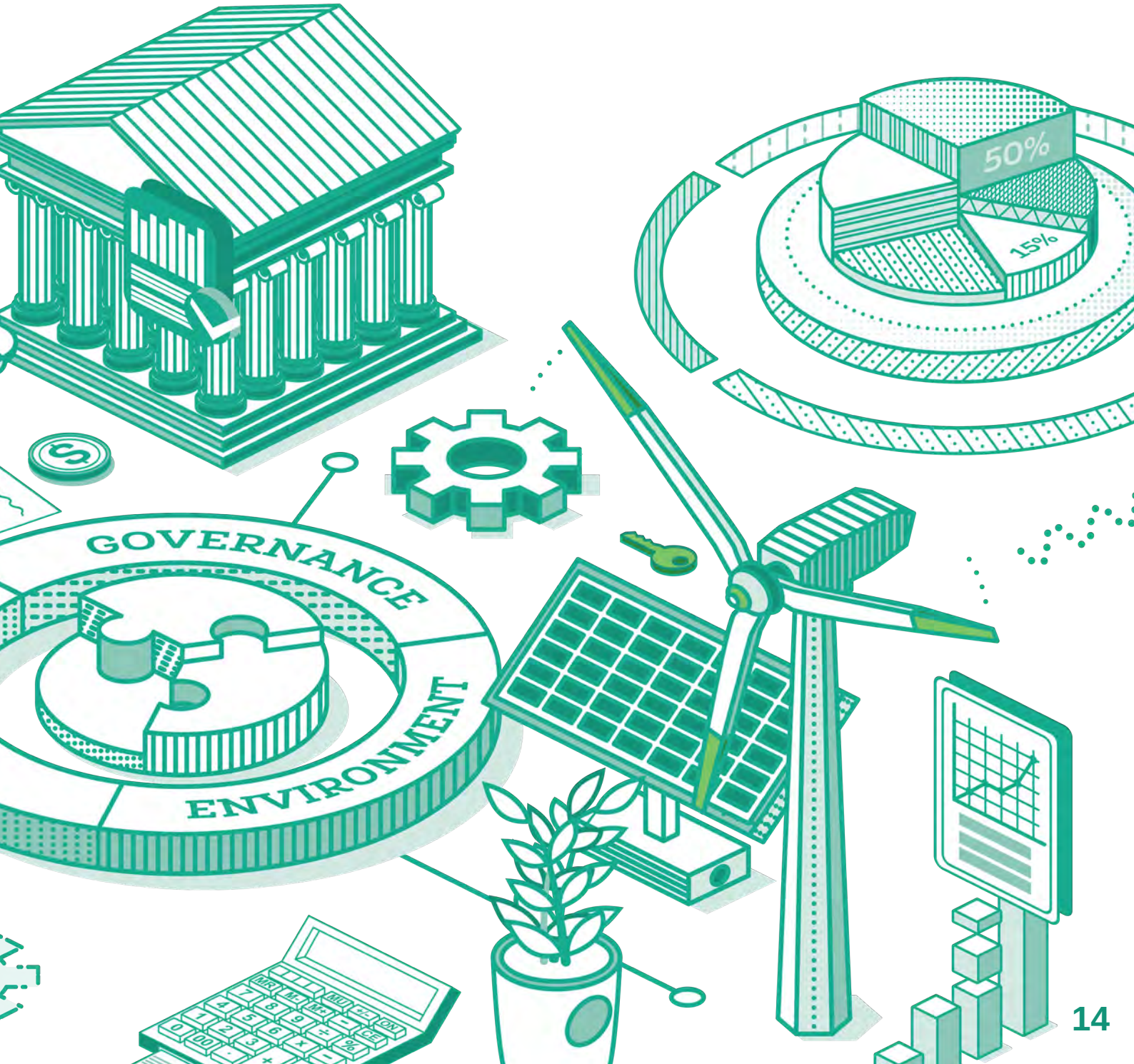
In the Netherlands, manufacturing industry employs 15.82% of the working population, a whole 7% more than global standards[2]. Industry is not only responsible for providing steady stream of employment, but also responds to consumer demands by supplying essential products and services. On a global scale, industry is also responsible for 1/5 of carbon emissions and consume 54% of the world's energy sources[3]. The manufacturing industry plays an important role in accelerating climate change, and as such, should be driving efforts to mitigate its effects. As a result, manufacturers all around the world are now under pressure to comply to new policies and incorporate sustainable practices into their operations. But, where to start?

The challenges of sustainability

Designing a sustainability program for a manufacturing company with global operations comes with challenges. Because sustainability can be such a broad topic, narrowing the scope to address topics that are not only relevant but measurable can be a challenge. Defining the key organizations and initiatives that will drive global policy in a world where everyone is pushing their own version of sustainability can be another challenge. Setting a direction for sustainability that is broad enough to be considered complete and overarching without setting the scope too broad that it becomes unmanageable is probably the most pressing challenge. Sustainability will look different to every company, regardless of their geographical location, size, or industry. Challenges will come and go with any new venture that requires adjusting certain practices and prioritizing key aspects within operations. Recognizing those challenges can only reflect positively on organizations, as it is a direct result of true transformative efforts. That is why it is important to set a baseline, set a direction of what is necessary to be achieved, and begin the journey towards corporate sustainability.

The United Nations Sustainable Development Goals

One of the main aspects to consider moving forward, are the global sustainability efforts that set the direction for all organizations to align to. As part of their 2030 agenda for sustainable development, the United Nations member states have agreed on 17 goals that will guarantee a better future[4]. These goals are meant to be used as a common language that reflects the interests of all stakeholders, from individuals to large organizations.



While the goals and their specific targets are based on global standards, no single organization is expected to contribute actively to all goals and targets. The goals that most closely relate to the manufacturing industry and are easily achievable are:

Goal 8: *Decent work and economic growth*
The manufacturing industry in the Netherlands is responsible for a large part of the economy. Providing decent, inclusive, and productive work is essential for economic growth.

Goal 9: *Industry, innovation, and infrastructure*
Promoting sustainable industrialization requires resilient infrastructure and fostering innovation. There are large economic and social benefits through innovative sustainability projects.

Goal 12: *Responsible consumption and production*
Worldwide consumption and production patterns drive global economy. As such, efficient use of natural resources is essential to mitigate the manufacturing industry's negative impact on the planet.

Goal 13: *Climate action*
The manufacturing industry is one of the first affected by the consequences of climate change. This goal addressed any activities that involve taking urgent action to mitigate its effects.

The manufacturing industry employs thousands of people from the Netherlands and other foreign countries, providing them with decent work and remuneration as per Dutch standards (Goal 8). Industry has the potential to promote new technologies and fuel sustainability in manufacturing through innovation (Goal 9). A sustainability program formalizes current and future efforts to improve energetic consumption and waste patterns (Goal 12). And finally, environmental initiatives and targets such as transitioning to sustainable energy sources will ensure a 45% reduction in carbon emissions by 2030 (Goal 13).

Defining an Environmental, Social, and Governance (ESG) strategy

Another essential component of a sustainability approach is having sustainability embedded in the business strategy. An ESG strategy aims to define corporate sustainability efforts in three areas. It incorporates relevant topics in a framework that will help stakeholders understand how an organization manages risks and opportunities. ESG strategies are a growing business trend that improves on and expands the scope of the already defined Corporate Social Responsibility (CSR) framework. Companies with an ESG strategy are more likely to create value and outperform in the present market[6]. A manufacturing company should define an ESG Strategy to measure corporate sustainable initiatives, translate them into indicators, and drive improvement. An ESG strategy is a set of topics categorized into the three ESG areas. Each topic has a set of sub-topics with specific data collection requirements, measurement procedures, and resulting indicators that can be acted upon.

A sustainability program for the manufacturing industry

Corporate sustainability should start somewhere, and by establishing a working baseline for data collection and measurement, a company can begin to manage sustainability projects and address sustainability concerns. The following program was designed to meet the most pressing topics for manufacturing industries in the Netherlands.

Three topics were defined per ESG area and are briefly explained below:

E for environmental

The environmental factor addresses all efforts concerning the natural world where an organization has a considerable impact. Three environmental topics were defined:

1. *CO_2 footprint* – measuring and reducing carbon footprint across the value chain

2. *Energy efficiency* – relative reduction of energy use and procuring from sustainable energy sources

3. *Waste management* – tracking and managing waste patterns, increasing packaging reuse practices and percentage of recovered waste

S for social

The social factor addresses all organizational efforts that have a direct effect in society and quality of life. Three social topics were defined:

1. *Employment* – effectively measuring and reducing employee turnover rates

2. *Health and safety* – measure and standardize compliance with the highest health and safety standards.

