

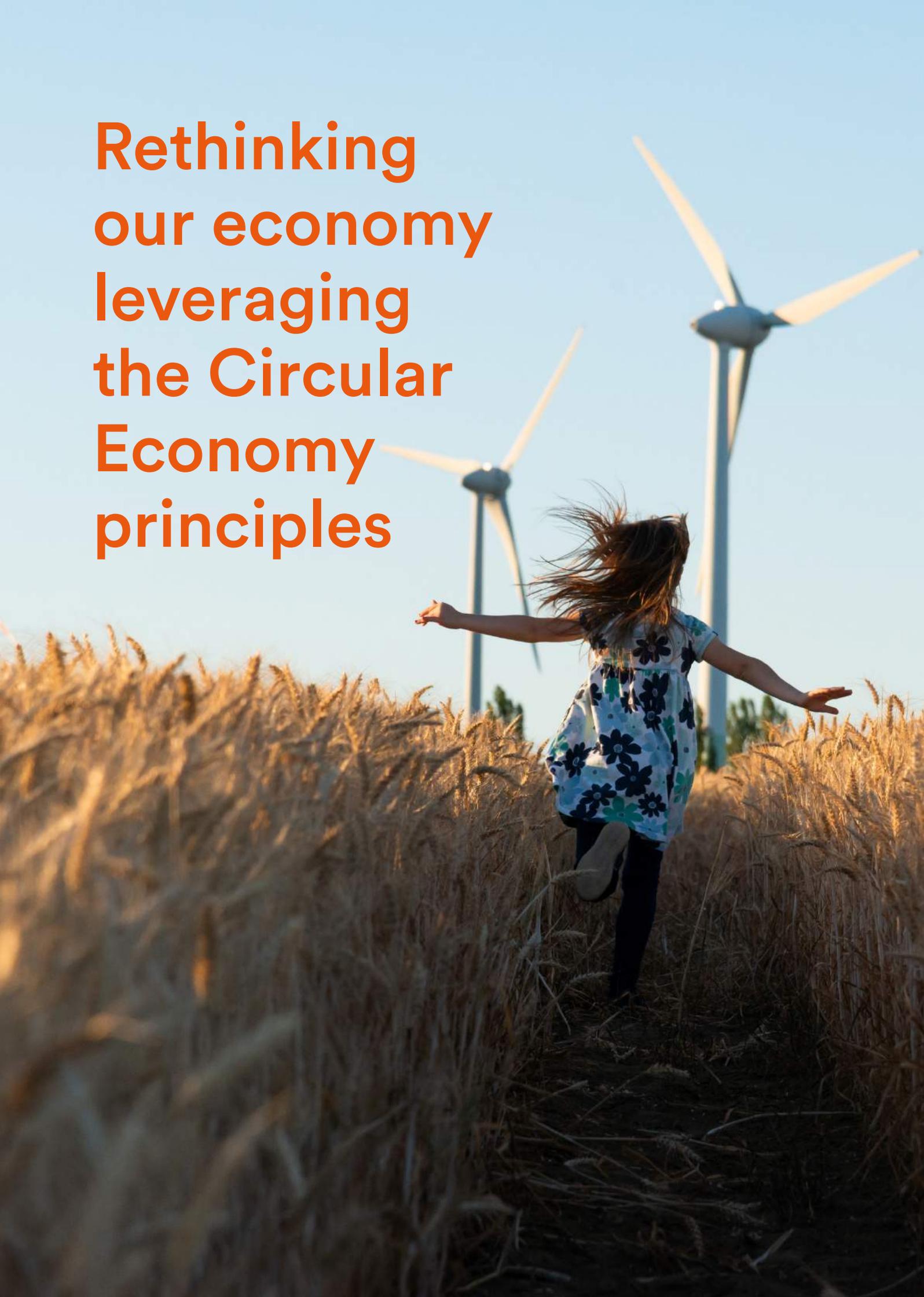


Circular economy *forum*

RE-THINK MILAN 2020



Rethinking our economy leveraging the Circular Economy principles



Index

PREMISE	4
EXECUTIVE SUMMARY	5
INTRO	8
AGRI-FOOD	15
CITIES	33
ROUNDTABLE	59
MATERIALS	63
TECHNOLOGY	90
ACKNOWLEDGEMENTS	110
TONDO	111
TONDO LAB	112
DISCLAIMER	113

Premise

The “Re-think Circular Economy Forum” event was designed to stimulate critical thinking, showing concrete cases and evolutionary trends of the Circular Economy. The main purpose of the event was to present the macro-trends linked to the European Union’s vision, showing practical paths for its implementation, and introducing ongoing Circular Economy projects that might lead to the launch of new innovative and entrepreneurial activities. Another purpose is to further expand and connect the ecosystem supporting the Circular Economy, facilitating the interaction between all the relevant actors for the implementation of innovative projects.

The event was held online on October 27th and 28th, 2020 and had four main focuses: Agri-food, Cities, Materials and Technologies.

Why Agri-food?

Food is our main source of livelihood. The alarming fact is that 1/3 of this food is thrown away without being consumed. The goal is therefore to analyze any scenarios for sustainable development, with less impact on the soil and the environment, and with a correct reuse of raw materials that are currently wasted.

Why Cities?

Cities are the engine of the modern economy where 85% of GDP is produced and where 75% of resources are consumed. Circular and smart cities are based on materials, technologies and flows that optimize and connect infrastructures with the human and social capital of those who live there.

Why Materials?

The materials are the basis of each product. The product design phase is also the most relevant for the choice of materials and the consideration of the impacts that these may cause during use and at the hypothetical end of the use cycle.

Why Technologies?

Technologies are increasingly transforming our lives. Technologies can improve the use of resources by reducing waste, simplifying flows or optimizing the use of infrastructures.

During the four sessions, interventions of experts, companies, start-ups, research institutions have followed. In addition to the four main topics, the event gathered an introductory phase on the 27th, and a roundtable on October 28th, where different actors operating in support of the Circular Economy. This document collects all the interventions made during the day, divided into different sections.

The event was organized in collaboration with Intesa (IBM Group), Es-selunga, The General Consulate for the Kingdom of the Netherlands in Milan, The Royal Danish Embassy, Phoenix Materials, Fondazione Pistoletto, ALMED, ALTIS Graduate School Business and Society, and Smallfish. For the event, the onerous patronage was received from the Cariplo Foundation. The event has also received the patronage of the European Commission, Ministero dell’Ambiente e della tutela del Territorio e del Mare, Municipality of Milan, and of Camera di Commercio of Milano, Monza, Brianza and Lodi. The media partner of the event was Adnkronos.

Executive Summary

The impact of the linear economic model on our planet has now become unsustainable, producing dramatic effects on biodiversity and causing the warming of the atmosphere. The Circular Economy stands as an antithetical model to the linear model and represents a possible solution to these problems.

The idea behind a circular approach is to imitate the behavior of nature, where the concept of waste does not exist and each element becomes an input for another process. The Circular Economy sets this goal with a systemic vision, which is aimed at rethinking the way we design our products and processes to eliminate all possible negative externalities, encouraging the circular use of materials and regenerating the natural system.

In recent years, more and more actors have been implementing circular business models, showing that such models, besides having a positive impact on our ecosystem, are also economically sustainable. During the Re-think Circular Economy Forum, several entities operating in the Circular Economy such as companies, start-ups and institutions have been presented, with a focus on four specific areas: Agri-food, Cities, Materials and Technologies. In addition, there were two other sessions, one of introduction to the concept of the Circular Economy and its implementation at the European level thanks to the EU Circular Economy Action Plan, and one dedicated to the supporting ecosystem.

Intro

In the introductory session, there was the intervention of Francesco Castellano, President of Tondo, who explained the urgency of building up a new economy, fostering the Circular Economy. This emergency scenario requires an innovative approach and therefore he decided to create Re-think, an event format that is promoting engagement on possible circular solutions, and favoring the interaction of multiple international stakeholders. Afterwards, Federico Porrà presented the European Commission's vision and policies on the Circular Economy for the period 2020-2024 with a particular focus on the new EU Circular Economy Action Plan. Thereafter, Professor Roberto Zoboli concludes the introductory part illustrating the new challenges and opportunities for the Circular Economy coming from the new EU policy framework.

Agri-food

The agri-food session started with EIT food and right after Neorurale Hub highlighting the current projects and solutions under development with a focus on the valorization of side streams and food waste; the creation of innovative smart and/or sustainable packaging concepts; the design of innovative regenerative agriculture practices to prevent the loss of fertile soil and biodiversity; nutrition, energy production and the pollution of the environment. Afterward, Esselunga described the actions implemented to prevent food waste and to ensure sustainable packaging.

Subsequently, IUUV, Circular Food Technology and Krill Design followed, describing their models oriented respectively at biopolymers, upcycling food waste and product design through waste transformation. Then, Danone explained its path towards the Circular Economy in food. The agri-food session ended with AgroCares, AVIPE and Local Green that illustrated the use of sensor technology in circular agriculture, the Circular and Bio-Economy in the EU Wine Sector, and the adoption of Vertical Farming to achieve better performing farms.

Executive Summary

Cities

The cities session was opened by Enrico Giovannini who underlined the importance of sustainable development and circular economy within the EU paradigm, followed by Lucia Scopelliti from the Municipality of Milan that described the main Milan's Circular Economy initiative. Afterward, the General Consul of the Netherlands talked about the Netherlands' position as a Circular Economy pioneer working with businesses, civil organizations, knowledge institutions and other authorities to achieve a sustainable economy for the future and become fully circular. Following, Stefano Boeri from Stefano Boeri Architects and Paolo Cresci from Arup explained the main urban projects concerning forestation and decarbonization of urban systems.

Thereafter, with Enel X, Physee, ATM, A2A the topics covered were: circular citizens, AI to design buildings, urban mobility and waste as a resource. Aquaporin, instead, described their technology aimed at re-using and reducing water consumption. Finally, Vitesy and OECD explained respectively air purification and the role of cities and regions as promoters, facilitators and enablers of the circular economy.

Supporting ecosystem

The supporting ecosystem session was a roundtable moderated by Federico Luperi from Adnkronos, the media partner of the event, in which the actors involved operate in support of the Circular Economy, such as Fondazione Cariplo, Intesa Sanpaolo Innovation Center, Eureka! SGR, Circular Value Fund, Fondazione Pistoletto and Ayming.

Materials

The materials session started with Material Balance Design, followed by Matrec and Novamont that illustrated new circular materials and bioplastics. Afterward, ISTECCNR explained how food by-products can become cosmetic ingredients and plant fertilizers. Ricehouse, Alisea and Fili Pari on the other hand showed how waste materials can be re-used to give life to construction and textile items.

Thereafter, SMALLrevolution described its method for recycling plastic from households plastic waste. Sony, instead, presented Triporous technology that can purify water and air. Another interesting technology was showcased by Phoenix Materials (by EPM): nanocoating for the protection and endurance of surfaces. Last, Circle Economy clarified the main approaches to analyze and measure goals in terms of the Circular Economy on a global and company level.

Executive Summary

Technologies

The technologies session started with Professor Davide Chiaroni from Politecnico of Milan, followed by Shyaam Ramkumar from Tondo and Pietro Lanza from Intesa (IBM Group), who underlined the importance of digital technologies for the successful creation of circular business models. Afterward, Excess Materials Exchange explained its digital matching platform that finds new high-value reuse options for materials and (waste) products of businesses. Following, IREN and then Sympower covered the big challenge of enhancing the electricity network capability reducing waste and inefficiencies and enabling smart grids.

Subsequently, Seluxit discussed 3 ways IoT can support the Circular Economy. Then, with Greyparrot, the AI-based computer vision to support waste management was illustrated. Last, Eni concludes the session highlighting the results of the development and implementation of an innovative tool to predict the short-term trend of the energy efficiency index and to suggest the optimal actions to manage an upstream production plant.

INTRO

The Circular Economy represents an Urgent Economic Opportunity

REPORT RE-THINK, MILAN 2020

The Urgency and Relevance of a Paradigm Shift

Speaker: **Francesco Castellano**
 Founder of Tondo and Tondo lab

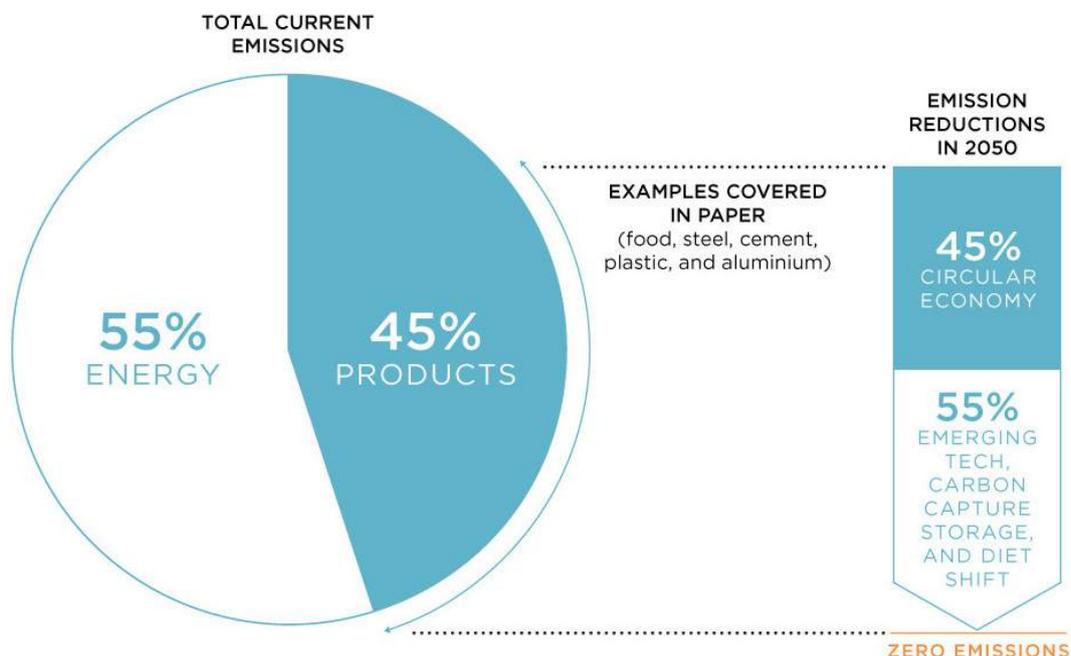
Francesco Castellano starts his speech by stressing the importance of accelerating the transition towards the Circular Economy. Based on a 2018 IPCC report, we have only 30 years left to reach zero net CO2 emissions and keep the temperature increase under 1.5 degrees. In order to reach this target, there are two main actions we need to undertake: **fostering the Circular Economy** by designing out waste, keeping materials in use and regenerating nature, and accelerating the switch toward **renewable energy**.

In particular, the Circular Economy can help tackle the overlooked **45% of emissions** by transforming the way goods are made, based on an Ellen MacArthur Foundation report (“Complete the picture”, 2019).

Additionally, the Circular Economy Action Plan, one of the main blocks of the European Green Deal, introduces legislative and non-legislative measures targeting areas where action at the EU level brings real added value, converting social and environmental challenges into **economically viable opportunities**.

Therefore, while it is quite urgent to **rethink our economic model**, it might also be a great economic opportunity for the companies that decide to embrace it. The event format **Re-think** aims at supporting this transition, transforming the Circular Economy into a practical reality, by showcasing possible solutions

Img. 1
 Ellen MacArthur Foundation (2019),
 «Complete the picture»



and enlarging the ecosystem supporting these kinds of activities. In particular the event will be focusing on four main areas, namely agri-food, cities, materials and technologies.

Food is our main source of sustenance, and currently 80% of the food that is produced is consumed in cities. The alarming fact is that 1/3 of this food is thrown away without being consumed. During the event, many aspects of the new agriculture trends will be investigated: regenerative agriculture, circular bio-economy, agriculture 4.0 with the introduction of digital or robotic elements, new types of cultivation such as Indoor and Vertical farming, and new methods of food preservation and transportation.

Cities are a vital part of our modern economies, where 75% of resources are consumed and 85% of GDP is produced. Circular Cities aim at decoupling economic growth from resource consumption, while keeping the assets in use at the highest level, also thanks to digital technologies. Many areas are relevant for the Circular Cities of the future like energy, waste, buildings, water, air or transportation. During the event, all these areas will be touched starting from the design phase of a city as the core and initial element to lead this transition.

The Urgency and Relevance of a Paradigm Shift

Speaker: **Francesco Castellano**
Founder of Tondo and Tondo lab

Materials have an essential role in the path towards a Circular Economy. A Circular Economy is not simply to recover materials from products at the end of their lifecycle, but it also to create new materials that can have a lower environmental impact and that be more easily recovered at their end. It is also to design products considering their life-span and usage, choosing the most appropriate material. During the event, all these elements will be presented, highlighting the importance also of measuring the circularity level of a certain product or company. In addition, we will focus our attention on biomaterials that are increasingly replacing synthetic ones, emerging practices in the reuse and regeneration of materials and future trends in material science.

Technologies are acknowledged to have important implications for the Circular Economy, and different studies have been developed on how to integrate the digital technologies within the Circular Economy to accelerate the transition. In particular, digital technologies can be used to spread knowledge about the Circular Economy, create digital business models, and increase the role of consumers. During the event, emerging technologies will be presented that overturn the concept of waste and optimize the use of resources with a focus on AI, IoT, Blockchain, Clean Energy, and other digital applications for the Circular Economy.

Before leaving the floor to the speakers, Francesco also presents briefly the Tondo's ecosystem.

Tondo is a non-profit organization focused on Circular Economy, who wants to create a large ecosystem on the Circular Economy developing a bridge between universities, startups, corporates, institutions, and people. Overall, Tondo operates on 3 levels:

- **Knowledge**, supporting the development and diffusion of relevant knowledge regarding the Circular Economy;
- **Ecosystem**, incrementing the opportunities of innovative and entrepreneurial projects by creating a wide and heterogeneous network;
- **Projects**, promoting the development of innovative projects regarding emerging technologies, circular materials or new business models.

Recently, Tondo team created also Tondo lab, a benefit company with the aim to support corporates and startups in designing, implementing and scaling circular solutions.

Tondo lab simplifies companies' journeys toward the Circular Economy by sharpening the knowledge about the Circular Economy, fostering the implementation of innovative projects within an organization and supporting the collaboration between different business actors.

A new Agenda for the Circular Economy: the Circular Economy Action Plan in the European Green Deal

Speaker: **Federico Porrà**
Policy Officer at European Commission

Federico Porrà explained European Commission's vision and policies on the Circular Economy for the period 2020-2024, in particular by presenting the new EU Circular Economy Action Plan, a key pillar of the European Green Deal.

The Circular Economy is one of the key pillars for the recovery in the post-Covid era, an opportunity to support the green transition and create inclusive growth. On September 17th, the European Commission published its 2021 Annual Sustainable Growth Strategy (ASGS), which launches this year's European Semester cycle, including a Staff Working Document providing strategic guidance to the Member States when presenting their Recovery and Resilience Plans. Today, the Circular Economy is even more relevant than before, precisely because it is a tool that can be used to create local jobs and boost sustainable growth, while supporting resilient supply chains and new business opportunities.

The Circular Economy Action Plan is part of the European Green Deal, Europe's growth strategy and policy vision to put the European Union in the path to reach climate neutrality by 2050. The Commission is working to mainstream circularity principles along all main strategies adopted in the context of the Green Deal, such as the Farm to Fork Strategy, aiming at making food systems fair, circular, healthy and environmentally-friendly, and food chains more sustainable. Another example that he mentions is how the Circular Economy can enable smart mobility in the XXI century.

Building on the first Action Plan launched in 2015, the new Circular Economy Action Plan is currently one of the most ambitious documents ever adopted on the Circular Economy, thanks to its comprehensive approach targeting the entire life cycle of products. In fact, it introduces legislative and non-legislative actions on sustainable products, production processes, consumption, waste, secondary raw materials, and several key product value chains.

The Action Plan announces a sustainable product policy framework, which will be adopted and implemented in synergy with European Parliament and the Council for European Union. The framework will be based on three pillars: product design via a Sustain-

able Products Initiative, consumers and production processes.

The Commission has been working to include circularity criteria in the current Eco-design Framework Directive, which applies to some energy-related products. Such minimum criteria include, for example, durability and reparability. The European Commission's intention is to make the Ecodesign framework applicable to the broadest possible range of products, expanding its scope to i.a. non-energy related products.



Img. 2
The European Commission in Brussels

Some of the innovative aspects that will be likely introduced via the Sustainable Products Initiative and other appropriate instruments will develop on the nexus between circularity and digitalization. Amongst others, a digital product passport – currently under consideration – could be a powerful tool to ensure a better flow of information on products, waste, and chemical components, ultimately fostering the Circular Economy across the products' lifecycle. In the Circular Economy Action Plan, the Commission

A new Agenda for the Circular Economy: the Circular Economy Action Plan in the European Green Deal

Speaker: **Federico Porrà**
Policy Officer at European Commission

acknowledges that empowered consumers are able to make sustainable decisions, so they play an important role within the scope of the Circular Economy. The Commission will propose a revision of EU consumer law to ensure that consumers receive trustworthy and relevant information on products at the point of sale. In addition, the Commission will work towards establishing a new 'right to repair' and consider new horizontal material rights for consumers.

At the same time, they will be working on the green public procurement aspect of the Circular Economy, involving public buyers at all governmental levels, starting from member states to propose minimum mandatory green public procurement criteria for sectoral legislation, at EU level - without creating an unjustified administrative burden for public buyers. Considering the current evolving context, this is something that would be very powerful for the circular economy to become more mainstream.

The Industrial Strategy and The Circular Economy Action Plan are working in synergy, introducing an agenda able to support with financial and non-financial means a greater uptake of circularity in production processes, for example by supporting industrial symbiosis. Such vision applies to SMEs as well, which compose the backbone of Italy's and EU's economy. In The Action Plan, the Commission identifies tailored policies for key sectors, where there are good opportunities for the Circular Economy and where urgent action is needed, like food, construction and building, electronics and ICTs batteries and vehicles, plastics, packaging and textiles. Additionally, the Commission will adopt a new comprehensive strategy for textiles, an important flagship for the following years.

Within the Just Transitional Fund, the consideration of an inclusive circular transition is taking place, where people and regions are not falling behind and the circular economy can be one of the ways for these regions to become more and more competitive in the European market.

The Commission will update the current Monitoring Framework for the Circular Economy, new indicators will take account of the focus areas in this action plan and of the interlinkages between circularity, climate

neutrality and the zero pollution ambition. Indicators on resource use, including consumption and material footprints to account for material consumption and environmental impacts will be further developed.

In conclusion, Porrà mentions how the European Commission will pursue the circular economy research and innovation aspects via investment programs like Horizon Europe. Moreover, Cohesion Policy funds will help regions to benefit from the circular transition, by reinforcing their industrial fabric and value chains Funds.

The Circular Economy Action Plan is an ambitious and common agenda that will be implemented in synergy with the other European actors, including stakeholders. Finally, he believes that it is possible to make this ambitious vision a reality in the years to come.



Img. 3
Main elements of The European Green Deal

Circular Economy Opportunities and Challenges from the new EU Policy Framework

Speaker: **Roberto Zoboli**

Rector's Delegate for Scientific Research and Sustainability at Catholic University

Roberto Zoboli starts from the general architecture of the European Green Deal identifying different areas of action: the decarbonization and zero pollution area, the bioeconomy area - from Farm to Fork to preserve European natural capital and biodiversity, and the transition to a Circular Economy area. These areas can be considered separately but also in a NEXUS approach, which is used by international organizations and think-tanks to study the interactions between the different areas of reality and policies.

All these interactions can be in synergy but also in conflict over the different processes and policies. For example, the Circular Economy can save bioresources by using biowaste as input, for example in green chemistry. In the case of decarbonization, the biomass-based RES (energy/biofuels) can create possible pressures over virgin bioresources especially after the strong support on renewable energy sources in Europe. Finally, the Circular Economy can provide waste-based feedstocks for RES, reducing the demand for virgin bioresources. The acknowledgment of these interactions can be beneficial for policy integrations and for the achievement of the European Green Deal (EGD) objectives avoiding potential conflicts.

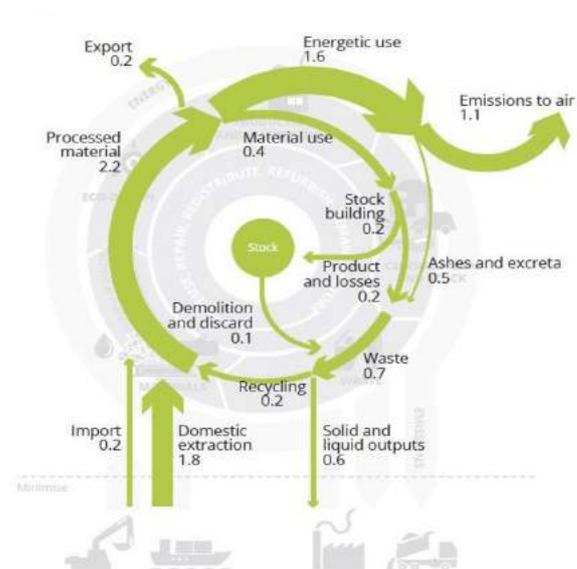
At the European level, in the NEXUS the focus is on biomaterials. Knowing that there is a great amount of residues in production (442 mt/year), there is a large potential that is partly unexploited but, in some cases, there is a high demand pressure on some sectors like wood residues. Looking at the biomaterials flows in European Union it is possible to notice that these resources are not used properly, a large part of materials are wasted or used in low-value processes:

- The energy use is about 72% of total uses and it is four times the material use, with large emissions;
- Recycling is just 28% of waste, and 11% of extraction is from nature;
- Non-recycled waste is twice the import, and about 38% of domestic extraction.

In front of these inefficiencies, according to Zoboli, one of the problems is the high burning of virgin biomass. The pathway towards massive use of virgin biomaterials for energy brings to not exploiting virgin

biomass properly. On the other side, taking the material recovery pathways for biomaterials, innovative business models can be still insufficiently developed and this is an obstacle to overcome. There is a potential for bioplastics from converting residues into bio-based polymers. There is growing industrial interest in non-food 2nd and 3rd generation renewable feedstock like wood residues, dairy, fruit and vegetable by-products, waste streams and algae. An example of integrated business models are biorefineries. Even in this case we are looking for 2nd generation feedstocks from outside the food and feed sector to avoid competition and give high value to the recovery of these bioresources.

The case of the nutshell of Ferrero, using Nutella leftovers to create packaging for its chocolates, is an example of recovering value from a very low feedstock. In conclusion, he identifies the main actions of the Farm to fork strategy in the perspective of climate change and energy. A critical point is about carbon sequestration in forestry and agriculture, suggesting biogas production from manure, agricultural residues and not virgin materials and dedicated crops. Also, the biodiversity strategy is going in the same direction. The revised RES Directive promotes the shift to advanced biofuels based on residues and non-reusable and non-recyclable waste, minimizing the use of food and feed crops for energy production.

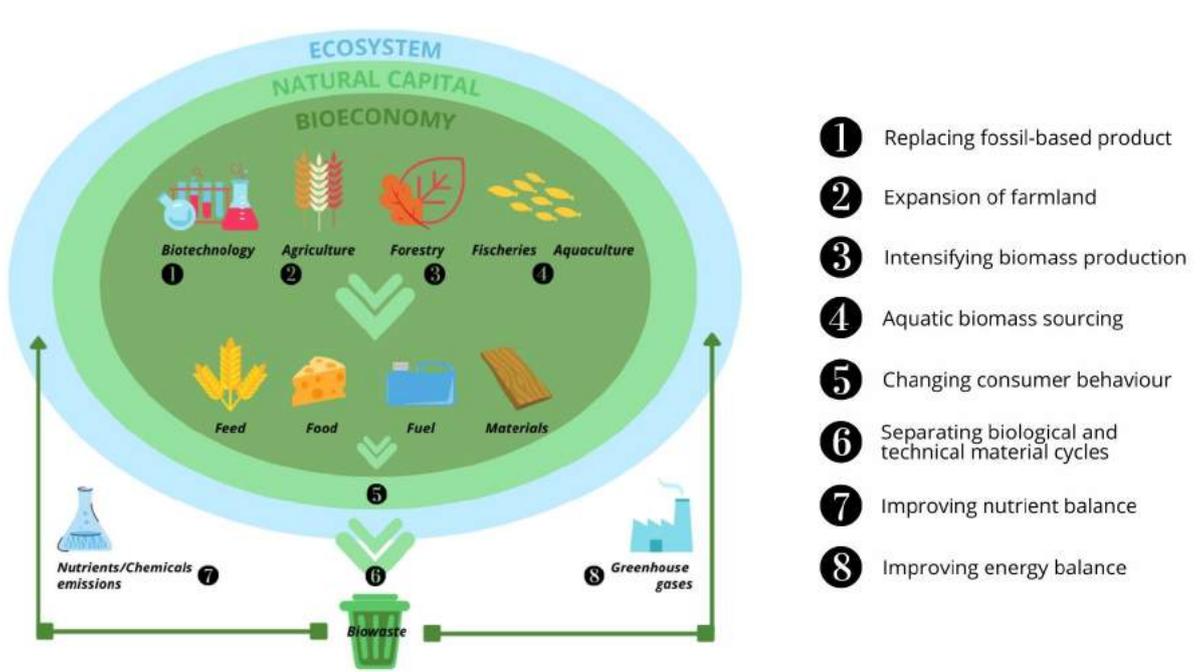


Img. 4
Biomaterial flows through the EU economy
(Gigatonnes per year, 2014) (EEA 2018)

Circular Economy Opportunities and Challenges from the new EU Policy Framework

Speaker: **Roberto Zoboli**
 Rector's Delegate for Scientific Research and Sustainability at Catholic University

Img. 5
 Pathways and good practices for fostering a circular bioeconomy



There is a clear policy signal toward this opportunity of giving value to virgin bioresources. His final message is to not burn value. The maximum value for virgin biomaterial, even residues, is the material circularity pathway, not in the energy pathways. And the integrated business models, for example, the biorefinery can optimize the opportunities.