3. *Training and education* – measuring commitment to continuous learning and train workforce on all topics relevant for their personal wellbeing and professional development

G for governance

The governance factor addresses the defined systems and processes that define how an organization is managed. Three governance topics were defined:

1. *Business ethics* – providing training and effective communication of anti-corruption policies to all stakeholders

2. *Contingency strategies* – ensuring proper processes and procedures of how to act in case of a calamity and respond to unforeseen events

3. *Procurement practices* – set ethical standards for procurement to minimize potential risks in the supply chain

An ESG strategy is largely based on the three pillars of sustainability: planet, people, profit. The three areas are not mutually exclusive and changes in one area will inevitably have an impact in the other areas. Balancing efforts across all topics is key to achieve sustainability.

The Corporate Sustainability Reporting Directive

Global efforts to mitigate the effects of climate change have evolved into new policies and legislations that have a large-scale impact. As of 2025, all businesses operating within the European Union regardless of size must report their activities according to the CSRD, which is a set of standardized guidelines and requirements[5]. Companies must not only disclose financial performance, but how it is related to their environmental and social impact. A part of measuring that impact is expressed in forward looking targets in all ESG areas. The reporting organization must be able to prove that their sustainability practices align with their business model, strategy, and internal policies. The sustainability program is not only aligned with these requirements but is already incorporating the baseline for reporting according the CSRD guidelines.

Conclusion

While sustainability may look different for every company even if their business is in the same industry. The scope and operational capabilities may vary immensely, but it must be guided by the right mindset and vision. Within the European Union, governmental efforts to standardize and push sustainability are consolidated in the CSRD. On a global scale, the UN SDG represent the goals organizations should strive to achieve within their operating capabilities. No single solution will work for everyone but having a baseline for future sustainable developments is a necessary first step. The results of the data collection for the first year will bring useful insights for further improving and expanding the sustainability program. It may also highlight practical issues that might require reassessment of certain indicators. No singular sustainability program is fool proof. Only by measuring, testing, and improving might the manufacturing industry find a path towards sustainability. All companies should start somewhere, and the time to start was yesterday. ■

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AMC NU

ADVANCED MANUFACTURING PROGRAM (AMP)

Powered by: **Regio Deal Twente**

Together with regional government and partners, the Fraunhofer Innovation Platform for Advanced Manufacturing (FIP-AM) has developed the Advanced Manufacturing Program (AMP) to establish a transitional framework towards Manufacturing 4.0 and empowering manufacturing industries in the Eastern part of the Netherlands.

The Advanced Manufacturing Program (AMP) provides subsidies through the RegioDeal supported by the Province of Overijssel and the Dutch state. It aims to encourage rapid development of Twente and other regions in the East Netherlands by forming an Advanced Manufacturing hub with an outward looking European image. With this the AMP greatly enhances the region's reputation and business climate.

Within the AMP, the Fraunhofer Innovation Platform for Advanced Manufacturing at the University of Twente develops innovation projects around manufacturing technology themes. Every AMP project is built around solid industrial collaboration, empowering companies with relevant knowledge and new technological and industrial methodologies, Through the hub, these can be shared with other high-tech manufacturing industries in the region.

Member companies of the AMP can solve their specific technology problems and answer their market-oriented questions. This is achieved by developing and creating demonstrators that offer participating companies direct technological insight. FIP-AM then utilises workshops and master classes to further disseminate this newly acquired knowledge.

The Advanced Manufacturing Program (AMP) is a funding program that helps us support you in your transformation to Manufacturing 4.0. This is made possible through the Regio Deal supported by the Province of Overijssel and the Dutch State.

Rijksoverheid provincie Overijssel regio Twente Twente

THEME 01_

PROJECT PARTNERS WANTED

For a consortium of metal processing companies

Are you a metal processing company in need of assistance in preventing quality issues due to worn-out tools such as milling cutters and bits? **If so, you can join a consortium of other companies with similar experiences and take part in an AMP-subsidised project.** The objective of the project is to develop a predictive model for when these tools can be replaced in a timely manner.

Any questions or interested in participating? Please contact us.

THEME 02_

WORKSHOP INVITATION

Interested in AGVs or AMRs for the manufacturing industry?

FIP-AM@UT, together with Novel-T, are organising a workshop on the application of **Autonomous Guided Vehicles and Mobile Robots (AGVs and AMRs)** for the manufacturing industry on **Thursday 13 April.** During the workshop, our experts will be on hand to discuss individual requirements. For more information and free registration for the workshop, **have a look at page 39 of this magazine!**

If you are experienced in this matter and willing to share your knowledge, we'd like to hear from you.

THEME 03_

NEW PROJECT LAUNCHES

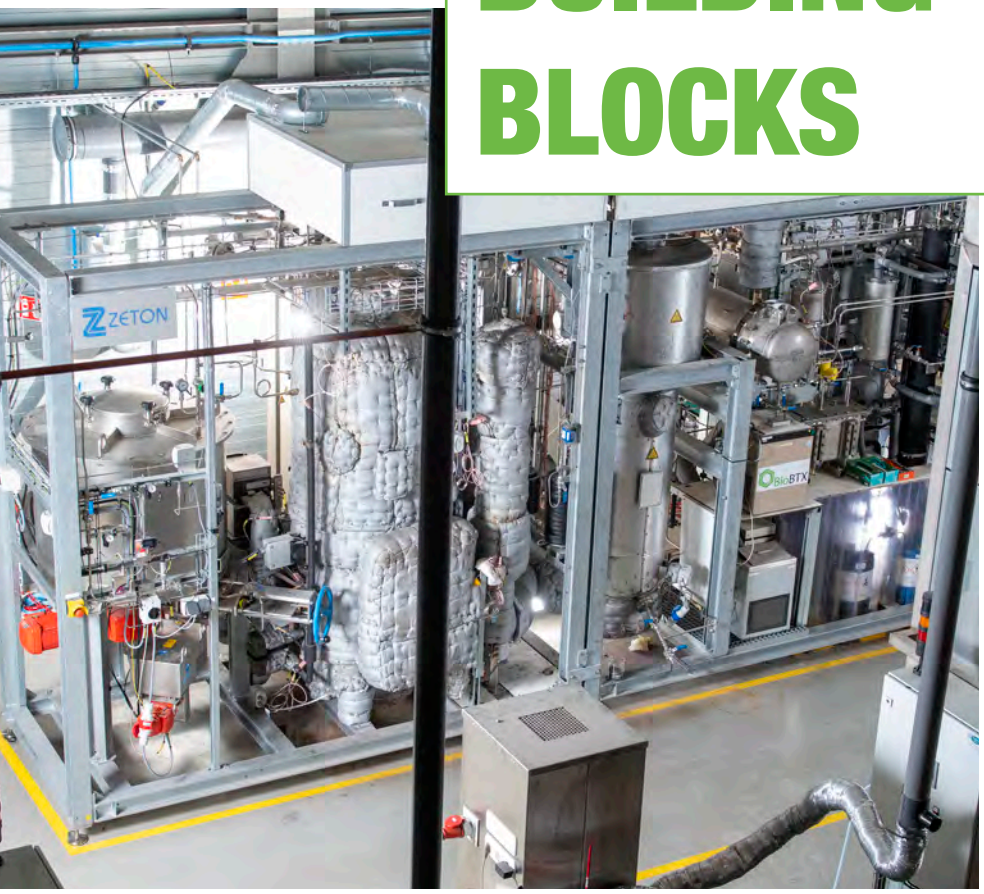
Around the Advanced Manufacturing Program

We have been busy lately with the **launch of 6 new AMP projects!** MachViz focuses on a real-time augmented/virtual reality (AR/VR) shop floor visualisation. M3Dsoles (pronounced med soles) researches the application of 3D printed podiatric soles. In MIND, a study is underway to optimise the production of industrial drones. Dive2 looks at the efforts manufacturing companies are making towards diversity and inclusion in their workforce. AutoKID is developing an inspection tool incorporating AI for laser welding. Lastly, Volle Bak aims to create a sustainable basis for cities through a smart waste management solution.