AGRI-FOOD

A Circular Food System is Essential for our Future

REPORT RE-THINK, MILAN 2020

Towards a Circular Food System

Speaker: **Giovanni Colombo**

Senior Public Affairs Manager at EIT Food

EIT Food is one of the eight Knowledge and Innovation Communities created by the EU under the umbrella of the European Institute of Innovation and Technology, and is building an ecosystem to generate innovative solutions to make the food system more circular and bring these solutions to the market. The “Circular Food Systems” is one of its six Focus Areas. EIT Food, as Europe’s leading food initiative, is working to make the food system more sustainable, healthy and trusted. EIT Food works in synergy with Europe’s leading agri-food companies, research institutes, universities and startups to transform the food system and tackle some of the big societal challenges such as food waste.

In the EU, around 88 million tonnes of food waste are generated annually, which represents 20% of food production and it is estimated that this could feed 200 million people. The production and disposal of this food waste generates 170 million tonnes of CO₂ which accounts for 6% of greenhouse gas emissions of the European Union. The global cost is 870 billion euros. Today, the reduction of food waste is an opportunity because it could help to close the gap between the food needed to feed the planet in 2050 and the food that was available in 2010 by more than 20%. This has been recognized also by the UN SDGs target n° 12.3 which asks us to halve the food waste by 2030. In the European context, food waste covers food loss and food waste, and it occurs at all stages of the value chain. Even though in Europe food waste occurs mostly at the consumption level, synergic efforts should be addressing the problem of food waste at all stages of the value chain.

Colombo begins defining a “Circular Food System”, using the definition provided by the Ellen MacArthur Foundation: a circular economy for food consciously emulates the natural systems of regeneration so that waste does not exist, but is instead feedstock for another cycle. In such a system, resources can return to the soil in the form of organic fertilizer and some of the by-products that are regenerated can provide additional value before returning to nature.

Currently, the work of EIT Food contributes to the implementation of the three EU strategies: the Bioeconomy Strategy (2018), the Circular Economy Action Plan (2020) and the Farm to Fork Strategy (2020),

which takes for the first time an integrated approach to all the value chains from farm to fork and states the commitment of the Commission to reduce food waste by half by 2030. The action deployed towards a Circular Food System requires the respect of a hierarchy of different strategies to manage food surplus, by-products and waste:

- Prevention and reduction of surplus food at source;
- Redistribution and reprocessing of surplus food for human consumption;
- Use for animal feed;
- Disposal (waste sent to landfill, products going to sewer and waste incineration without energy recovery).

Innovative solutions can have a significant impact at all stages of the value chain from primary production to processing, distribution and consumption. It is also important to acknowledge that innovations that aims to deliver a sustainable circular food system must pass four key tests:

1. They must demonstrate the positive impact, which should be measured through a life cycle assessment;
2. They need to be economically viable, i.e. they must be supported by a clear business case;
3. They need to respect food and feed safety relations;
4. They need to be accepted and trusted by consumers.

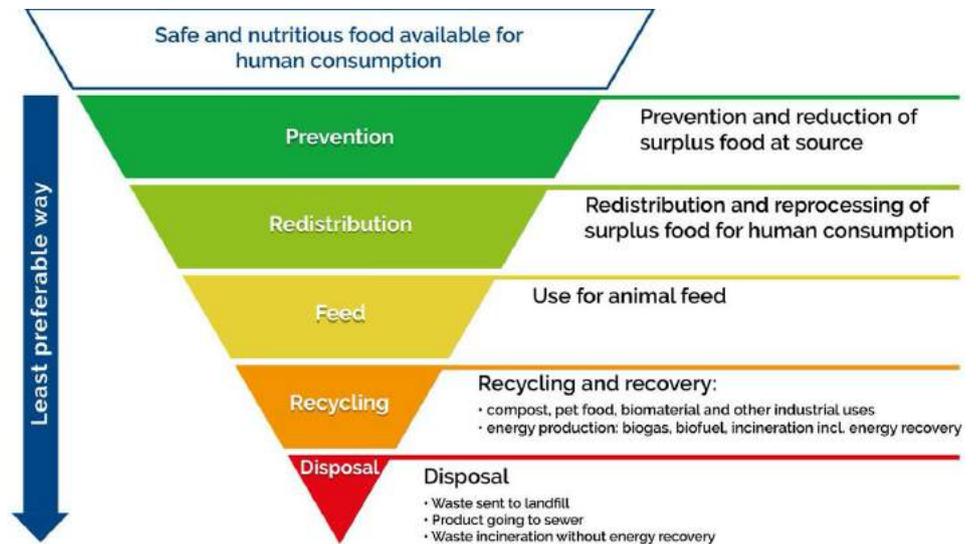
Finally, he gives a glance at some of the solutions that are under development and supported by the EIT ecosystem at different stages.

FiberGlob: This startup – selected and supported by EIT Food – is developing an organic peat replacement, made from an industrial pulpwood waste-stream, which can be used as a horticultural substrate for healthy food production. It will help growers produce quality plants using less peat while decreasing the environmental footprint of their activity, and simultaneously, promoting waste-flow recirculation within the Agri-food value chain. Growers are running out of peat which is extracted from northern Europe and it is not locally available due to the increasing distribution

Towards a Circular Food System

Speaker: **Giovanni Colombo**
Senior Public Affairs Manager at EIT Food

Img. 6
Adapted from Teigiserova et al. 2020, Papargyropoulou et al. 2014 and UNEP2014, in the European Commission's Knowledge Centre for Bioeconomy, "Brief on food waste in the European Union", 2020



REFRESH 2019

cost. As peat is a non-renewable raw-material and peat bogs are natural carbon sinks, its extraction is associated with environmental issues (increased in GHG emission and climate change). The Paris Agreement established that peat extraction will stop by 2050 and new licensing is prohibited. There is an urgent need to replace peat using a local by-product applying circular economy as a driving-force for global changes. The novel solution increases quality, productivity, and gradually reduces dependence on peat, facilitating the transition to sustainable horticultural practices.

Another example is the Swiss company **RethinkResource**, which developed, with the support of EIT Food, Circado, the first cross-industrial trading platform for industrial side streams. The goal of this project is to enable companies worldwide to easily identify candidate side streams for valorization to catalyze matchmaking between suppliers and buyers and to build a knowledge base to boost the circular bioeconomy.

Phenoliva is another interesting EIT Food project which

aims to develop an integrated waste management concept for the olive oil industry. Olive oil production, annually, generates more than 30 million m³ of olive mill waste, so most Mediterranean countries face serious environmental and economic problems handling this waste, which can be harmful to the environment and needs appropriate treatment before being disposed. In the Phenoliva project, olive antioxidants are extracted from olive pomace (residue from olive oil production) according to a novel process and the resulting extract is processed to an innovative food antioxidant. Besides antioxidants, the process generates pomace oil, biogas, irrigation water and biochar (full circularity).

Finally, **Orbisk** has developed a smart camera to be installed on the top of waste bins, in the horeca and food service sector, which automatically registers all food that is being thrown away up to the ingredient level. By using innovative technology and AI, Orbisk provides the food service industry with detailed insights into their food waste. This helps them reduce waste while optimizing their profit margin.

NeoruraleHub: Producer of the environment

Speaker: **Luca Pilenga**
 Chief Operating Officer at NeoruraleHub

Luca Pilenga re-emphasizes the need for a cultural switch in the farming approach which, according to him, should be promoted through incentives. As today incentives are considered subsidies, he starts clarifying the difference between the two concepts. Subsidies are provided to farmers to keep farming while incentives are used to promote the change, like new sustainable approaches.

He identifies sustainability as a key driver for the future of agriculture and in the development of large cities. Sustainability involves lot of aspects of our lives from the farming activities to the transformation of food, to the recovery of biological waste and all the innovation that is required. Large cities keep growing despite the Covid and 20% of the population will move from rural areas to urban cities centers by 2050. It is a massive transformation and it will also stress the contrast between the fast-growing cities and the degradation of the surrounding lands which are not capable of providing any services to the cities. The UN foresees that agricultural production, in order to keep up with the increment of the world population, will have to increase by 60% by 2050 while 33% of soils is already mid-to-highly degraded due to loss of fertility.

According to their experience, NeoruraleHub claims that this contrast can be overcome through an innovative cooperation within the cities and the suburbs. Through innovative technologies, techniques and know-how, NeoruraleHub system is capable to reduce the impact of human activities, especially in high-density population territories. Suburbs can be transformed in a resource for growing cities, which will require additional food, energy and place. There is also much importance in the water management and in the waste management, activities that cannot be done within the cities but need to be done around the cities. Starting by improving the efficiency of the food value chain, from Farm to Fork, NeoruraleHub helps creating valuable externalities in the areas where it implements its activities.

The result is a mix of reduced natural resources consumption (water, soil, energy, materials), CO2 sink, improved air, water soil and landscape increased quality. Following this concept, and with the support of the European subsidies, Neorurale develo-

ped an innovative project in Italy, transforming more than 1.700 hectares extended agricultural desert area around Milano, into a valuable provider of essential services (power, food, biodiversity, CO2 storage).

They created rivers, lakes, natural infrastructure that were there before human devastated the area. In just 20 years, the land has been able to recover from the damages caused by the industrialization of agriculture and restore the biodiversity of thousand years ago. They have been certified as the first agricultural company in Italy in biodiversity and they have increased soil fertility. According to Luca, this is something they have already tested in Italy and it is a huge approach change, something that can be exported as a way to do farming and to plan city development, creating a strong cooperation with all the stakeholders within and around the city. Another fundamental aspect of this sustainability model is its economical sustainability. For example, the biological waste produced by the city can be transformed into a fertilizer for the land where food is produced in a sustainable way and at the same time producing power and water management service for the city.

Through cultural innovation this experiment can spread around and become a normality. And we have to incentivize change to realize the sustainable transformation also from an economic point of view. For this reason, incentives should promote sustainable change also from the economical perspective.



Img. 7
 Neoruralehub Model - image by Neoruralehub

Food Waste & Sustainable packaging

Speaker: **Antonio Vaccari**

Head of Health, Safety and Environment (HSE) at Esselunga

Esselunga is a consolidated Italian food company, arising as a retailer and producer as well. The concepts of sustainability and circular economy are intrinsic in Esselunga's business model since the beginning. The sustainability strategy is founded on 5 pillars: clients, employees, suppliers, environment, suppliers and community. In the perspective of an environmentally-friendly action, its main macro scopes are minimizing CO2 emissions, sustainable packaging and waste reduction. A concrete application of this statement is, in the last 20 years, the elimination of secondary packaging by using 2 million of reusable and washable cases in internal circuit.

Antonio Vaccari, Head of Health, Safety and Environment (HSE) begins explaining the delicate balance between the issue of packaging and food, and Esselunga's efforts in managing this balance in everyday choices. He starts acknowledging that:

- In 2018, 20 million tons of plastic packaging have been produced in Europe;
- One third of food production is wasted.

The sustainable packaging strategy is aimed to reduce, recycle and replace plastic with other materials (paper) and to decrease the use of over-packaging. At the same time, Esselunga wants to ensure the quality of its products from the perspective of food security, barrier effect to oxygen for an appropriate shelf life and to reduce potential waste. By 2025, the Company seeks the 100% of Esselunga products packaging to be made of compostable, recyclable or recycled materials. Esselunga pursues this scope by involving its upstream suppliers and their downstream consumers, using a scientific approach, also supported by the Life Cycle Assessment (LCA) method, and, benefiting from a proprietary tool, Esselunga can do the everyday ecodesign and evaluate the impact of the packaging choices through indicators, like plastic and water consumption, CO2 emissions and circularity.

With the Esselunga FEVBIO Plastic free purpose project, launched in 2017, the company is committed to replace the packaging and the labels of fresh products from the Esselunga BIO Line with compostable materials. Consequently, decreasing the release of about 137 tons of plastic in the market every year and facilitating the recycling phase for the consumer, as

all the waste is organic waste. The restyling of packaging has been extended to other product lines as well, like Esselunga's eggs, by adopting a packaging made of wood pulp, which is entirely recyclable in paper waste.

An example of innovative re-design of packaging is the project concerning the Fresh Milk BIO. The packaging is the result of a good cooperation between Esselunga, packaging and milk suppliers. Through the LCA methodological approach, the environmental impact resulting from the reduction of CO2 emissions due to the replacement of packaging and the reduction of plastic consumption has been measured. Through this project, it is also possible to see the effort to make the consumer more conscious about the products he/she buys. Detailed information is provided on the front of pack about the packaging choices and, through a QR code, it is also possible to understand the method applied. This action resulted in the reduction of an additional 20 tons of plastic during 2019.



Img. 8

From Esselunga Sustainability Report 2019 - image by Esselunga

Another project with a significant impact on plastic reduction is the work done on all Esselunga private label water, by replacing them with new transparent bottles made of 50% of recycled plastic. With this action Esselunga reduces the amount of virgin PET placed on the market by 1,000 tons. In the perspective of a circular economy, and in partnership with the consortium Coripet, Esselunga provided some of its stores with eco compactors in order to encourage the waste collection. More than 525,000 bottles, equivalent to 12 tons of plastic, have been collected since late 2019.

Food Waste & Sustainable packaging

Speaker: **Antonio Vaccari**

Head of Health, Safety and Environment (HSE) at Esselunga

Another project, unique in Italy, has been developed in partnership with Fater, a company best known for the Pampers brand, and launched at the beginning of 2020. It involves the collection and recovery of used diapers, through the business unit Fater Smart that developed the world's first process for recycling used hygiene absorbent products, able to transform them back into materials such as cellulose and plastic, leading to the production of children's books and toys. Diapers are one of the most polluting wastes in the world, because they are not recyclable (until now). Esselunga and Pampers invited the city of Verona to collect used diapers using an APP and special bins in Esselunga stores.



Img. 9
The Pampers project - Fatersmart - image by Fater Smart

The diapers were taken to an innovative recycling plant where the cellulose was transformed into paper. Just in the first month, 250,000 diapers were collected and 5,000 books were printed and given to the families whom contributed to the collection and, in November, a playground was inaugurated in Verona. Through this project, since the beginning of 2020, more than 85,000 kg of diapers have been collected with a CO2 saving of more than 35,000 kg.

“To be safe is better than to be sorry” is the guiding principle of the strategy for waste reduction. As a

Img. 10
The collaboration with Banco Alimentare - image by Esselunga



food company, Esselunga has a total control over the production and the sale of the main products with the company label. In stores, it is possible to contain most of the waste by: making a punctual and effective planning of orders, based on a deep knowledge of customer's purchasing habits; the support of a re-ordering computer system. On the other side, in the production plants, it is possible to contain the surplus representing a potential waste through an effective planning of industrial processes and the valorisation of all ingredients and raw materials. Food surplus, such as unsold food, returns and food scraps, can be donated, used as animal feed or reused for energy.

Esselunga has also a well-established active partnership with Banco Alimentare: they fight food waste by donating the surpluses to needy people in a systematic and safe way, sharing their expertise. Esselunga, for example, offers training to the volunteers of Banco Alimentare; additionally, audits are carried out by technicians from Esselunga's Quality Assurance Department; this active, two-way partnership has allowed the two organizations to grow together. In 2019 they donated more than 1.700 tons of food, 42% more than the previous year, and the equivalent of 3,4 million meals. Through food donation they not only support needy people, but they also guarantee them a balanced diet.

While, Super Foodies is an educational project involving 2.549 children through more than 200 educational labs. Through these workshops the Company raised awareness about proper nutrition and provided accurate information about food storage, in order to promote a responsible consumption and reduce food waste. Within the scope of food waste reduction, Esselunga believes that consumers can actively contribute as well. So, through the website www.esselunga.it, Esselunga provides guidance from food and purchasing conscious choices to recycling.

Biopolymers, Materials Future: IUV case

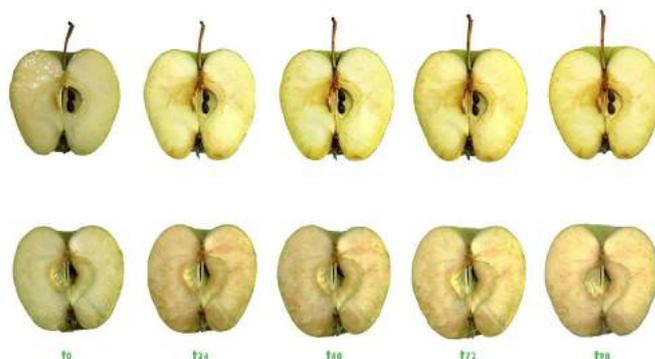
Speaker: **Cosimo Maria Palopoli**
CEO at IUV

Cosimo Palopoli begins his speech by introducing the structure of bioplastics that are molecules, able to self-assembly and to generate long chains: biopolymers. Biopolymers are 100% natural, mostly biodegradable, sustainable and able to show performance and unique properties. They can be biobased, i.e. of plant-animal origin, or alternatively they can be fossil-based, non-biodegradable resources. An example of the latter is plastic, which is man-made by industrial chemistry. The need connected by a search for bioplastics solutions, thanks to Ford, brings to the first car chassis made by soya. The goal? To reach a lighter and greener solution. A revolutionary discovery that soon, like the greatest revolutions, had to give way to the war leaving in this way plastic as the winner. However, during the late 80s researches on bioplastics biopolymers gained ground, explaining also the dangers connected.

IUV is an Italian startup found in 2019 working on the research, production and sales of sustainable and natural plastic-free packaging into the Fast-moving consumer goods (FMGC) sector. It is from the blend of bio-based materials and food by-products that they have managed a value proposition beyond the simple EN 13432 certification: edible, safe solutions, increasing shelf-life and offering wellness to new consumer experiences.

They have developed two main lines: the first one is Columbus Egg for food and the second one, Aegis, not for food products. For the Columbus Egg, they have developed a formula made from natural bio-based polymers, biodegradable-compostable in order to preserve or improve the freshness, stability, durability, appearance, taste, colour and fragrance of foods. The first is applied as a spray or as a liquid formula. The second one, Aegis, is a single disposal solution alternative to plastic applied to confectionery of dry products to improve the quality and the shelf life of the products. Aegis formula is made from bio-based natural biopolymers, biodegradable, compostable, designed to package non-food consumer goods, such as cosmesis, home care, people care and pharma. Due to the state of emergency, they have focused their business model on licensing agreement, even if their goal is to establish themselves as manufacturers.

Total Addressable Market (TAM) for food packaging is in the order of 7.7 billion euros.



Img. 11

Example of an apple degradation - image by IUV

IUV has consolidated a project idea in Technology Readiness Level 4 (TRL4) prototypes and patented both formula and process at the national level. Further to the successful analysis report IUV has filed a European patent application. They want to close for the next twelve months agreements policies with early adopters in order to be able to test the technology and thus advance to TRL8,9. Following the pilot phase, there will be the production and sale of the semi-finished products line, the starting of exclusive licenses with partners and the increase of the workforce, through revenues and investments, to ensure a more than proportional growth.

Due to the COVID emergency, they are reshaping the strategies of the IUV, trying to cover a wide range of sectors in Italy, especially overseas. They believe a first step to increasing capital can be achieved by planning a campaign of crowdfunding.

The Hidden Resources: How 10% of Estimated 2027 Global Food Shortage can be Covered by 1 Waste Stream

Speaker: **Karin Beukel**

Co-founder at Circular Food Technology

Karin Beukel begins by acknowledging the consequences of a linear food ecosystem, which is the result of a food system focused on the economy of scale and scope:

- **Food Loss:** 1/3 of all food produced is never consumed.
- **Hunger:** 820 million people suffer from hunger; 2 billion people are food insecure and 785 million people lack access to safe and clean water.
- **Malnutrition:** 13% of the adult population is obese. In 2017 obesity was the underlying cause for 8% of deaths.
- **Over consumption:** we are currently consuming at a rate where we would need more than 1,7 of the planet every year, and 22% of global CO2 emissions come from the food sector.

As a way to tackle these challenges, Circular Food Technology is following the path of up-cycled food. Ingredients that otherwise would have not gone to human consumption are procured and produced using verifiable supply chains, and have a positive impact on the environment. They believe this is the new market trend because recent market data shows:

- A growth of 20% in sustainable fast-moving consumer good sales (Nielsen, 2019)
- Up-cycled food market is 47 billion USD in the US market (Future Market Insights) 57% of customers aim to buy up-cycled food in the coming years (Mattson, 2019)
- Consumers are ready to pay more for up-cycled products than conventional products (Drexel Uni).

Circular Food Technology focuses on Brewer's spent grains (BSG) which are leftovers in the beer production. BSG are demolded and mashed grains used to brew. Every year more than 40 million tons of spent grains are discarded as waste and just 1 ton of BSG can be transformed into 200 kg of highly nutritional flour and 4 to 500 l of enriched liquid. Circular Food Technology's mission is to up-cycle lost food resources from the industry in order to create more food from existing resources and to provide nutritious and healthy food without compromising the culinary experience.

Their vision is to establish circular food economy:

- To limit hunger, malnutrition and lack of resources and clean water;
- To improve the climate impact of the wood and beverage industry

Their business model is built on three basic ground pillars:

- **Technology:** their patent pending processing and technology is a combination of deep industrial technology and hyper modern AI tools.
- **Innovation:** open innovation and collaboration is the DNA of Agrain. They build their business through partnerships with both academia and commercial partners.
- **Scalability:** they want to have a global outreach, across countries in different development stages.

They built a modular business model, from tech to the go-to-market, that can be scaled down to fit into local contexts.

Karin Beukel also shows how the value added comes through the different steps of up-cycling 1 ton of BSG. Discharging BSG as biomass has a value of 20€, when used as feed it has a value of 40€, after it has been processed into flour, the value increases to 800€ and when it is put into Ready To Eat (RTE) products it is 4.000 €. It is 100 times the value (from feed to RTE)



Img. 12

Brewer's Spent Grains - image by Circular Food Technology

The Hidden Resources: How 10% of Estimated 2027 Global Food Shortage can be Covered by 1 Waste Stream

Speaker: **Karin Beukel**

Co-founder at Circular Food Technology

and from just 1 ton of BSG it is possible to rescue 0,5 million kcal (40 kg of proteins and 110 Kg of dietary fiber).

So, it has a huge potential both economically and nutritionally. The main Agrain products in the Danish market are Agrain Super flour, Ready To Eat products and they are also launching Ready To Drink products. Their ambition is to set up 5 productions in 5 markets in 5 years.



Img. 13

Agrain products - image by Circular Food Technology

Circular Food Technology pushes this agenda in both developed countries, by marketing healthy and sustainable alternatives to on-market products, and also in developing countries by establishing local productions with local partners, to ensure better resource management and real local and global impact. They will build this business together with partners and they constantly scout the right ones to build this with.

The current business model is built on direct sales of

already existing products (RTE products and super grain flour) with a core customer value of sustainability, tasty and healthy food products. They offer to future partners a model for up-cycling BSG to a safe and versatile market, Ready To Eat ingredients through an innovative combination of complex technology processing and product market fit. This product offering also comes with service and support in terms of R&D, IP and brand name.

Through this model and partnerships across the world, they work for a sustainable future linking directly to the UN Developments Goals 2 (Zero Hunger), 6 (Clean Water and Sanitation), 12 (Responsible Consumption and Production), 13 (Climate Change) and 17 (Partnerships for the Goals).

She underlines the need to build a circular food system in the future with all stakeholders throughout the value chain. They need researchers for knowledge creation on up-cycled food. They need support from food manufacturers to commercialize up-cycled food and to support these new innovators in implementing up-cycled food ingredients into current products. Consumers should demand that up-cycled food will be put on the shelves and to spread the knowledge of up-cycled food and circular food in the future.

Also, Chefs and Kitchens can help with this by testing, learning and creating new innovative food products based on these ingredients. Then, policymakers need to build and implement a legislative framework that supports the up-cycled food industry. Investors must support and develop innovative start-ups worldwide.

She concludes by saying that BSG is only one waste stream and by up-cycling it, we can alone cover 10% of the estimated global calorie deficit in 2027.

From Food Waste to Product. Tales of the Circular Economy

Speaker: **Ivan Calimani**
Founder of Krill Design

Krill Design is a startup founded in October 2018 in Milan, focusing on the circular economy design and technology.

Ivan Calimani starts his speech by describing the current situation in terms of waste. Each year hundreds of millions of tons of organic materials are generated and 98% ends up in landfills incinerated and rotting in open dumpsters. European companies generate 88 million tons of waste per year, accounting for 20% of all European food production, which leads to an economic loss of 143 billion euros annually. Wasted food is estimated to generate around 3.3 million tons of CO₂ annually, representing about 8% of the global emission.

The food and beverage industry is looking for effective and sustainable solutions for waste recycling, pursuing the path of the Circular Economy. In fact, food waste could provide feedstock for high value products and help build a Circular Bioeconomy. New solutions, often, require a long trial phase of implementation and do not always turn out to be advantageous for companies.

Krill Design has developed a Circular Economy model that opens and closes within the same client, from waste to product, in just one service. Their solution is to transform homogeneous food waste, for instance peel, seeds and shells, into 100% biodegradable biopolymer. Using 3D printing, they realize new products useful to satisfy internal needs of the same company that generated the waste. Krill Design's distinctive feature is their end-to-end solution: they offer a tailor made solution from generating a sustainable raw material to creating the final product.

Their model develops along four phases:

- 1. Waste and regeneration phase:** all customer's waste is identified and examined through a technical analysis, in order to design the best formula and meet the material expectations.
- 2. Biopolymers production:** with the obtained formula it is possible to run biopolymers production, according to the quantity necessary to make the end product.
- 3. Product design:** working with clients, products are designed to best meet their internal needs. For example, to realize furnitures, gad-

gets, campaign prizes or components for their products internal process.

- 4. Product production:** through 3D printing technology it is possible to run, on-demand, local production of the product required by the client.



Img. 14
Was Orange Project - image by Krill Design

Then Ivan Calimani discussed a first example of their circular economy projects, the Was Orange Project for Autogrill, a leading global operator in food and beverage services for travelers. They requested to transform the tons of orange peel generated every morning for breakfast, into sugar bowls and seats to use in their stores. A Circular Economy project that reduces CO₂ emissions, produces sustainable furniture and creates great storytelling for their consumers.

An example of a local Circular Economy is the Co.ffee Era project, sponsored by the Municipality of Milan; it aims to create a network of bars and restaurants from which they take exhausting coffee grounds to create biopolymers for products they sell within the same bars and restaurants. However, during the last years, more and more companies requested to design and manufacture products outside the Circular Economy Projects but still using one of the biopolymers made from food waste they developed.

From Food Waste to Product. Tales of the Circular Economy

Speaker: **Ivan Calimani**
Founder of Krill Design



Img. 15
Co.ffee Era Project - image by Krill Design

Following the growing interest around the sustainable products they made, they plan to launch on the market some products designed specifically for the B2C market. They are now making lamps, chairs, vases and many other sustainable goods that will be soon available on the market.

Krill Design team is an enthusiastic group of established engineers, designers and bio-based material experts working to offer an effective solution for the food waste problem. In their two years of activity they attracted the interest of major companies and media, winning prestigious prizes and financing from Horizon 2020.

Innovating Towards a Circular Economy for Food...

Speaker: **Merijn Dols**

Global Director of Open Innovation & Circular Economy for Food at Danone

Merijn Dols is an activist for a positive food future, he focuses on the intersection of the Circular Economy framework and open innovation. He discusses the need of a culture of innovation, giving the priorities to jump start a transition.

The current food system has delivered many benefits, however, there are also many throwbacks. A report, that he co-authored with the Ellen MacArthur Foundation, shows that for every dollar of revenue generated in the food industry, society incurs in 2 dollars of cost. One in social cost, like healthcare, and one in ecosystem cost, like soil depletion. Hence, he affirms that the food system is broken, it is simply no longer fit for purpose.

Now, the Circular Economy is being adopted across the industries, we see benign chemistry as a key principle being applied in different fields. However, food is lagging. In food, many innovators are redirecting and re-converting by-products and waste into new products, and this is desperately needed. But he questions if these solutions are designed to solve the underlying systemic issue or they are simply optimizing the current broken system and potentially perpetuating the “doing less harm” system.

So, he proposes a shift to a new way of thinking where he would define the Circular Economy of food as a food system with positive, social, ecological and economic impact, by design. This shift requires an alternative paradigm to the current system, which is a linear take make dispose model, relying on a premise of infinite growth grounded in mechanistic thinking. In this paradigm we view the world as a machine. A key driver of the required infinite growth is efficiency, which means “doing more or the same with less”. This race for efficiency combined with the view of the world as a machine, in which we seek to maximize individual elements of the system, creates a very fragile system that is prone to shock. In favor of efficiency, all redundancies have been designed out, every element of the system has become highly specialized (monocropping), scales are being maximized (long supply chain) and stocks are being minimized (just-in-time delivery).

In contrast, the Circular Food Economy is a restorative economy by design.

It is analogous to nonlinear living systems. It is a complex adaptive system, which aims for a dynamic stability, achieved through effectiveness instead of efficiency. The Circular Economy aims to optimize the whole system rather than maximizing individual elements. And it works effectively at every scale making a resilient biodiversity. It brings, through its regenerative nature, the economy back to its primary function to provide social stability and keep society together, which the current economy is not doing.