More information about our projects? Please contact us.

e.rouchou@utwente.nl +31 (0)6 4876 7414 **Elias Rouchou**

PLASTIC FROM POST-CONSUMER ELECTRONIC DEVICES AND INDUSTRIAL WASTE STREAMS TO NEW CHEMICAL BUILDING BLOCKS



Introduction

In today's transition from a linear to a circular economy, an increasing interest - and necessity - exists in circular feedstock for bulk and platform chemicals for the industry as replacement for fossil feedstock. This is driven by the need to omit fossil feedstock to reduce the overall CO_2 emission of the chemical industry. Not only the sustainable character is important, but recently the rising prices of conventional (oil-based) feedstock and strategic importance of these commodities have further intensified the incentive for industry to transition towards alternatives. However, as seen today, the quantities of potential biobased and renewable input streams to provide these chemicals is by far not enough to source the transition by the industry to a circular economy. Therefore, the aim of industry is to efficiently use all available alternative, circular, and renewable non-fossil feedstocks.

A large share of CO_2 emissions by industry is related to the production of fossil-based chemicals (approximately 3.6Mton oil was used in the petrochemical industry in 2021 (extrapolating monthly figures published for the first half of 2021), and all this oil will be converted in CO_2 at the end of life of products, if they are not recycled. By transitioning towards circular and biobased (bulk and platform) chemicals the dependence of fossil resources and the CO_2 emissions of this sector can be strongly reduced.

BioBTX

RIWALD recycling

The rising prices of conventional (oil-based) feedstock have further intensified the incentive for industry to transition towards alternatives. However, as seen today, the quantities of potential biobased and circular input streams to provide these chemicals is by far not enough to source the demand of industry. Therefore, the aim of industry is to efficiently use all available alternative, circular, and renewable feedstock; this includes the so-called complex and mixed waste streams. When value chains are in place that enable valorisation of currently wasted complex and mixed waste streams, it allows both the recycling and chemical industry to achieve this goal towards reducing its environmental impact simultaneously. A circular economy is like hitting two birds with one stone, a win-win for both parties.

Challenge for Riwald Recycling and BioBTX for a Circular Economy

To provide industry with circular and biobased bulk and platform chemicals new value chains need to be developed where 'challenging' waste sources such as mixed plastic, are converted by innovative technologies into new chemical building blocks.

These chemicals can be used to replace current fossil-based chemicals. This is where the point of interest of Riwald Recycling and BioBTX meet.

At Riwald Recycling, a large plastics stream results from recycling of electronic equipment, and fractionating this equipment in pure metal streams, and a plastics waste stream. Riwald is producing from its metal recycling multiple tonnes of currently non-recyclable mixed plastics, and a part of these streams are being sent to incineration due to the lack of recycling methods, leading to suboptimal use of raw materials and no stimulation of the circular economy.

BioBTX, a circular chemical technology development company, developed a technology to produce high value chemicals (BTX) from non-homogenous carbon rich waste streams. By valorising the plastic waste of Riwald's electronics recycling via the BioBTX technology, the waste plastics do not have to be incinerated and less fossil resources are needed for the production of chemicals. This new collaboration makes it possible to get one step closer towards a full circular economy in 2050.

Green Prospects

The collaboration between Riwald Recycling and BioBTX makes it possible to find a solution for the increasing complexity of Waste Electrical and Electronic Equipment (WEEE) products in combination with their quality of plastics resulting in a higher percentage of recycling instead of energy recovery via a waste incinerator. With this collaboration both partners benefit from each other's expertise and will be able to collectively receive a higher recycling percentage. These kinds of collaborations are important for the industry customers such due to their circular economy philosophy and raw material policies, leading to a downstream declaration with a high percentage of recycling instead of landfill and incineration and producing high value chemicals from non-fossil resources. ■

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SPINNING JENNY:

LOCAL PRODUCTION AS A SUSTAINABLE SOLUTION FOR THE TEXTILE INDUSTRY

Spinning Jenny will soon open its very first high-tech Dutch factory that will spin large quantities of yarn from recycled textiles. The name Spinning Jenny refers to one of the first types of spinning machines that played a major role in the industrialization and upscaling of textile production. This new company "Spinning Jenny" is also trying to play a major role in changing the textile industry. The business aims to unleash a new sustainable textile revolution with their yarns. With an investment of over 7 million, this sustainable enterprise is building one of the most modern spinning mills today.

SPINNING JENNY

sustainable yarn

Sustainability is becoming increasingly important. It also plays an important role in the textile industry. More and more consumers no longer accept textiles that have been produced under poor conditions or have a major impact on the environment. Yet, the textile industry is considered one of the most polluting industries in the world. But how polluting is it? The pollution from the textile industry is not just in the footprint of that one sweater or towel. The problems are bigger!

The problems can be found in the enormous urge to consume, the growing production that the industry has experienced in recent decades and the shift of production to the Far East. These problems do not appear to be abating for the time being. It only seems to be getting worse in recent years. The ever faster changing supply of cheap clothing by various fashion chains also contributes to this. The consumption problem is also clarified by the hard figures recently published by the Ellen McArthur Foundation, a British research center. According to an estimate by the Foundation, the number of garments sold in 2015 doubled from 15 years earlier. This increased clothing production worldwide in 2015 to more than 100 billion garments produced in a single year. And so demand continues to rise unabated in recent years.

However, more and more consumers also no longer accept textiles produced under poor conditions or that threaten the environment. They have less consumerism and an increasing demand for more transparency from the industry. They want more control over the production chain. But the

international nature of the fashion industry does not necessarily provide this transparency and prevention of environmental damage. What's next?

Towards a circular textile industry

Due to consumerism, the demand for fiber as a raw material for textiles continues to rise. Thus the impact of the textile industry on the environment also increases through CO_2 emissions, microplastics, large consumption of water, pesticides, land and raw materials.

A more circular textile industry could reduce these problems and the pressure on the environment. Nowadays, the industry is still linear. This means that mainly new raw materials are used for the production of clothing. After use, these raw materials are discarded and lost. The discarded textile is largely incinerated or (abroad) ends up in landfills. It is becoming increasingly clear that this linear design of the textile industry has major negative impacts on the environment.

Spinning Jenny is confident that the textile industry can be transformed into a circular economy where raw materials flow back into the production chain instead of being lost. In a circular design, every step - from production residues to post-use waste - looks at whether residual materials and waste can be used for new high-quality products.

Not only Spinning Jenny, but also the Dutch government wants to have a fully circular textile sector by 2050. The intermediate goal for 2025 is that a textile product should consist of at least 25% recycled/sustainable material. Also, by then 30% of the raw materials, materials and products entering the Dutch market must be reused or recycled after collection (Ministry of I&W, 2020). But we are not that far yet. Today, less than 1% of the textile industry still consists of recycled raw materials (Ellen MacArthur Foundation).

Spinning Jenny

Spinning Jenny and its local manufacturing environment for circular and sustainable yarn production, offers opportunities that can help the textile industry move towards circularity. It provides growth opportunities for Dutch textiles and contributes to the government's sustainability goals. Although the start-up of Spinning Jenny took some time.

About 3 years ago, Spinning Jenny wrote her first business proposal. Now, 3 years later, she has managed to bring that plan to reality. Financially this has been realized with the help of a Dutch grant called DEI+ and several investors. On the technical side, there is cooperation with local parties and European machine builders. The choice of Twente as a location is a strategic one. Twente is traditionally a textile region where a lot of knowledge can still be found.

The basic technique Spinning Jenny uses to make her yarns has long been known as OE or rotor spinning. This technique allows the spinning mill to process shorter fibers, making it suitable for recycled textiles. By the way, Spinning Jenny is not going to recycle itself. The mill receives recycled textile fibers. It only prepares and spins them into various yarns for demanding applications in industry, home, apparel and automotive, among others. The combining of basic technology with a custom made composition of the latest machinery and techniques makes that Spinning Jenny can deliver unique products.

The production environment with high-tech machinery measures some 6,500 square meters and will spin some 3 million kilograms of yarn annually. The machinery currently being built up can proudly be called the most modern in Europe at the moment. Some of the machines even have technology that will not be presented until mid-2023 at the ITMA - the world's largest international trade fair for textile and clothing technology.

In addition to the high-tech machines and a skilled team, Spinning Jenny has more than 1,000 solar panels which supply a large part of its energy needs. This makes Spinning Jenny's production process even less harmful to the environment. For every 100 kilograms of yarn production, they save about 11,000 liters of water, 2100m^2 of land, 3300 kWh of energy and 1100kg of CO_2. In addition, the sustainable plant is prepared to become a fully automated production environment in the future. For now, this unique company is making every effort to go into production by the second quarter of 2023. ■

Author:

Liset Pander
Operations Manager

TWENCE MAKES SUSTAINABLE ENERGY EVEN MORE SUSTAINABLE THROUGH CO_2 CAPTURE

CO_2 is a greenhouse gas. CO_2 from fossils fuels, along with other greenhouse gases, is causing climate change: the earth is heating up. We want to reduce this worldwide. By capturing CO_2, Twence contributes to the reduction of CO_2 emissions in the waste to energy sector and to making the region more sustainable.