To understand the role of innovation, we must look at how systems change. A mechanistic linear worldview leads to cause-effect thinking, relying on for example, intra and extrapolation. In innovation, that translates into an innovation board or committee taking the key projects and innovations. And this is systemic from a belief that we can predict which innovations have the biggest chances to succeed. Looking at this from a complex adaptive system perspective, this is ludicrous because complex adaptive systems, like nature, change through emergence and adapt without a central organizing agent, without a management of control they have the ability to self-organize. Just as mutation is the adaptive power of mankind, innovation is the adaptive power of the food system, so no one can predict which innovation or experiment will succeed. Experiments, mutations in humans or innovation in the food system, simply can have one of two things: negative feedback loop, which triggers a correction and means that it dies out; or positive feedback loop, leading to a divergent behavior which means the system starts to snowball.

According to him it is a positive realization because it means that everyone can change the system simply by starting to experiment. However, a shift in our culture and structure is needed. Firstly, we need to embrace and even celebrate risk, not just success, in order to be bold and try the impossible. Secondly, we need to be more open and work together in the spirit of reciprocity. We must move away from a transactional mindset and become like a nodal point in the network. This stems from the fact that innovation occurs through the serendipitous collision of seemingly unrelated ideas.

Innovating Towards a Circular Economy for Food...

Speaker: **Merijn Dols**

Global Director of Open Innovation & Circular Economy for Food at Danone



Img. 16

Agricultural field - image by Danone

To spread innovation, we need as many ideas to connect and collide as possible, from a diverse range of places, industries, geographies and advantage points as possible. To have ideas come from unexpected angles, we need to be connected to as many different places and people as possible. Thus, we need to become porous. This culture of innovation comes naturally to innovators and entrepreneurs, but it can be challenging for big historically more self-reliant organizations.

To jumpstart that transition to a Circular Food System and a culture of innovation, he focuses on four things: common language, metrics, design principles and iconic examples. Firstly, today there is no one agreed upon **definition or taxonomy** for the circular economy of food. As circularity is starting to spread, a common language is becoming ever more important. It is essential to ensure that we can leverage this collective power to innovate and experiment, and at the same time safeguarding the essence and impact of the concept, avoiding that the circular economy becomes just another buzzword.

At the AI for Good Global Summit, Danone announced that they have partnered with XPrize in order to develop a circular economy-based framework for a series of challenges to help meet the SDGs. Secondly, **metrics**, as the Circular Economy is a complex adaptive system and boundaries within such a system, are arbitrary. If we are focusing only on one or two indicators like CO₂ and water consumption, we might have perverse and disrupting effects on indicators we have not looked at, like biodiversity or laborism. Therefore, we need an accessible and comprehensive set of metrics that measures social and ecological impact over food. Within this scope, Danone has partnered with HowGood, a startup from Brooklyn, in the development of an impact assessment tool for product development, which is called Latis.

As experimentation is the adaptive power of the system and everyone has the possibility to start experimenting; his third priority is to jump start a **circular design guide for food**, a set of simple principles that will allow to leverage the passion and power of all those developing food, from a large CPG to a small venture, to start generating as many innovation and experiments as possible, to maximize the chances of shaping the future of the system. In this case, Danone is working with the Ellen MacArthur Foundation to explore and develop such design principles and capture them in the design guide. And finally, as the circular economy is a difficult concept to grasp, iconic examples are useful to make the circular economy tangible and they are lagging in food. For this reason, with like-minded companies and NGOs, the company has partnered with Thought For Food and launched the first ever Circular Economy of Food Challenge, which brought over 2.000 submissions from 175 countries together.

Summing up, the circular economy of food requires a shift of paradigm, from a mechanistic to a complex adaptive view; we therefore must redefine the goals of the system and innovation is the adaptive power of this system; then, the biggest leverage point to catalyze a system level shift is at a very intersection of these two: at the intersection of division, the goal of the system, and the catalyst for change, innovation.

However, no one can do this alone. If we want to maximize the chances of successfully changing the system and realizing the vision for a positive food future, we must maximize the number of serendipitous conditions of seemingly unrelated ideas. For which, we must embrace a culture of innovation, adopt a reciprocal mindset and become a porous nodal point in the network. In order to jump start that, he focuses on common language, metrics, design principles and iconic examples.

The Use of Sensor Technology in Circular Agriculture

Speaker **Christy Van Beek**
Chief Agronomist at AgroCares

Talking about shifting from linear to circular agriculture means to move from a linear system of disposal and incineration to a circular system, which implies a higher use of renewables.

Christy Van Beek, in her talk, focuses on agriculture. Looking at the agricultural system, circularity is often seen as circularity of soil, plant, animal and manure. So, plants take the nutrition from soil, they are converted into biomass, which is consumed by animals, who produce manure, the manure is applied to soil and so on. That, in a sense, is a circular system. However, during each step there are losses, making the system not sufficiently circular. Trying to improve that system means to know whether these flows are properly measured, it means to check flows and balances at every production step. In this perspective, Sensor technology can help to monitor circularity in production.

AgroCares develops innovations to determine carbon and nutrient contents in organic products on the spot within a few minutes. With the AgroCare Scanner it is possible to measure the flows and status of the soil, the plants, the animals and the manure. So, in every step in the circular system there is a check-in balance in place. Their technology includes all the four components in one operational system: innovative sensor technology, intelligent learning global databases, algorithms and machine learning and expert applications.

Firstly, it is necessary to have a sensor that is robust and easy to use. The sensor itself measures a spectral image, which does not tell directly about nutrient and carbon contents in losses. For that, you need databases and then algorithms to convert these database readings into the desired data. The databases are the core of their organization, as they contain 17.000 samples which, in their reference laboratory, are analyzed for spectral signals, recording the right chemistry.

Then, there are algorithms to convert the data set readings into nutrient data, which are interpreted in expert applications, in order to report this information to the user. AgroCares has developed apps for different services and needs. For the circular agricultural system they are developing apps to determine nutrient and carbon contents in soil, in leaves and

in manure, in order to cover the entire system. They have also launched the Carbon monitor application, designed to determine carbon contents on the spot. They introduced the first scanner in 2017, in Kenya, and currently, they have a network of scanners all over the world. They are active in 25 countries and all these organizations collect data that helps to better define and monitor what is happening and to what extent it is circular.

It is a fully digital solution to monitor the flows of carbon and nutrients in the Circular Economy. It helps to measure, and thereby to manage, the production system.



Img. 17
AgroCares product - image by AgroCares

The Circular and Bio-Economy in the EU Wine Sector

Speaker: **Miguel Cachao**
Agronomic Engineer at AVIPE

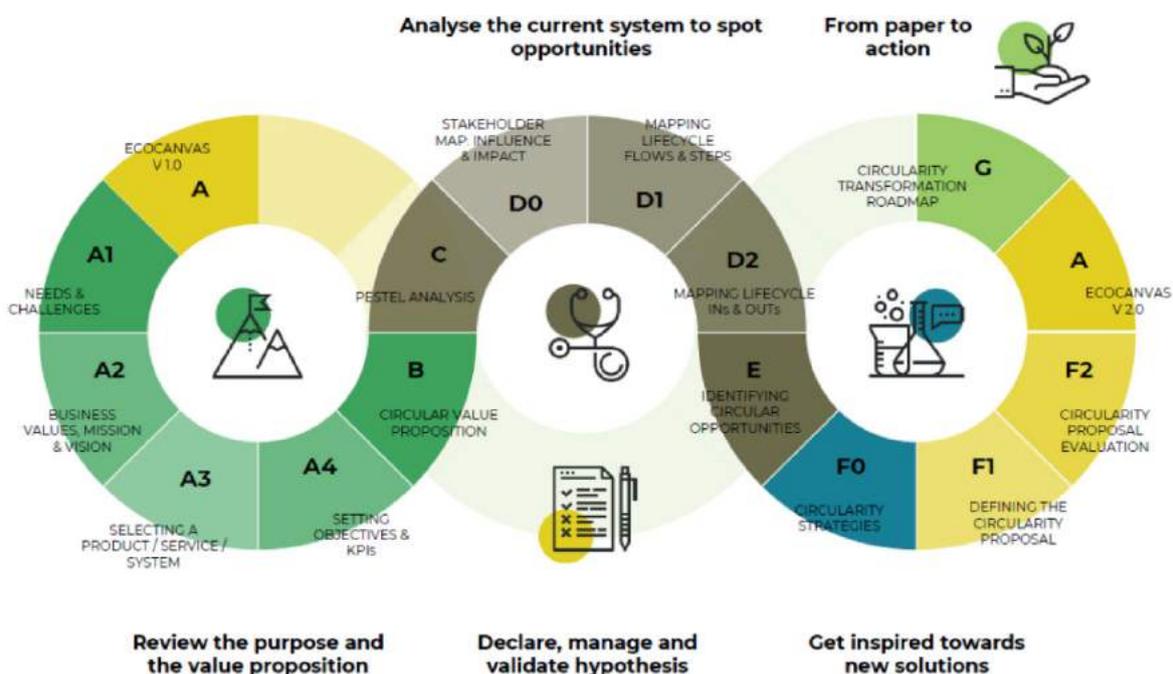
AVIPE is a farmers' association located in Pamela, Portugal. They mainly work with grapevines, vineyards and vines, covering about 4.000 hectares. Mostly, they provide technical assistance: from pests to business management, irrigation, nutrition and industrial investment projects for farmers. They also have a role in education. In the last couple of years, they have been involved in different R&D European projects. One of these is Embrace, an Interreg Med project about the application of the Circular Economy. By using an easy and intuitive tool to build a circular economy business model (CEBM), this project aims to find, develop and establish new ways to add value to wastes from wineries and vineyards. This will allow and help them to create an ecocanvas.

Miguel Cachao starts identifying the waste in the wine sector, focusing on pruning residues, stalks, grape pomace and wine lees. Regarding the pruning residues, there are some technical issues due to the difficulty pruning activity. It is a hard task to do with machines, besides, they only allow to collect a smart part of pruning residues. So, manual pruning has bigger residues and you can collect them, but it is more expensive. With the Embrace project, they want to understand how, these residues can become more valuable for farmers.

Farmers know that they can deploy organic material in the soils incrementing its quality over time. But giving better destinations to these residues can bring more income for farmers. Looking at the map, it is possible to know the valorization of the residues and where we can make them valorize.

There is energetic valorization, fertilizer, feedstock, human food, cosmetics, pharmaceutical and some winery practices. With this map, they try to contact some companies in Portugal to see if these residues can be interesting for them. For example, regarding the pellets, there are some companies trying to develop solutions for home usage, for district heating or for municipality buildings like libraries or swimming pools that can use this pellet to produce energy. As well as the biogas, there are already some solutions available in the market and that can be used on farm to produce electricity. There are also some cosmetics using phenolic compounds in their products.

They have also developed a small project with an academia, in order to use these residues for algae production. After being processed, this algae can be used as animal feed for goats and sheep, as it has a high content of proteins and it can substitute corn or soya in their nutrition.



Img. 18
AVIPE method - image by AVIPE

Growing Vertically: One of the Answers for the Future

Speaker: Paolo Forattini
Co-Founder of Local Green

Paolo Forattini begins his speech underlining the definition of agriculture. Local Green is a startup that created a new vertical farming system to increase the profitability of vertical farming, increase productivity and decrease costs.

People now tend to connect agriculture with nature and this is a big mistake. Agriculture today represents 70% of water global consumption, uses massively pesticides and fertilizers, and many crops are genetically modified. Now farms grow outdoors in large fields with low productivity and up to 50% of the food produced does not reach the consumer. The reason is pretty simple: the value chain and supply chain of agriculture are extremely long; there are many kilometers, many players and this reduces nutrients, quality of food and lots of food go wasted.

Then Paolo showed where fruit and vegetable production is located today. The places are just a few for climatic reasons. Mediterranean climate is the perfect one; in this environment crops grow 5 times up ten times the products you can grow outside this area. This is really bad for the environment and for the food logistic system.

For example, Asia is an area of 4 billion people that need to be fed with fruit and vegetables carried by US, Europe, Australia, Chile and this can make the food quality lower.

The next challenges for the future are: the expected population is going to reach 10 billion, urbanization level will increase to 68%. These data tell us that we need to increase food production by 70%. To give an idea on how this percentage is huge Paolo says that 70% means we'll need to grow more food in the next 40 years than we have done in the last 10 000 years. In order to do this, agritech will play an important role and will make the difference.

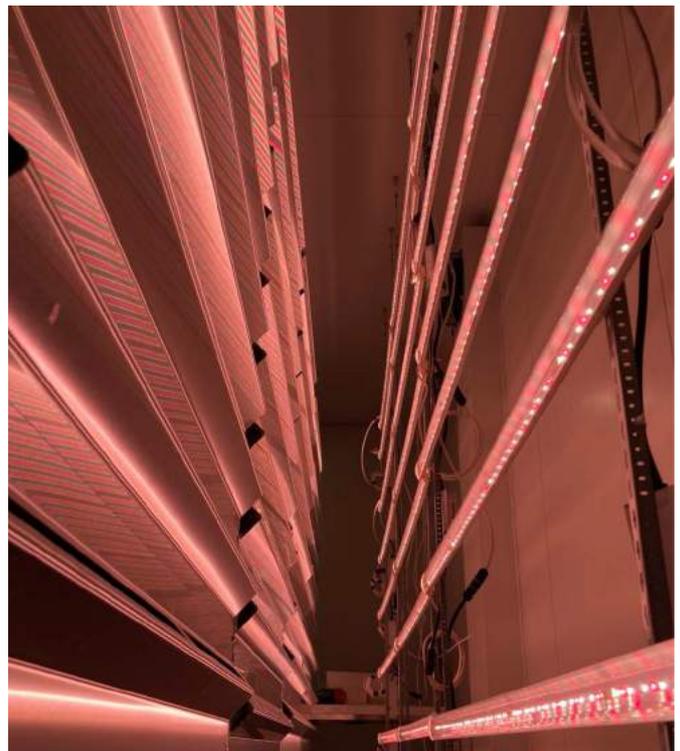
So vertical farming is part of the solution because it allows to bring the farm "inside", it protects the crops and increases productivity. In addition with vertical farming it is possible to grow and distribute locally and don't care about the weather with constant quantity and quality. The productivity for this technique is 300 higher than productivity in open fields. Also the water consumption is reduced by about 95% compa-

red to water consumption on arable land. Moreover, zero pesticides and 95% less fertilizers are used when you grow vertically.

Vertical farming has not taken over yet for many reasons: air circulation problems, it is extremely labor intensive, the system tends to clog and logistics is very often poorly implemented. To tackle vertical farming limits they created local farm, a new design vertical farm, able to produce + 48% plants/m³, -75% labour need, and it needs only 25% of capital thanks to a new design in house system.

Local Farm improved air circulation thanks to the vertical design, automated just what was necessary in order to reduce labor needs, redesigned irrigation system to withstand clogging. Last they used just one spot where the product is harvested and transplanted. They believe a vertical farmer should always bring the food to the people and not the contrary.

Afterwards, Paolo showed their prototype, co-founded by Neorurale Hub. Tons of data can be collected because every parameter is controlled (CO₂, nutrients level, water, irrigation).



Img. 19
Example of Vertical Farming production - Image by Local Green

Growing vertically: one of the answers for the future

Speaker: **Paolo Forattini**
Co-Founder of Local Green

The idea they are testing now is to go to the market with their product. The reason why is they want to test their technology in-house. These systems are quite expensive and need to be tested in depth and they want to do these tests in-house in order to have more control on every action.

For the future Local Green aims to become a technology provider for different players that want to produce indoors. Consumers also validate this solution. As a matter of fact, 60% of customers consider eating local products important, 62% believe that it is important to buy sustainable products and 59% do not consider the price a key driver in product choice.



Img. 20
Example of Vertical Farming - image by Local Green

Rewinding Used Cooking Oil into Bio-Based Materials

Speaker: **Antonino Biundo**
CEO at REWOW srl

Antonino Biundo starts his speech describing Used Cooking Oil (UCO) which derives from vegetable oils used for food cooking, processing, and storage. They are also highly polluting for the environment: only 1 liter of UCO may pollute up to 1 million liters of water. In Europe, 4 million tons of UCO is generated per year, but only 5% is collected. In Italy, 64% of UCO comes from households and only 20% is collected, which is mostly used to produce biofuels with a low value on the market.

At Rewow, they create a second life for used cooking oils and, at the same time, they want to raise awareness to triple the collection of this waste. To achieve this, in July 2020, they filed the patent on the Chemo-Enzymatic Process to produce innovative Aliphatic Polyesters and thus increment the added value of UCO.

The market of bioplastics is constantly growing, and it is expected to reach 28 billion dollars by 2026. The other producers of bioplastics produce their products with either synthetic or biological processes. However, biological processes are more expensive, especially for the significant downstream processing costs for their technology. The Rewow materials are produced synthetically from waste, but they have similar characteristics to the biologically produced ones, especially for the hydrolysis and flexibility. Moreover, Rewow, together with other few companies, is planning and making awareness raising campaigns.

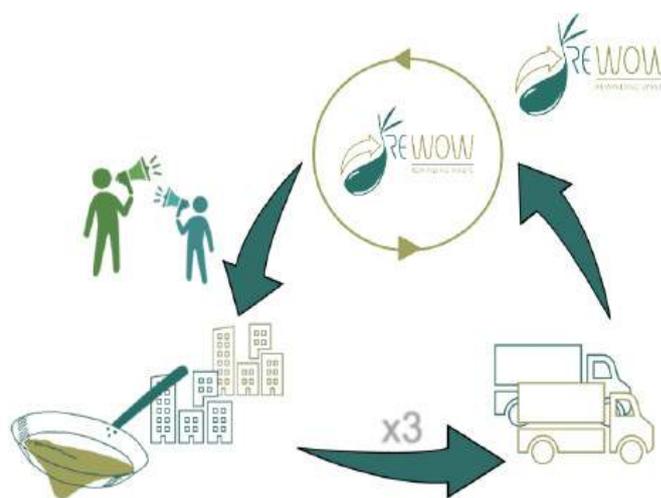
Rewow wants to be a solution to produce sustainable bio-based polymers for different value chains. They start taking the UCO collected from their industrial partners, like Eco trend, a collector and regenerator of UCO.

Eco Trend is also part of CONOE, the national consortium of the collectors and regenerators of UCO. So, they transform the collected waste into their products for different value chains. These products can go to different markets, especially, consumer goods, food packaging and cosmesis. With the analysis of their financials, they figured out that already from the first year of life of their venture, they will be able to get some revenues, even though very small. With further analysis and activities on research and development, they can reach the breakeven point after the

second year of life.

With this aim, they are also looking for different funding: for a pre-seed round, to produce the minimum viable product; for the seed round, to scale-up the solution; for the venture round, for the Semi-industrial plant. They are also building a network that goes from the academic sector, especially with the University of Bari, to the industrial sector, like Eco Trend, and national consortia, like ANBI and CONOE.

Antonino Biundo holds a Ph.D. in Biotechnology from the University of Natural Resources and Life Sciences of Vienna. He worked on the biodegradation of plastics and the synthesis of bioplastics. The idea of Rewow was born in Stockholm, during his first Post Doc. But he decided to move back to Italy and bring value also to his country. So, in December 2019, he moved to Bari, where he built the core team of the company. Also, advisors from the academic and industrial sectors are part of it.

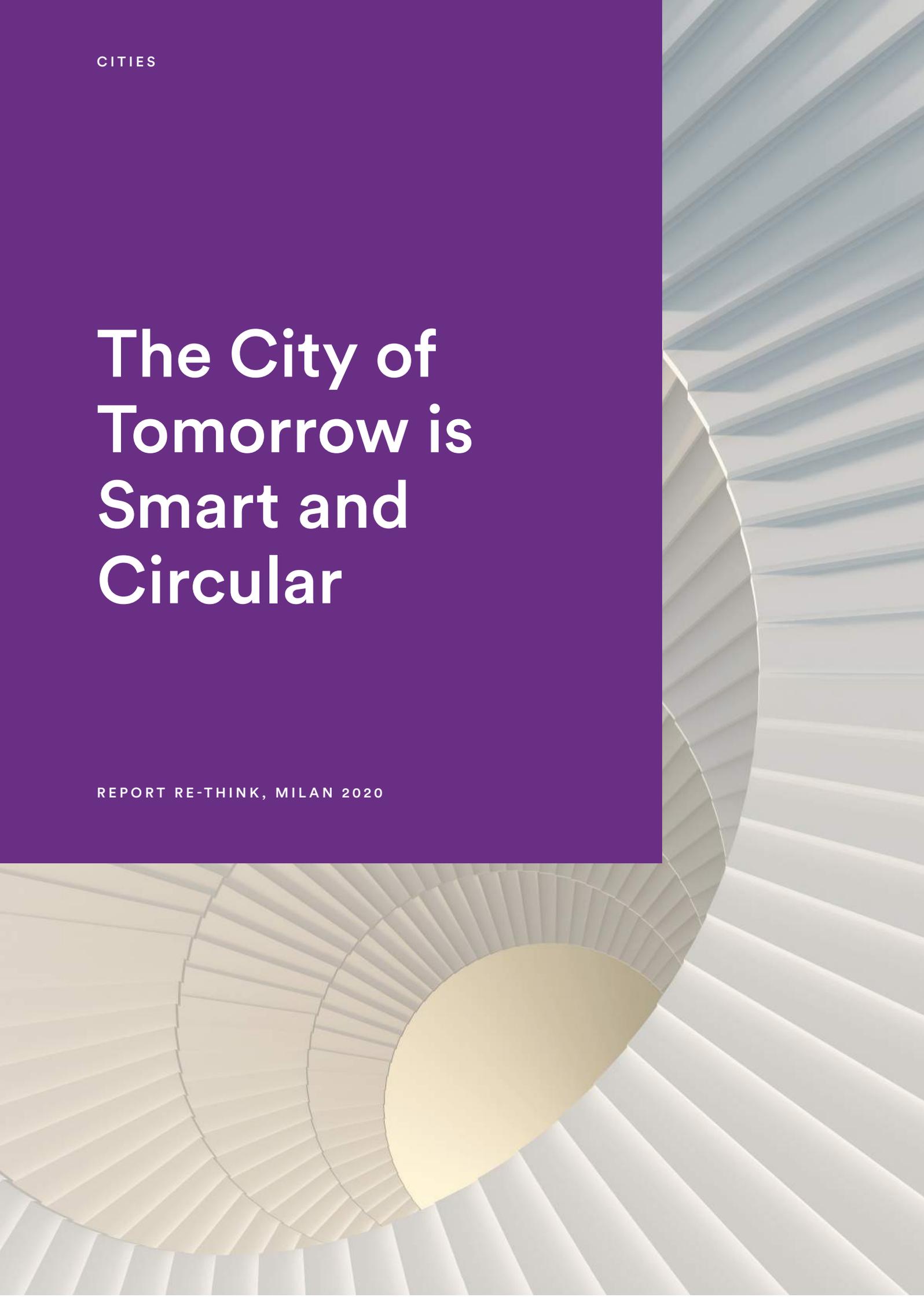


Img. 21
Rewow process - image by Rewow

CITIES

The City of Tomorrow is Smart and Circular

REPORT RE-THINK, MILAN 2020



Sustainable Development and Circular Economy: the new Paradigm for the European Union

Speaker: **Enrico Giovannini**

Founder and Director of the Italian Alliance for Sustainable Development (ASviS)

Enrico Giovannini begins his speech recognizing the Circular Economy as the key point of rethinking the economic and social model. He believes that, currently, the concept of circularity is mainly used in reference to material stuff and there is a limited thinking about the need to “recycle” also people. Consequently, without reinvesting continuously in people, they are most likely to be treated as “social waste” (Pope Francis). Having a large part of the population feeling like waste, will not ensure the social and institutional dimensions of sustainability.

The current Covid-19 crisis clarifies that if people feel to be excluded from the social and economic processes, institutions are at risk of instability, as people will be pushing for radical changes in the status quo, i.e. a revolution. The “Arab Springs” are an example of this: started as an environmental problem, then transformed into an economic and social crisis, ended with an institutional instability and a revolution. Also, migration is an indicator of how people who are treated as “social waste” try to recycle themselves moving somewhere else.

He reminds that the economy, society, environment and institutions need to be fully integrated in a vision of sustainable development according to the 2030 Agenda and the 17 Sustainable Development Goals.

In 2019, the ILO Global Commission on the Future of Work published a report discussing how, in business accounting, workers and their training are accounted for as a cost, like intermediate materials or raw materials, which reduce the company’s profit. According to him, this perspective does not support a circular economy model augmented to people.

Then, he focuses on how the European Commission interpreted the 2030 Agenda, establishing it as the core element of all European policies. According to that choice, during the last year, the European Commission put forward several proposals touching different domains of the 2030 Agenda and the circular economy is one of the paradigms adopted in all sectoral policies.

To pursue the transition towards sustainability, it is fundamental to invest in technologies that will help in recycling materials, minimizing the impact on the

consumption of natural resources.

However, in Europe, there are several iconic examples showing that investing in the Circular Economy allows to reduce the overall cost of production despite the need to recruit more people, with positive results on employment rates, companies’ profits and the environment. For companies going in this direction, the division in charge of sustainability and innovation is more and more put close to the CEO, as they have assumed a strategic function for the overall company.

Furthermore, with the rethinking of the global value chains due to Covid-19 and the possible reshoring of some activities, he underlines the need of a political change in the perspective of a regional globalization. The European decision to use sustainable development as the overarching framework of all its policies could lead to the development of a new phase of capitalism.

Instead of just coping with what the Anglo-Saxon tradition has developed over decades, now Europe has the possibility to develop its own model and eventually export it to other parts of the world. So, this is mainly a ‘paradigm shift’ problem and this is why we need more iconic examples of choice for sustainability at national, European and world level. He concludes giving three important messages about the important role of **cities, universities and governments** in this transition.

Cities are the most dynamic component of our societies and they play both crucial cultural and economic-political roles in pushing communities to adopt the Circular Economy perspective.

ASviS, in a report published in October and in one of their position papers on the occasion of the Festival of Sustainable development, focuses on the role of cities and food strategies in order to minimize the waste of food, but also to convey the cultural message to the entire population that recycling is not only convenient but possible if it is organized by the public hand.

Secondly, in Italy ASviS promoted the establishment of the Italian University Network for Sustainable Development (RUS), fostering the collaboration of universities with public bodies as well as with public and

Sustainable Development and Circular Economy: the new Paradigm for the European Union

Speaker: Enrico Giovannini

Founder and Director of the Italian Alliance for Sustainable Development (ASviS)

Img. 22
The 2030 Agenda for Sustainable Development



private businesses, in order to join forces and achieve RUS' goals regarding the Third Mission of the University. They are also engaged in developing a multidisciplinary approach in tertiary education programs.

At last, Europe needs strong leadership. Notwithstanding the pressure made by the Commission, the final decisions are made by governments, but some European countries are not yet at the level of preparation and willingness to make the jump towards this new paradigm. Governments need to be able to effectively coordinate the actions taken under the European and national funds.

Finally, ASviS has launched its second e-learning course dedicated to companies, especially small companies, on the Circular Economy, sustainable development and sustainable finance.

It is fundamental to extend the non-financial reporting also to small companies, obliging them to measure the economic, social and environmental impact of their actions. In addition, large cities and institutions should adopt the same approach to monitor the progress towards the circular economy, in order to ensure their actions are going in the right direction.

Circular Milan

Speaker: **Lucia Scopelliti**

Head of Unit Economic Development at Municipality of Milan

Lucia Scopelliti explains the actions undertaken by the city of Milan with the aim to transform the production and consumption flows from linear to circular. Experiences on the circular economy at city level show that cities have an active role as promoters, as facilitators and enablers. Cities can act as promoters on circular economy strategies, but they are also facilitators connecting stakeholders operating along all the value chain, that are not necessarily used to collaborate with each other. Finally, cities are also key enablers since they provide the conditions for the circular economy to happen, setting up incentives, infrastructures and mobilizing funds. As cities play a big role in public investment and procurement, sub-national governments account for 60% of public investments in OECD countries.

Cities have the chance to consider green infrastructures, nature-based solutions and zero energy options whenever it is possible. Cities are also laboratories for innovation that generate social and environmental benefits. Most importantly, they play a key role in the circular economy, given the responsibilities for local public services: transports, solid waste, water and energy. In this sense, cities can really contribute to the circular approach, by developing a forward-looking vision promoting synergies across all these sectors. The city has taken a majorly forward on the circularity front, by joining several international organizations. For example, the Circular Economy 100 led by the Ellen MacArthur Foundation, which also includes, for instance, the cities of Toronto and London, leading Silicon Valley companies (Apple, Google) and high-profile European businesses as well (Ikea, Tetra Pak).

Milan was welcomed to this program because of three still ongoing efforts. Firstly, the results achieved against food waste and the city's commitment to create shorter food chains according to the city Food Policy. Secondly, the city's initiatives to increase awareness on sustainability in the fields of fashion and design, which are both key trends of Milan's economy. Thirdly, the Resilience Strategy adopted by the City of Milan and pursued in the context of the 100 Resilient Cities network. The Municipality of Milan has set some key and concrete target points related to the SDGs and where the Circular Economy is a relevant part.

One of the city's goals is the reduction of greenhouse gas emissions of 45% by 2030. The City of Milan also wants to improve the separate waste collection performance, currently it is about 66% but it aims to reach 75% of waste recycling by 2030. Moreover, the "Advancing towards zero waste declaration" aims to reduce the generation of solid waste per capita by at least 15% and the amount of waste disposal incineration by at least 50%, by 2030. They have also set targets related to the use of sharing mobility services and the reduction of soil/oil consumption, another critical issue for cities nowadays.

They have tried to frame their most important projects related to the circular economy, considering them from two perspectives. The first is to be read in terms of public instruments that can vary in terms of intensity of raising policy awareness, tax and fiscal incentives, grants, space concessions and European funds. The second reading can be done in terms of food, waste, and energy. These metrics have been done in order to understand which were the most critical areas for the City of Milan.

The city focuses on aspects that are peculiar to its economy, such as fashion, design and creativity. After the EXPO 2015, also food became a new economic driver and it entered the public agenda recognizing and promoting the right to food.