Twence®

About Twence

More than ever before, it is clear that the key to a better future lies in a sustainable world. This world is the world of Twence. Twence knows like no other how to create sustainable solutions for complex issues such as climate change, shortages of raw materials, and fossil fuels. Twence recovers raw materials from waste, and produces heat, steam, and electricity. With advanced technology and ground-breaking projects, Twence contributes to the developments our world needs. As a public organisation, Twence focuses on the region and is convinced that cooperation is essential to make the region more sustainable. Together with municipalities, companies, and educational institutions. Twence uses knowledge and expertise to convert opportunities into sustainable solutions. By connecting and encouraging, they encourage others to also contribute to a sustainable region.

Energy and raw materials transition

Our society is on the eve of an energy and raw materials transition. Energy will have to be generated almost completely sustainably. Raw materials will have to be used sparingly and reused as much as possible. In the Paris Climate Agreement of 2015, far-reaching targets were formulated to limit global warming. These have been subsequently translated into national targets. Compared to 1990, the Netherlands has set itself the target of reducing CO_2 emissions by 49% by 2030 and by 95% by 2050. Under the current climate agreement, the waste to energy sector, of which Twence is part, has the obligation to reduce CO_2 emissions by 1.1 million tonnes per year.

Climate impact

Every tonne (which amounts to 1,000 kg CO_2) captured sustainably instead of being released into the atmosphere has an impact comparable to planting 31 to 46 trees. Trees remove CO_2 from the air and transform it through photosynthesis into oxygen and plant material. Photosynthesis is the process by which plants convert water and carbon dioxide into glucose (C6H12O6) and oxygen under the influence of sunlight[1].

Sources

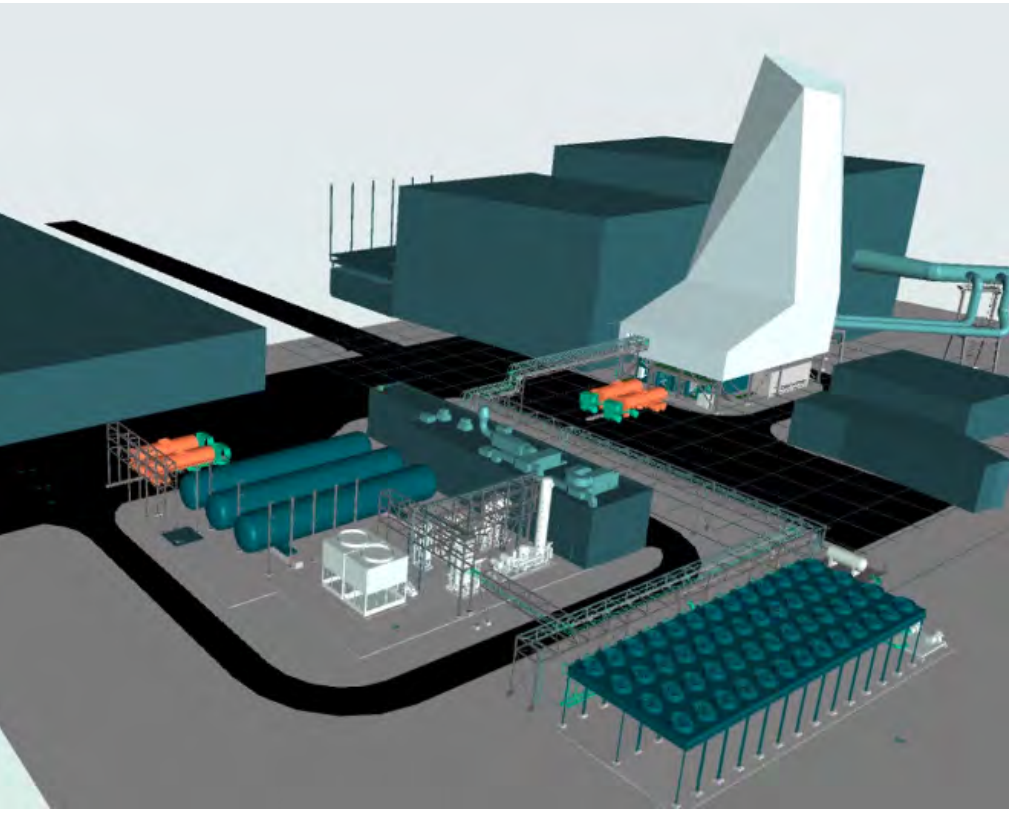
[1] https://www.encon.be/nl-BE/berekening-co2-compensatie-bomen

Waste is a source of energy

Twence tries to recycle waste as much as possible. But there is always some waste and business waste left that cannot be recycled and that is processed in the Waste Energy Plant (WEP). Twence mostly generates energy from this. Twence is the largest producer of sustainable energy in Overijssel. Twence produces 502 GWh of sustainable heat and 290 GWh of sustainable electricity annually. That is enough to supply 65,600 households with heat and 150,000 households with electricity for a year. What used to be regarded as waste is now a source of energy.

Generation of CO_2 from waste

But what actually is the relationship between CO_2 and waste? During the combustion process in the WEP, flue gases are generated. Flue gases contain CO_2. This CO_2 is extracted from the flue gases in three stages. During the first stage, the flue gases are cooled together with the CO_2. In the second stage, the CO_2 is absorbed from the flue gases using solvent. The flue gases without CO_2 are returned to the WEP. In the third stage, the flue gases with CO_2 are separated as pure gas from the solvent by boiling it with residual heat from the WEP. However, in order to transport it, the CO_2 must be liquid.



Under pressure, everything liquefies

The gaseous CO_2 is captured, dried, further purified and liquefied by pressurising and cooling it. The CO_2 is then stored for subsequent transportation to the end user.

Closing loops

Residual waste is not only a source of energy. As demonstrated, Twence also extract raw materials such as liquid CO_2 to make greenhouse farming more sustainable. And so this closes the loop and makes Twence sustainable energy even more sustainable. This enables Twence to make a great contribution to the circular economy.

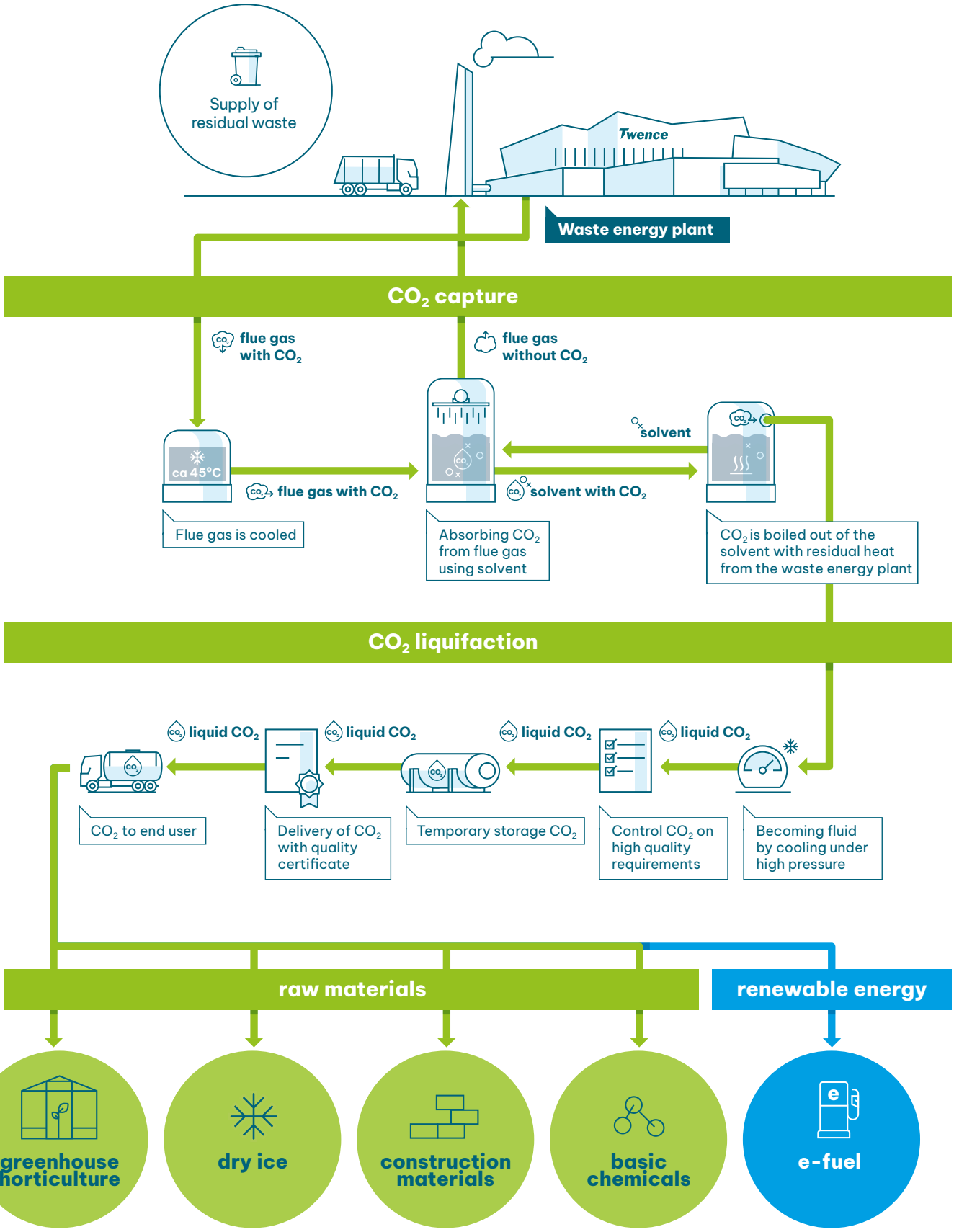
Capturing 100,000 tonnes of CO_2

Twence is currently constructing a large-scale CO_2 capture plant that will be able to capture up to 100,000 tonnes of CO_2 per annum. The plant is expected to be operational by the end of 2023. ■

Author:

Ilse Jansink
Manager Communications

Process CO_2 capture



Would you like to know more? Please visit our website: https://www.twence.com/projects/large-scale-co2-capture

PIONEERING AND BOOSTING THE SUSTAINABLE ENERGY TRANSITION WITH TECHNOLOGY SYNERGY

Renewable gases, that replace high-emission finite fossil fuels, and the hydrogen revolution are essential to support the transition to a low-carbon economy, industry, and energy system. At the Kennispark area in Enschede, near the University of Twente, HoSt Group has been headquartered since 2010. Here, hightech systems with efficient and clean conversion technology for the generation of renewable energy and valuable end-products from residual flows come to fruition for local and global deployment.

HoSt BIOENERGY SYSTEMS

The large and fast-growing family company, founded in 1991, is committed to be at the forefront of a circular decarbonised economy by deeply investing in technology. Evidenced again by the latest acquisition of a specialist hydrogen company that further enhances the full proprietary technology suite across renewables gases, renewable heat, and renewable electricity. These technologies include anaerobic digestion, upgrading of biogas to biomethane, CO_2 capture and CO_2 liquefaction and bio-LNG, and renewable heat and electricity through thermal conversion of wood waste, RDF, and waste.

Clean energy technology synergy

HoSt expanded and bolstered its renewable gases technology portfolio by adding hydrogen technology to the portfolio through acquisition of the company HyGear, completed early February this year. The Arnhem, Netherlands-based company is a global market leader in small scale on-site industrial hydrogen generation systems. This combination fuels future growth for both companies, drives the energy transition, and creates strong commercial, technological, and knowledge synergy.

Jelle Klein Teeselink, CEO at HoSt Group comments: “Combining these companies lead to a unification of proprietary, complementary energy technology resources, driving the decarbonization and energy transition. It establishes a fundamental knowledge base, empowerment, and pathway for the vital acceleration of renewable gases and renewable hydrogen development and deployment across different markets and geographies. It also provides us with a strong footprint in Asia through their location in Singapore. At HoSt, we are thrilled and look forward to the strategic fit that amplifies the mission of both companies.”

Renewable natural gas (green gas), produced from organic waste by means of anaerobic digestion and biogas upgrading, can be converted to renewable hydrogen providing hydrogen with a carbon negative footprint.

Greening the region & beyond

Carbon-neutral and carbon-negative clean energy technologies provide in decentralized renewable gas, renewable heat, and renewable power generation, contributing to the diversification of energy sources which is more important than ever, everywhere.

Anyone passing by the Royal Grolsch beer brewery in Enschede has in all probability already seen the new installation. This biomethane system, built by HoSt, purifies the biogas from the brewery’s wastewater to produce renewable natural gas, also known as biomethane. Biomethane is a sustainable substitute for fossil natural gas and is added to the existing natural gas network. Annually, this results in 1,800 tonnes of CO_2 emission reduction. HoSt owns and operates the plant in an ‘energy as a service’-model. In Zenderen, also in the Twente region, HoSt built a biogas upgrading plant for Twence, the local waste management company.

“The government has ambitious goals for the production and use of biomethane to increase independence from natural gas imports, among other things. The scalable, clean and economically efficient technology to achieve this is already available and smaller regional projects like this will be needed and most certainly contribute to the goals,” says Jelle.

Due to the war in Ukraine, the Ukrainian energy system is damaged more and more each day. Nowhere is it clearer that diversification of Russian gas and energy security is urgently needed. HoSt recently built a biogas plant in Ukraine, is currently realizing a second one, and builds three biogas upgrading projects in Ukraine. Small steps at a time, these installations provide renewable energy to local people and fight against a complete energy blackout.

Outside of Europe, the United States has a large market for renewable natural gas projects. HoSt is constructing three new biogas plants at dairy farms in upstate New York and in Ohio. Together, these biogas plants produce the equivalent of running 3,000 US family cars on the clean fuel bio-CNG for a year. With many dairy projects located in the Mid-West of the United States where winter weather can be severe, it is extremely important to design with this in mind. Innovations for the US market include a heat recovery technology ensuring significant reductions in gas utilization for heating.

Clean thermal energy conversion

Energy prices are soaring and energy scarcity is increasing day by day. On top of this, the industry sector, such as greenhouses and the paper and packaging sector, needs clean and efficient energy to increase energy security and independence. A ready-to-use and feasible solution to tackle the problem for industrial heat and electricity consumers are medium-sized combined heat and power (CHP) plants, fired with locally sourced wood waste (biomass) or refuse derived fuel (RDF).

At a paper and packaging factory, HoSt is now building a 15MW combined heat and power plant that will combust RDF. Approximately 50% of the natural gas consumption of the factory will be replaced with renewable heat.

By utilizing waste streams as an useful resource, available in abundance worldwide and otherwise have no other purpose, these type of cogeneration plants can serve as a future-proof and sustainable solution to high prices for fuel, heat, and electricity. Pre-pandemic heating and electricity prices are therefore achievable.

Strong research & development

With a strong in-house research and development team, the technologies to promote renewable energy are innovative and improved continuously. After a decade of research and development on the technology of thermal conversion to produce renewable heat and electricity, the firm realized the cleanest industrial cogeneration plant in the Netherlands, fired with locally produced wood waste. “The R&D effort resulted in the cleanest wood-fired heat and power plant on the market in terms of emissions and efficiency and, through its modularised and standardised design, enabled significantly lower costs than other plants in terms of construction speed and compactness.”, says Jelle Klein Teeselink.

With over 400 employees across 7 offices, including in the US, France, Latvia, Poland and the UK, the team pioneers and boosts the vital acceleration of renewable energy development and deployment worldwide. Jelle: “The year 2022 was an unprecedented year for the renewable energy sector, for the world and the HoSt Group. We keep on building towards a better and cleaner world and are full of green energy”. ■