In this perspective, EXPO 2015 appointed Milan as an International Food Capital and has made possible to attract and aggregate public and private initiatives in the agri-food sector. So, food for Milan is not just an output of productive activities as it is also considered from other perspectives like design, tech innovation, education and awareness.

Among these initiatives, Milan Food Policy represents a crucial step, setting guidelines based on the principles of sustainability and social justice. Under this umbrella policy, different types of initiatives are framed and supported with a special attention towards the reduction of food waste. As a matter of fact, the city has opened the 2nd hub against food waste, that will help collecting 60 tons of food per year, the equivalent of 200.000 meals per day, and it will allow to fight social inequalities by redistributing food among those in need.

Circular Milan

Speaker: **Lucia Scopelliti**

Head of Unit Economic development at Municipality of Milan

Furthermore, she mentions two European funded programs dedicated to the circular economy: OpenAgri and REFLOW.

“OpenAgri: New skills for new Jobs in Peri-urban Agriculture” is a project belonging to the Urban Innovative Action (UIA). On one hand, the project aims at experimenting with innovative ways to reconnect the urban and rural areas of the city; on the other hand, it will work on developing new skills and competencies to bring innovation in peri-urban agriculture. OpenAgri has two main objectives: the refurbish of a former farmstead (Cascina Nosedo) and the regeneration of 30 hectares of public agricultural land for experiments involving NGOs, companies and citizens. The idea is to develop a project that covers a larger area than a farmstead alone, setting up laboratories for Agri-ecology and water recycling. According to this vision, Cascina Nosedo could become a circularity lab fostering the incubation of circular businesses and the R&D of new techniques for water recycling.

“REFLOW: Milan Pilot City” is a project funded under the HORIZON 2020 program. In partnership with the Politecnico of Milan and three FabLabs (Polifactory, WeMake and OpenDot) and the goal is to realize a circular agri-food project connecting peri-urban agricultural activities to municipal covered markets, by developing different circular and tech solutions for

sustainable food logistics and smart food transformation, distribution and conservation processes.

She concludes sharing what they have learned from their experience, that the Circular Economy represents a great opportunity for cities. There are different sectors where, for public administration, it is urgent to take action and food, for e.g., is an emerging multidimensional policy challenge, ecological, social, economic and spatial as well. In these sectors, the circular economy allows multidimensional outcomes.

For example, reducing food waste means, for a city, developing its environmental, economic and social resilience. Moreover, building circular production and consumption models can have a significant impact on the territory in terms of urban regeneration.

And finally, for cities, the circular economy can be a driver for the development of new skills, jobs and technology. They have particularly experienced this in the agri-food sector, but it applies also to other sectors.



Img. 23

A picture of Porta Garibaldi area in Milan. An area which has been totally transformed in the last years - image by the Municipality of Milan

The Netherlands Circular Strategy: Let's make the Circular Shift together!

Speaker: **Johan O. Verboom**

Consul General in Milan for the Kingdom of the Netherlands

Johan Verboom introduces how the Netherlands is consolidating its position as a pioneer in the circular economy, promoting initiatives and investments in incubators and innovative startups.

The circular economy transition is assuming even more importance due to the Covid-19 situation and the European Union is the most active organization supporting this transition (Circular Economy Package, European Action Plan for the Circular Economy, Green Deal).

In this context, the UN 2030 Agenda for Sustainable Development and the Paris Climate Agreement form an important framework considering, at a policy level, the Circular Economy as one of the solutions for environmental problems, which represents an important economic opportunity as well. The EU expects the transition to the circular economy to boost economic growth by € 550 billion and to create 2 million jobs. McKinsey expects a net economic benefit for Europe by € 1.8 trillion by 2030.

Within this European framework, the Netherlands has also set ambitious goals: by 2030, they aim to halve the consumption of raw materials and by 2050, they aim to have a fully circular society. In order to pursue these goals, the Dutch Government has prepared a program for a circular economy setting 3 main targets. Firstly, they want to produce more efficiently, decreasing like this the use of raw materials.

Secondly, they want to use more sustainably produced renewable raw materials like biomass, making the Netherlands less dependent on fossil fuels as well. Thirdly, they want to implement more sustainable and circular production methods.



Img. 25

© Stills from the presentation by the Dutch Consulate General



In this perspective, the Netherlands has also established a specific agenda for 5 industry sectors, which are relevant for the national economy and have a significant environmental impact: biomass and food, plastics, manufacturing, real estates and construction and, finally, consumer goods.

Further, the Dutch government is amending legislation that stands in the way of the circular economy transition. All public authorities in the Netherlands must strive for the reduction of carbon emissions



Img. 24

© Stills from the presentation by the Dutch Consulate General



The Netherlands Circular Strategy: Let's make the Circular Shift together!

Speaker: **Johan O. Verboom**

Consul General in Milan for the Kingdom of the Netherlands

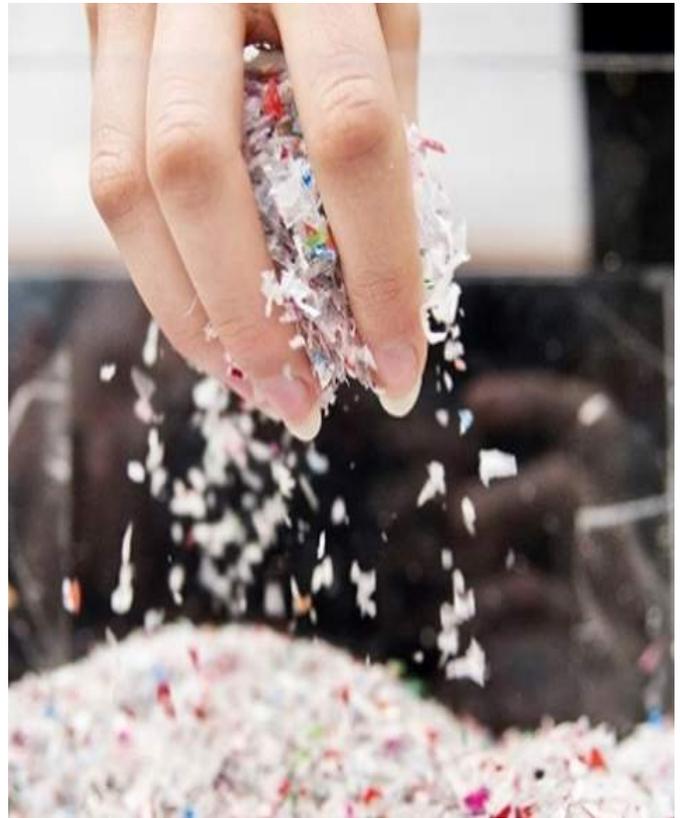
through circular procurement.

For example, Rijkswaterstaat, the Executive Agency of the Ministry of Infrastructure and Water Management, is experimenting with building a viaduct from reusable components. Another example is the Ministry of Defense, which is having parts of its equipment made from recycled parts of old military equipment. Also, the government is making use of prize incentives to encourage manufacturers to opt for recycled or biobased materials and to encourage consumers to choose sustainable products.

Further, the government, together with a number of business organizations, has established the internet portal Versnellingshuis (Netherlands Circular Accelerator), which boosts circular innovation at a regional and municipal level, by helping entrepreneurs to develop, launch and scale-up their circular products and services. Another valuable portal is PACE (Platform for Accelerating the Circular Economy) Action Hub, a public-private platform hosted by the Netherlands. Here, it is possible to find innovative presentations, projects and ideas.

He believes that international cooperation is key in this transition: working together, learning from each other and sharing best practices. In this perspective he encourages the cooperation between the Netherlands and Italy, all kinds of cooperation at different levels have been established: between cities, Milan-Rotterdam and Milan-Amsterdam, companies, startups, research institutions and universities.

He believes there are many areas where the Netherlands can learn from Italy and where it also has to offer some interesting innovative solutions.



Img. 26

© Stills from the presentation by the Dutch Consulate General



Future Cities and Urban Forestry - Vegetation as an Essential Element of Architecture

Speaker: **Stefano Boeri**
President of Triennale Milano

Stefano Boeri believes that cities can be the first resource for reversing climate change because they are, at the same time, the first cause and victims of global warming and climate change. In order to avoid producing new CO₂ and absorbing the emissions that already exist in the atmosphere, plants and trees are extremely efficient. For this reason, he is committed to “a global campaign on urban forestry”.

The first project that he introduces is the **Smart Forest City**, which will be realized nearby Cancun, in Mexico, where a Chinese company has already destroyed part of the mangroves forest in order to build a mall. In this project, the concept of Urban Forestry relates to the idea of the circular economy.

The city will host up to 130.000 people, it will have 5 or 6 epicenters around a series of University departments. It will be composed of more than 7 million trees and thousands of other plants. The most interesting part of the project is the buffer zone, the perimeter of this new city is composed of solar panels and a place for agricultural fields, where it will be possible to cultivate and produce part of the food for the citizens. So, the project encompasses both the idea of sustainability and self-sufficiency.

To this end, they are working with Transsolar, a German company focusing on climate and energy.

The city will also present a very particular layout creating the conditions for the citizens to reach whatever they need by 15 or 20 minutes walking.

According to him, this is a new horizon for the future of cities, where the urban environment is transformed into an “archipelago” of districts or urban villages. The water channel is connected to the sea via an underground system that allows the city to be irrigated in a sustainable manner and to use as potable water.

The city includes an electric and autonomous public mobility system to serve the internal system of smart paths and the mobility plan provides that all residents will leave vehicles on the outskirts.

He is involved in the development of a similar project, but in the desert near Egypt. The idea is to have a city that is surrounded by a perimeter of solar panels and agricultural fields, so the concept of self-sufficiency is applied here as well, in order to make the city working even with complicated and difficult climate conditions like in the desert. A green city with buildings of different sizes and functions, all covered by plants. Plants at every level will not only improve the surrounding air quality, but it will also provide natural shading as heat is an important concern in this case.



Img. 27

The Smart Forest City - image by Stefano Boeri Architetti

Future Cities and Urban Forestry - Vegetation as an Essential Element of Architecture

Speaker: **Stefano Boeri**
President of Triennale Milano



Img. 28
Tirana Riverside Project - image by Stefano Boeri Architetti

Tirana Riverside is a project under construction in Tirana, after the earthquake. It is another example of a green district that is strongly connected to the idea of self-sufficiency and social inclusion as well, in order to make this part of the city affordable for everybody. The concept is for a walkable neighborhood with a distribution of essential public services around three central locations, easily accessible for pedestrians from all areas of the neighborhoods and this includes retail, healthcare and education.

This is a district that will be capable of responding not only to post-earthquake emergencies, but also satisfying post-Covid 19 health requirements and the needs dictated by the climate crisis. Important components of the project are the public and private green spaces, distributed on public grounds, vertical surfaces and roofs, which are considered as li-

ving spaces for different daily activities. The district is planned with the idea to establish public school as the center of public life, as he believes that schools are the core of the future of the cities and they should be accessible every day at every time to everyone.

The last project he talks about is for Grand Genève, where they are planning a new metropolitan layout, which puts together Genève (Suisse) and Annecy (France). A circular metropolitan environment composed by village systems surrounded by a circle of forests. But the aspect that makes this project significantly important for him, is that at the center there is a mountain, the Salève, with its biodiversity. And this, according to Boeri, the future of the metropolitan environment.

Circularity and Decarbonization of Urban Systems: an Innovative and Systemic Approach

Speaker: **Paolo Cresci**

Head of Sustainable Development at Arup Italy

Paolo Cresci introduces Arup, a worldwide company working across every aspect of today's built environment. Starting from recent projects and case studies, he illustrates the approach adopted and the results obtained by setting up an integrated approach to Circular Economy and Decarbonization.

The intervention seeks to highlight the significant elements, relationships and advantages of a synergistic approach for urban transformation. Considering city as a system, the scientist Howard T. Odum created, in 1973, the concept of EMERGY, a model of natural and human ecosystems. In this concept embodied energy is associated to any kind of human action on the planet.

Arup, in partnership with C40, in the last two reports, "Deadline 2020" and "The Future of Urban Consumption in a 1.5 °C World" investigated and outlined strategies to set up decarbonisation roadmaps and best practices for our cities.

Over the last three years, Arup has also been a strategic partner to the Ellen MacArthur Foundation and contributed to develop the 'circular economy' thinking and practices in the built environment. The transition to a circular economy will require the application of systems thinking and new approaches to the way we design, operate and maintain built environment assets.

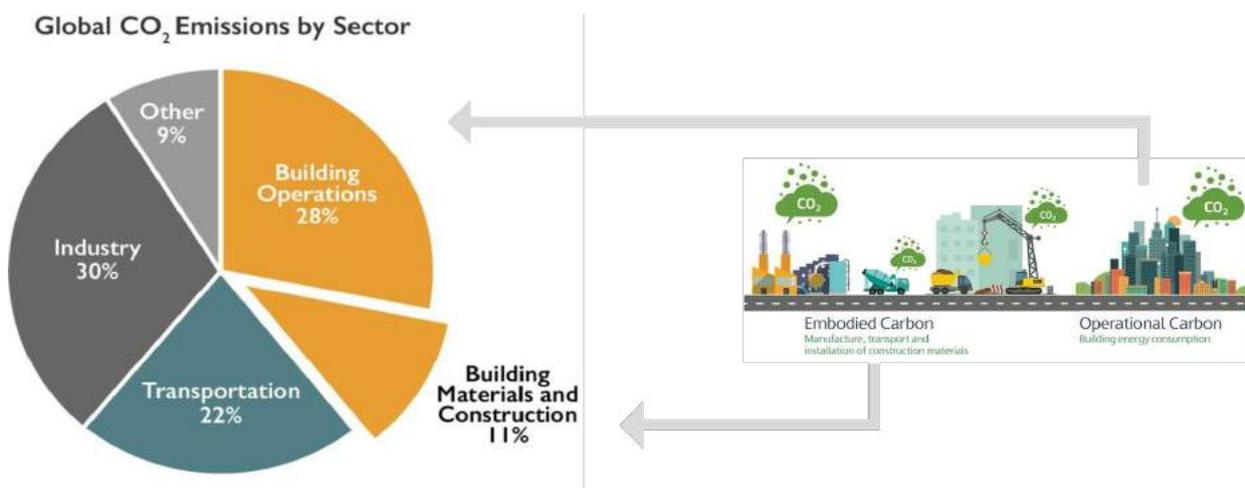
In 2018, Arup Milan, supported by C40's Reinventing Cities competition, started L'INNESTO, a car-

bon-neutral social housing project in Milan. By then, they have been involved in some of the major developments in Milan, looking into decarbonization from a quantitative perspective, which considers six main components (energy, materials, mobility, water, waste, land remediation and green infrastructure) and how they can offset the remaining CO₂.

In a large-scale development, it is possible to find the majority of the carbon components as well as challenges that we face in our urban systems. The analysis shows how the embodied carbon is a relevant component and without considering mobility, it counts 50% at least. This percentage is related to the life cycle of the development. If we consider 20/30 years time from now, it is crucial to focus on embodied carbon reduction measures.