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GLOBAL LEADER
IN RENEWABLE
TECHNOLOGY
EMPOWERING SUSTAINABILITY AMBITIONS
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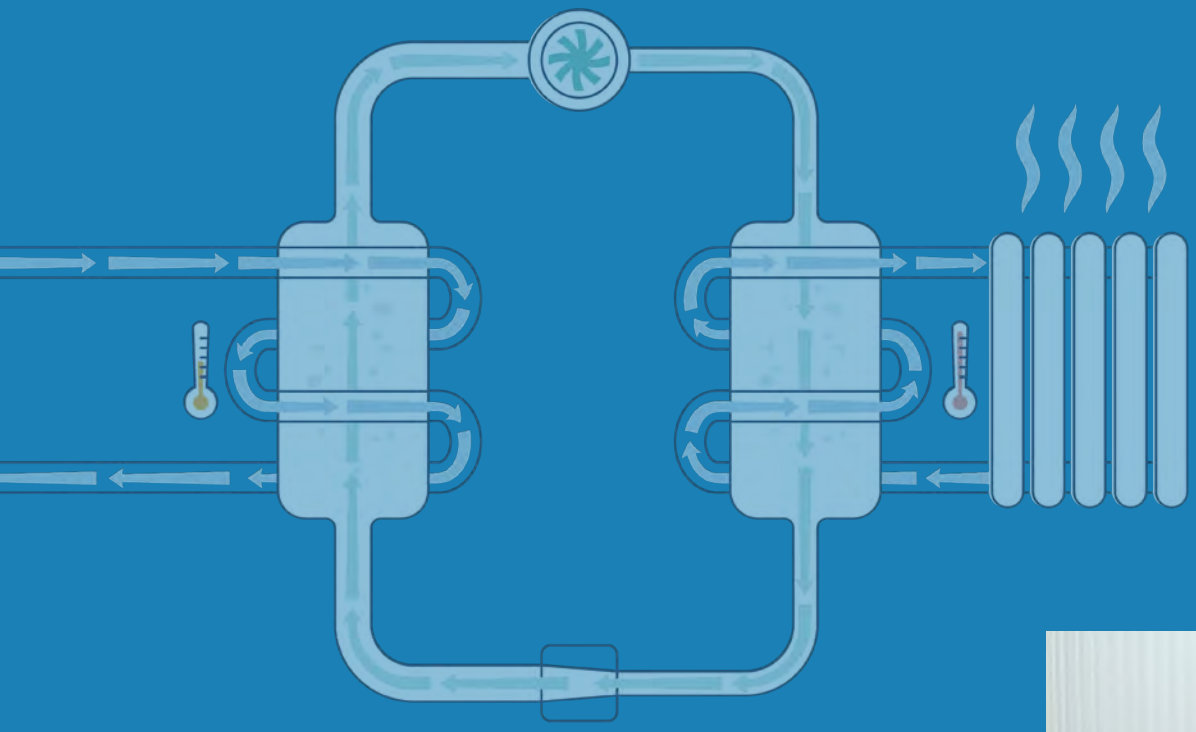


COOLL DEVELOPS SUPERHYBRID:

A THERMALLY DRIVEN HEAT PUMP BASED ON THE PRINCIPLE OF ADSORPTION

Technology

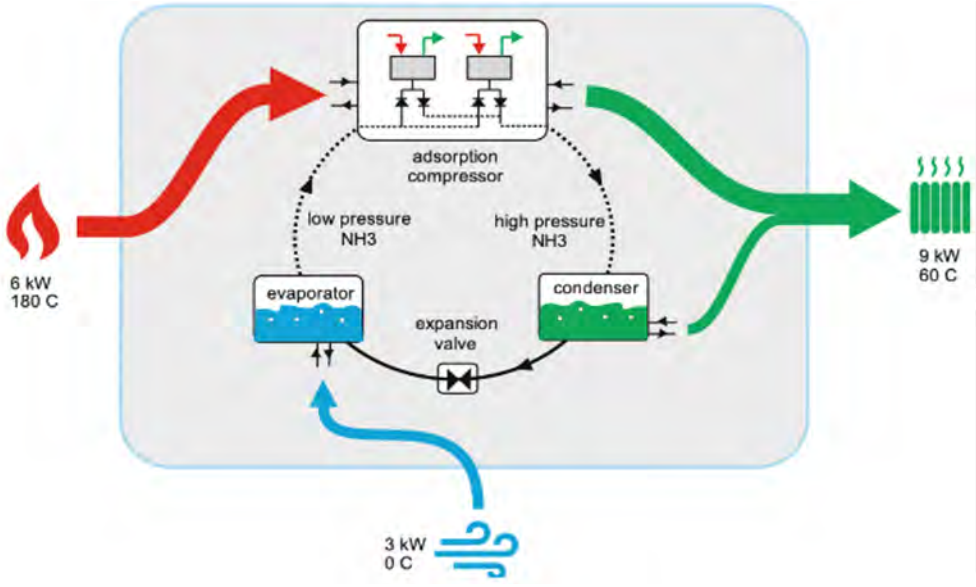
Cooll's SuperHybrid contains a similar continuous cycle to as a normal electric heat pump. However, compression of the refrigerant now takes place with a heat-driven adsorption compressor instead of an electrical-mechanical compressor. The required heat comes from a burner, which can be driven by both natural gas and sustainably generated (hydrogen) gas.

The adsorption compressor consists of two pressure vessels filled with high-quality activated carbon, which are heated and cooled cyclically. A complete cycle takes about 10 minutes. During heating of a pressure vessel (up to approximately 180 °C), the refrigerant is pressed out of the adsorption material under high pressure and transferred to the high-pressure side of the heat pump. The refrigerant then condenses and releases its heat to the heating circuit of the house (for example at 60 °C), after which the pressure of the refrigerant is lowered via the expansion valve. The refrigerant evaporates again at a low temperature (for example 0 °C of the outside air) and thus absorbs energy from the cold environment. The refrigerant then flows to the other pressure vessel at the initial temperature (60 °C in this example), adsorbing the refrigerant back into the adsorption material. After about 5 minutes, the function of the two pressure vessels reverses, creating a cyclic process. Compared to a standard central heating boiler, the gain is in the extra heat that becomes available via the evaporator and the condenser.

COOLL

About Cooll

The company Cooll Sustainable Energy Solutions is located in Enschede. Cooll started in 2009 as a spin-off of the University of Twente and originated from the development of innovative cooling and heat pump systems for the European Space Agency (ESA) and similar entities. Cooll is developing compact heat pump technology for existing buildings with a team of 30 employees and expects to be able to demonstrate SuperHybrid for homes in 2023.



Cooperation with Fraunhofer

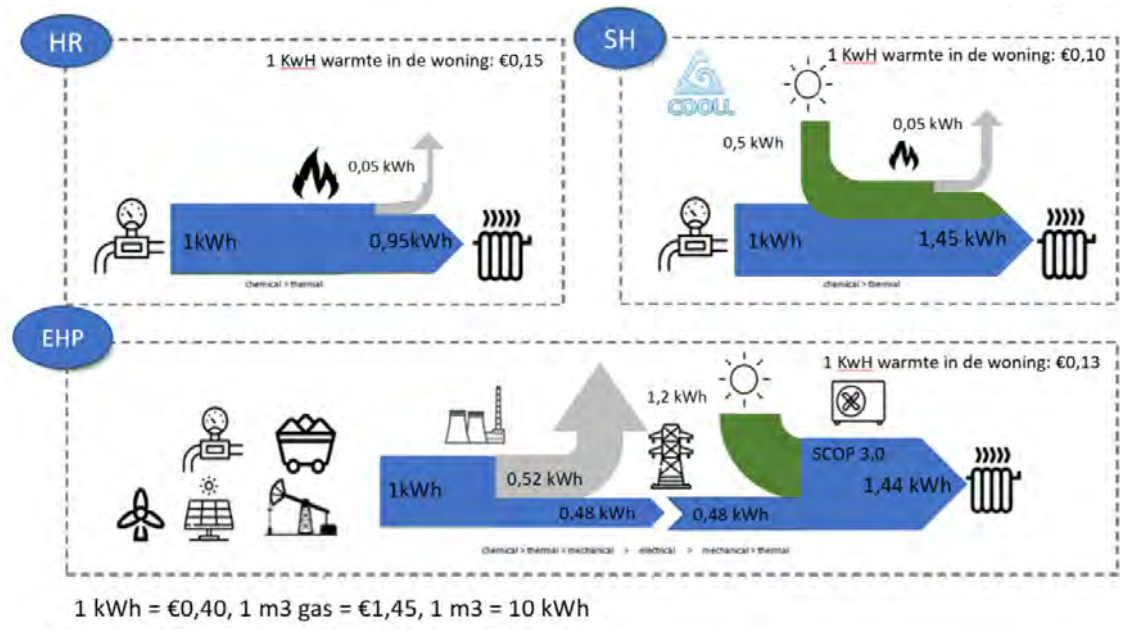
Cooll has been working with various Fraunhofer institutes for several years. The collaboration started through an EFRO project, during which the FIP-AM@UT supported Cooll with design and production issues around the adsorption compressor. The Fraunhofer IPT, IWS and IWU institutes also contributed to this. Fraunhofer ISE also played a role, among other things by studying the market potential of the Cooll heat pump and measuring the performance of Cooll's heat pump in the accredited test lab in Freiburg. Cooll and Fraunhofer ISE also participate jointly in the Thermally Driven Heat Pumps working group of the European Heat Pump Association (EHPA). The collaboration with Fraunhofer is therefore important to Cooll for several reasons.

Relevance for energy transition & hydrogen developments

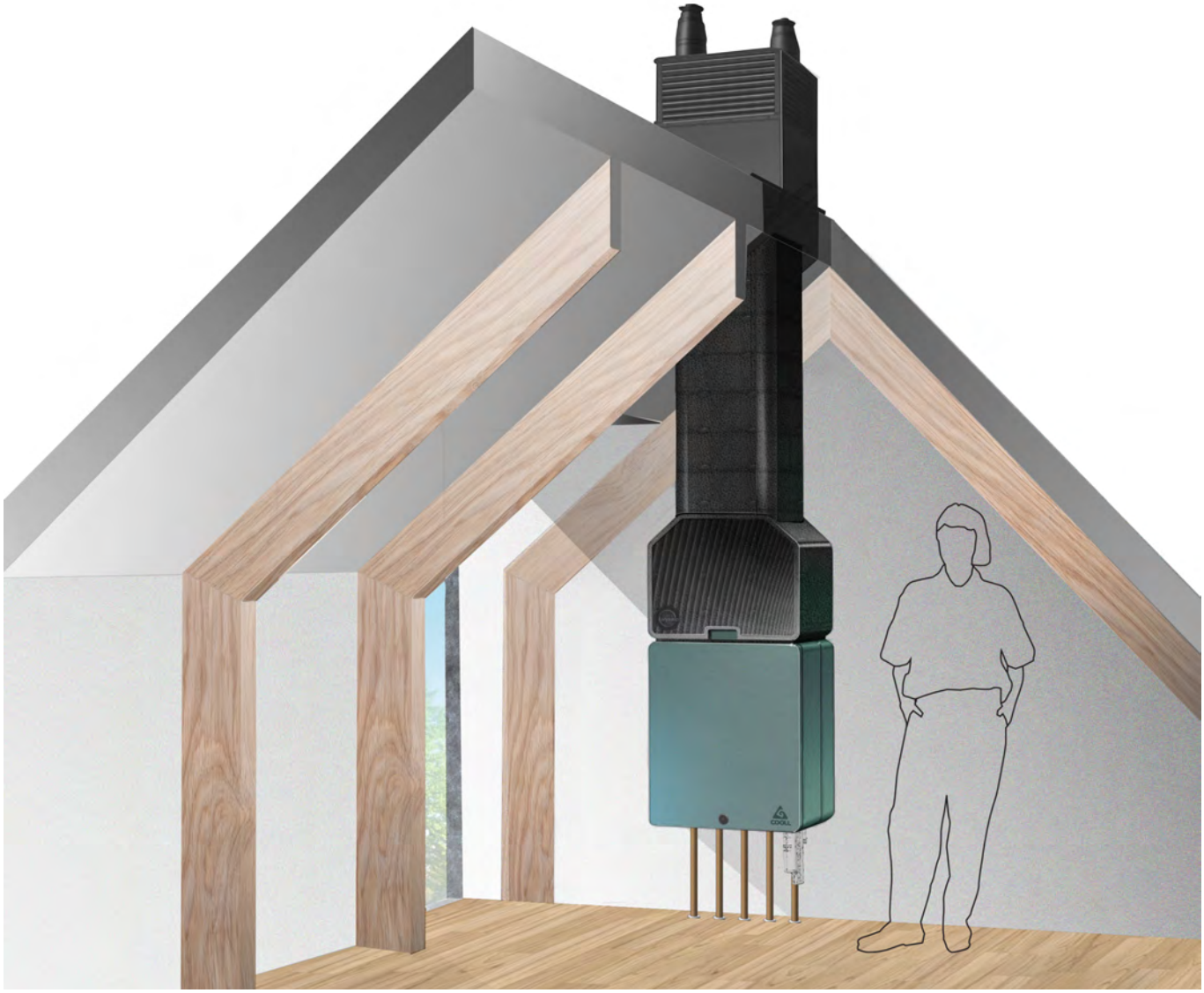
The International Energy Agency (IEA) expects that although the share of renewable energy sources will increase in the coming years, the use of fossil fuels for heating will remain substantial over the same period. (https://www.iea.org/fuels-and-technologies/heating)

This means that a large share of European buildings, especially somewhat older ones, will continue to rely on heating sources other than electric heating in the near future. In order to reduce CO_2 emissions in the built environment as soon as possible and to facilitate the transition to CO2 neutrality, a solution is needed that (1) directly reduces CO_2 emissions, (2) can be applied at low cost in a wide variety of buildings, and (3) can be powered by both conventional and renewable non-electric energy sources to be future-proof.

The EHPA and the European Heating Industry (EHI) issued a report on thermally driven heat pumps (https://www.ehpa.org/publications/report-thermally-driven-heat-pump-technology/) in 2022. This report describes the relevance of thermally driven heat pumps and the role they can play in helping to achieve the climate goals. In specific terms, the SuperHybrid from Cooll can save at least 30% on (green) gas consumption compared to a central heating boiler, without the need for increased electricity consumption. In addition, the product is easy to install on the spot of a central heating boiler and no noisy outdoor unit is needed.



Chain efficiency between different technologies (heat pump, HR boiler and the SuperHybrid/ thermally driven heat pump)



This saving also applies if green gas or hydrogen is used, which means that when applying this technology, less sustainable gas (and therefore storage and buffer capacity) will be needed to be able to supply a residential area with hydrogen, for example. This will increase the feasibility of various hydrogen projects, which are still in the pilot phase.

Current phase & future

Making a product market-ready with fundamentally new technology takes years. Cooll's technology has been developed and tested using a series of prototypes with increasing TRL levels. After various lab setups that demonstrated efficiency, among other things, a number of functional models have been built that have been tested in real life environments in recent years.

At the moment, some of these devices are also being used in the GROHW-2 project where an energy system with hydrogen generation, buffering and offtake is being demonstrated (https://grohw.nl/). Cooll's heat pumps are used here to heat the Apparatengebouw building at the Gasfabriek in Deventer by mixing 30% hydrogen into natural gas. In parallel, Cooll is working on a drive suitable for 100% hydrogen and the production of the first series of SuperHybrids has recently started. After obtaining the necessary certifications, these heat pumps will be tested in various homes in 2023.

Cooll expects that the multiple patented SuperHybrid technology will play an important role in the energy transition for the built environment in the coming years. Due to the substantial savings on natural gas, green gas or hydrogen, the SuperHybrid is a no-regret sustainability solution that does not place a heavier burden on the electricity grid. By 2025, Cooll expects this technology to be available to consumers. Cooll works exclusively B2B. ■

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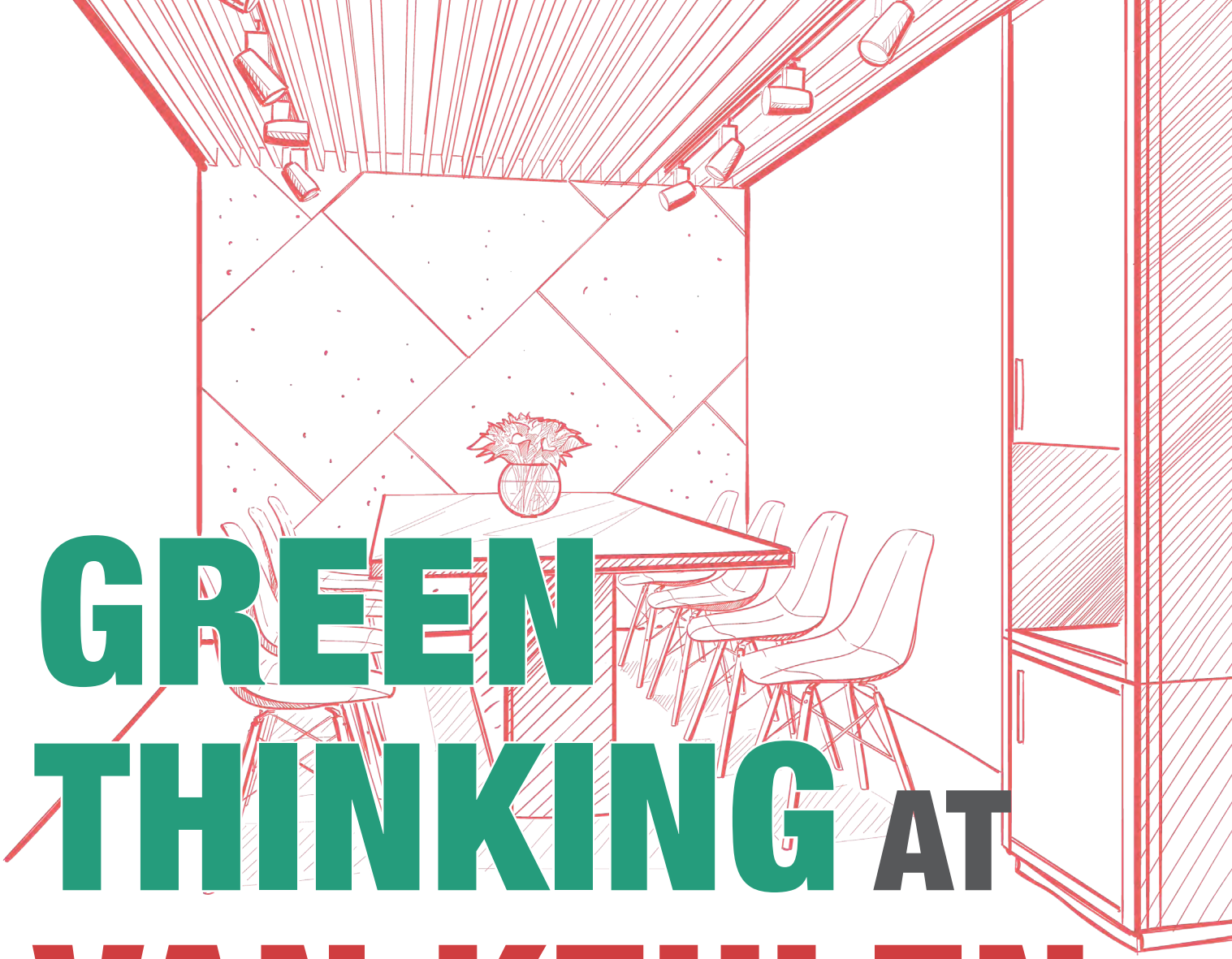


GREEN THINKING AT VAN KEULEN

VAN KEULEN INTERIEURBOUW

Van Keulen Interieurbouw is a successful family business from Nijverdal. Now, almost 80 years after its foundation, they have acquired several companies, with - besides Nijverdal - production sites in Tynaarlo and Mariënheem, more than 500 employees, and is now around 65,000m² of space at their main location. The company has grown into a market leading and respected player in Dutch interior ***building and shopfitting. Supermarkets generate the biggest*** *revenue share, next to non-food stores. They focus on the hotel industry, libraries, schools, and museums. Long before sustainability became as urgent as it is today, Van Keulen was actively involved in making their processes more* ***efficient and sustainable.***

Paul van Keulen is managing director at Van Keulen Interieurbouw. The company was founded in 1944 by his grandfather, he starts by saying: “My grandfather started with hammer and axe handles, then went on to playpens, and from playpens moved on to grocery stores. When the self-service concept for supermarkets came over from the United States, we got our first supermarket as a customer, which we stuck to and became expert in. Supermarkets have become and remained the largest customer area.” A number of strategic acquisitions enabled Van Keulen Interieurbouw to diversify to other market segments too, such as libraries, schools, and hotels. In short, Van Keulen Interieurbouw takes care of the complete furniture of these buildings between the ceiling and the floor. Roughly 60% of steel and 40% of wood are used for this, of which 5% of the latter group includes plastics.

Van Keulen has a strong philosophy that translates into a successful strategy: from payroll to assembly, everything is done in-house. All facets of the production take place in-house, only the raw materials are purchased. With this strategy, sustainability is very manageable, with no dependency on environmentally harmful production and polluting transport from non-EU countries. Moreover, this makes them more flexible: and they can quickly respond to changing or new demands in the market.

The process

The motto of Van Keulen Interieurbouw is “We make your wishes come true in detail”. The first step is product design, which they receive from their customer. Van Keulen then works out this design technically, looking at shapes, and which materials can best be used. Materials should be as lightweight as possible but meeting the strength requirements for the intended function.

Projects made by Van Keulen Interieurbouw

This is the first step in the process in terms of sustainability. After all, next to using as little material as possible, transport emissions also decrease when moving lighter products. However, maintaining quality remains paramount.

Van Keulen Interieurbouw does the production entirely in-house. After taking over a wire factory, they can now produce wire steel racks, in addition to steel and wooden constructions.

Finally, transport, is also executed by themselves: with 40 delivery vehicles, the interior parts are delivered and assembled on site by Van Keulen mechanics.

Sustainability

Sustainability has been an important topic at Van Keulen Interieurbouw for more than 20 years: “We are constantly making our processes more efficient. More efficiency directly contributes to sustainability. Especially if you produce everything in-house and in the Netherlands, that goes hand in hand, making it easier to guarantee sustainable practices.”

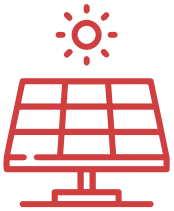
The most important sustainability activities of Van Keulen Interieurbouw for a greener world:

Furthermore, extra isolation of the buildings in Nijverdal is on the agenda and quite some action has been undertaken at the other locations. “We built the factory in Tynaarlo from scratch; the roof is full of solar panels and the building meets all sustainability requirements. As a result, energy consumption has dropped enormously. In addition, all CO_2 laser cutting machines have been replaced by machines that work based on Fiber, reducing consumption per machine by two-thirds. Four such machines have been replaced, achieving a huge reduction in energy consumption.” Finally, in nearly all buildings traditional lighting has been replaced by LED lights.

Rainwater is collected in a large basin that provides capacity for one million litres of water. This rainwater is filtered and stored and used for all degreasing operations of the epoxy spraying plant. In the past, tap water was used for this. Part of the toilets are also flushed with water from this basin.

All **waste is separated** at source: wood, plastics, and residual waste. Different metal types are also disposed of separately.

The **waste wood is incinerated to heat** buildings, and two degreasing baths in the powder coating plants.



There are now **6,000 solar panels** installed at Van Keulen generating about 1 megawatts of energy. It is being investigated whether the gas heating of the epoxy paint plants can be replaced by electric heating with energy from the solar panels. In the ovens, 160 to 180 degrees are needed for the curing of the products.

Old furniture returned from supermarkets is assessed for reuse. If it can still be used, it will be **refurbished and used again**. Then it either goes to Poland, where Paul van Keulen’s uncle has a site as well, or remains in the Netherlands for second-hand use in supermarkets.

Green thinking is also stimulated internally; for example, by offering a bicycle plan and minimising the number of car parking spots.

Van Keulen Interieurbouw at Nijverdal and Tynaarlo

Future

Van Keulen's future plans are mainly focused on further optimisation and sustainability of the processes. He mentions making more efficient use of the production resources as his main goal: "For example, by ensuring the lower skilled employees can continue to do the same processes in the future. This could for example be in collaboration with a robot or cobot, or with a low-tech solution: if, let's say, due to the decreasing pool of new professionals the welding work is done less accurately, we can teach our people to sand better to solve this."

They have also just bought a new high-tech panel bending machine for the Tynaarlo site. "An important question is how the geometry you have created is produced by the machine. There we are mainly looking at how that process can be optimised. Perhaps Machine Learning can play a part in this."

Van Keulen is also working on an automation process for their 3D package software. "With IronCAD we design our products. The objective for the coming years is: "How do we get everything we have designed directly manufacturable?"

The wood processing industry lags far behind the metal industry in terms of these software integrations, for example between designing programmes and machines, says Van Keulen. To develop this, they will soon start a project with the FIP-AM@UT.

For the production, Van Keulen Interieurbouw usually receives the designs from their customer. However, when these drawings are imported into their own systems, features such as holes that need to be milled or drilled into the product, are no longer visible. These must be manually re-applied in the design. The project with the FIP-AM@UT aims to develop the software in such a way that this feature recognition is automated, to be able to better estimate production times and lead time. ■

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OPTIMISE YOUR PRODUCTION PROCESS WITH AGVs AND MOBILE ROBOTS.

Having an effective production process is critical to staying relevant to your customers and being agile in this ever-changing world. However, the rapid advancements in the market bring forth their own unique set of difficulties, such as the shortage of (logistics) personnel, soaring labour costs, rivalry from countries with low wages, and a demand to stay relevant to your customers.

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At the 'Integration of AGVs and Mobile Robots in the Manufacturing Industry' workshop, Twin Tech and AMRobotics will share their knowledge when it comes to the application of software and hardware. Additionally, an entrepreneur with hands-on experience with AGVs and Mobile Robots in their own production and logistics processes will share their experience and offer insights. With the guidance of experts, you will have the opportunity to engage in structured discussions and learn the steps necessary to capitalise on the potential offered by AGVs and Mobile Robots. Upon completion, you will be able to understand the possibilities, anticipate potential pitfalls, and devise concrete strategies to begin your AGV/ Robotics integration journey. Please note that the workshop will be conducted in Dutch.

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