In terms of energy and related carbon we see a positive trend thanks to the possibilities offered by the ongoing energy clean transition, exploiting renewable energy generation on and off-site, which will help to reduce that component.

When we move into the embodied carbon, the challenge is higher, the problem is to offset it in the way we produce, deliver, build and re-adapt over time. It is also a matter of time, embodied carbon is generated at the beginning of construction and therefore if we do not act on this component quickly enough, and we are not putting in place the solutions to improve and reduce it, we will be in trouble.



Img. 29

UN Environment Global Status Report, 2017 - image by ARUP

Circularity and Decarbonization of Urban Systems: an Innovative and Systemic Approach

Speaker: **Paolo Cresci**

Head of Sustainable Development at Arup Italy

Carbon trends: if we project in 30/40 years' time, the impact of embodied carbon vs operational carbon, we will probably reach a proportion of 80% vs 20%. So, there are two elements here: the variation between the two components and the time to offset these two components.

Focusing on carbon measures, it is essential to look at how it is possible to build more efficiently, cleverly and with less materials. The percentages of material switching are relevant: the use of timber from 50% to 90% depending on the sector, re-use of building components, material efficiency. Each of these represents a big challenge for the manufacturing industry.

Starting from the carbon assessment and reduction strategy developed for L'INNESTO and looking at larger mixed-use developments in Milano, we observe that, in the current construction baseline, materials (without considering mobility) count for more than 50% considering a 20-30 years time perspective.

Depending on the mix of functions of the development we see the possibility to reduce this component from at least 25% to 50%. If the first is easily achievable already now, the second should be considered as the optimum target in the current construction market conditions and likely to be achieved in a 5-10 years time.

The reason of this gap is due to the different construction methodologies for the different assets. Here there is an investment aspect as well: using more timber, more recycled materials, using low embodied carbon and pre-fabricated solutions means an increase of the construction cost so we need to find ways to support this additional effort to foster the embodied carbon shift.

Another element that is pretty evident is that after applying the carbon reduction measures on-site we still have a significant carbon amount to offset off-site (mainly related to scope 3), that can be estimated in the range of 30-50% depending on the considered carbon components.

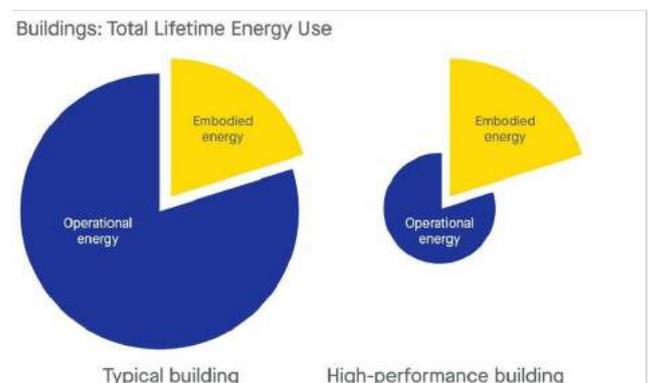
This CO₂ that cannot be offset on-site represents another opportunity for the Circular Economy that should be further investigated.

Carbon by asset: if you consider a typical mixed-use development, there are many types of building and functions, each of them with specific characteristics. By analysing more in depth the combinations of embodied carbon reduction targets for each specific asset we can see that in 20 years time (cumulative figure) the embodied carbon is 70% vs 30% of energy and in 50 years, we will reach the equivalent number between embodied and operational carbon, so 50%-50%.

This gives a clear idea of the importance of action on embodied carbon. The targets they want to achieve in these ongoing developments are as follow: 1-5 year time of development -25%; 6-10 years -50% for embodied carbon reduction, which is currently a real challenge in buildings.

In conclusion: he highlights that today we have analyzed and compared two main components, energy and embodied carbon, to have a better understanding of the role of embodied carbon and the contribution that Circular Economy shall provide.

We need to work altogether. In Arup's last report Realising the Value of Circular Economy in Real Estate, they define 8 essential figure actions as a methodology to tackle this challenge and foster a positive transition to circularity and decarbonization of the built environment.



Img. 30
Buildings: Total Lifetime energy Use.
ARUP, 2020

Engaging Citizen in the Transition to Circular Cities

Speaker: **Nicola Tagliafierro**
Head of Sustainability at Enel X

Nicola Tagliafierro discusses Circular Citizens, their close relationship with the concept of Circular Cities and the way they are shaping the future market. To define the identity of Circular Citizens, he starts looking at the micro-communities of circular consumers and understanding in which way their habits are changing. The analysis considers the five business models of the circular economy.

- **The sustainable inputs model:** in this case, the citizen pays attention to the financial opportunity. For example, a citizen interested in installing a solar plant on its rooftop is applying the model of sustainable inputs but, at the same time, he seeks to cut down its energy costs.
- **The product as a service model:** the citizen does not look at products in an ownership mechanism, but as a service. This represents a significant change in current consumer habits. In this case as well, consumers are driven by the financial opportunity, by reducing the initial investment to own the good and they are postponing this investment through the fees they will pay for the service.
- **The sharing business model:** for example, people using mobility sharing opportunities are strongly driven by financial opportunities as they do not have to spend any more to buy a car or other vehicles. This model identifies another important message: financial sustainability.
- **The increased product life model:** the consumer is interested in the possibility of repairing a good, so many initiatives are starting to introduce repairable products.

- **The end of life model:** many initiatives are oriented in recycling and reusing goods at the end of life. They try to push, through gamification and incentive mechanisms, the user to recycle and reuse its products.

So, on one hand, the citizen is looking to become more circular, but on the other hand, he is looking for financial opportunities. Summarizing these profiles, at Enel X, they built a **micro-community's paradigm**.

The residential PV community: for this community, Enel X aims, by 2030, to reach the 55% of total consumption covered by renewable energy. In this perspective, they have started to install more capacities. In 2019, there were 272 MW installed (a growth of 4,6% compared to 2018). In the last months, they have highly increased incentives in this sector as its growth significantly depends on these. The typical consumer of this community lives in a detached house and is mainly a man of the age from 35 to 55. So, this profile is related to the ownership of a house.

The electric mobility community: this is a big growing community in recent years due to the enhancement of incentives for electric mobility in order to reduce pollution. In 2020, there are 40 million circulating cars and even considering the impact of Covid-19 on these numbers, compared to 2019 there are +154% of electric and hybrid vehicles that have been registered. The average user of this community is represented 82% by men, aged from 38 to 54. This is important to understand why there is a focus on certain gender and age categories.



Img. 31
Enel X Recharging station - image by Enel X

Engaging Citizen in the Transition to Circular Cities

Speaker: **Nicola Tagliafierro**
Head of Sustainability at Enel X

The sharing community: in terms of the value of the European sharing economy in 2025, it is estimated at € 572 billion. There are already 270 companies with the sharing economy as their core business.

Compared to the previous user categories, city users are mainly women aged from 18 to 26 and students. Talking about smart workers as employees, the average user is a man aged from 26 to 45.

The repairable and durable products community: this is the newest community. The global revenue from this specific market is about € 2 billion, which created 100.000 of jobs in Italy. The citizen is interested in durability, repairability, upgradability and financial saving (across drivers).

The 2nd hand community: in 2019, the value of this market in Italy was about € 21 billion (28% of growth rate from 2012 to 2019). In this specific segment, the main categories of products that consumers buy are motors, home and personal appliances. These numbers are important not only from an economic point of view but also in terms of tons of saved waste (0.6 million tons/year).

In order to understand how to move from micro-communities to a macro circular community, Nicola Tagliafierro explains the concept of cross-fertilization by giving some examples of connections within the communities he previously illustrated. The PV community and the electric mobility community are connected as, by producing directly the electricity to recharge their own car, people have a double saving, and, at the same time, they can optimize their energy production.

Then, he focuses on how smart working, due to Covid-19, is changing our habits. It can push and drive these micro-communities to become one macro-community. For example, many people did not find the PV production useful as they were not at home during the day, so this business model did not have the right convenience for those people. Due to smart working, this situation is changing, people are spending more time at home. Many families are not using their car anymore, so it is not useful to own one. People are also eating more at home. So, the current situation is incentivizing people in storing renewable products

in their homes, using car sharing and buying zero km products.

In order to support cities in the transition towards the circular economy, Enel X provides innovative solutions as the Circular economy report for PA, which measures four components: energy, mobility, waste and emissions. This is an innovative tool for PA and citizens to see their level, so where they are starting and how they can improve through a roadmap.

Biomimetic AI to re-design buildings

Speaker: Ferdinand Grapperhaus
CEO at PHYSEE

Ferdinand Grapperhaus starts his speech by telling the way he sees tomorrow and namely **energy neutral**. In fact, he works with more than 50 people at PHYSEE where they develop different kinds of technologies to make our tomorrow energy neutral. How do they do that? Before answering this question explaining the concept of biomimetic inspired AI, he started with a little bit of history of buildings.

First of all, what is biomimicry? **Biomimicry** is the emulation of the models, systems, and elements of nature for the purpose of solving complex human problems. We learn from nature and we apply to technology and humans have been doing that in buildings for a very long time.

Then Ferdinand showed the first building ever made, built in the Neolithic, also known as the “Stone Age”, where humans used mammoth bones to rebuild cave structures. In Ancient Egypt, pharaohs were inspired by the solar system and built structures towards the sunlight. So, inspired and motivated by nature we build amazing buildings.

Also, during the Roman Empire, it was the first time people started using waterwheels and sawmills to have natural forces help us build beautifully. Unfortunately, in the 20th century, after the second industrial revolution, steel and glass accelerated the building industry and made us forget about nature.

Of course, there are some exceptions and what they see in their company for the future of buildings is that they start combining 2 things: **technology and nature**. How? The Fourth Industrial Revolution, that is taking place right now, enables all new kinds of possibilities. By connecting systems and powering with natural resources a new horizon sets the stage. This might seem complicated, and it actually is, but Ferdinand told us how it can be possible.

First of all, in PHYSEE they combine deep tech (technologies that need significant development time, intellectual property and efforts by big teams) and nature. Combining these 2 things, they develop SmartSkin. SmartSkin is smart because it uses deep tech and senses as a skin mimicked from nature.

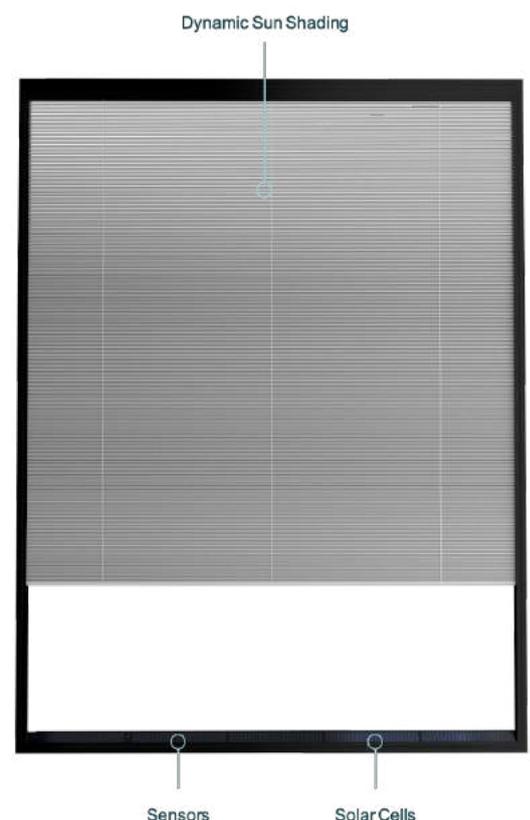
What is it exactly? They integrate sensors and solar

into windows to enable AI building control and then they use that AI building control to reduce the energy consumption up to 30% over total building. It is possible to use data that you get in a smart and efficient way to reduce the energy footprint of buildings by 30%.

They install SmartWindows on the entire building that have solar technology and sensors integrated inside each insulated glass unit (IGU). Together with an additional sensory system, SmartSkin forms a power and data grid that generates electricity and delivers valuable and actionable insights. In addition to SmartWindows they have developed in-house algorithms that use Model Predictive Control (MPC) for enhancing buildings’ and HVAC systems’ energy efficiency and significantly improving building user comfort validated by WELL building certifications.

People working in the office focus on their work and at the same time their SenseModule in the glass, but also in the rest of the office environment, are measuring outside weather conditions and inside climate conditions and they use the amount of heat that comes in the office to naturally heat the office once that is desired.

Img. 32
AI Building
Control for
Sun Shading
- image by
PHYSEE



Biomimetic AI to re-design buildings

Speaker: Ferdinand Grapperhaus
CEO at PHYSEE



Img. 33
An example of SmartSkin - image by PHYSEE

When the office needs to be cooled, they automatically lower the sunblind and keep out as much of the sunlight as possible. In that way, they get a skin for their building that starts to breathe and dynamically respond to the environment and keep the most balance in between the indoor and outdoor climate. And this not only goes for sunblind; it can also work for ventilation.

If their windows or facades measure that inside air quality is low and outside air quality is high, ventilation shafts can be opened automatically or windows can be opened and closed. Their goal is that people can continue to work, or leave or relax, or sleep while the AI system is controlling in the most efficient way the building climate control. They also deliver dashboards for their customers, showing how much solar energy has been used, the energy saved in kWh and other data.

They are installing tech to make their customers just relax, focus and enjoy, while the skin of their building thinks, acts, and improves the climate for them. This might sound like the technology of the future, new and complex, with lots of risks involved, but they have been already installing very successfully in residential projects.

PHYSEE is now expanding its technology outside the Netherlands, looking for architects and real estate developers who want to build buildings that know and learn and are aware of the environment they are in. They want to change the perspective with their technology.

Making space for tomorrow. ATM Full Electric Plan and Sustainability Policy

Speaker: **Paolo Marchetti**

Sales, Strategy, Innovation and Sustainability Director at ATM

Paolo Marchetti describes first of all ATM Group's main activities, from the management of Milan's public transportation to the bike sharing system. Moreover, the Group deals with parking, car parks and tow-away services, IT management of both congestion and pollution charge areas, track diagnostics and rolling stock maintenance, but also the management of Copenhagen's driverless metro lines.

The ATM Group has 10,000 employees, with revenues amounting to 1 billion euros per year. 185 million kms are covered on a network of 2,000 km in 95 municipalities around Milan and 2.5 million passengers were transported per working day in 2019.

ATM's main project is the **Full Electric Plan**, which represents a huge commitment in terms of environmental impact and a concrete response to air pollution. The Plan, started in 2017, aims to replace the entire bus fleet by 2030, reducing the CO2 emissions by 75,000 tons per year. In addition to the fleet changeover, four depots will be renovated and three new depots will be built from scratch.

The plan also provides for electric charging infrastructures both in the depots and at terminuses, which

all ATM service cars have already been replaced with electric vehicles.

The project for the new depots is a fully eco-sustainable concept developed by ATM and Politecnico di Milano. The buildings will be in harmony with the surrounding environment thanks to underground spaces devoted to working operations and overground green areas for the citizens, offering new livable spaces. The system of the new depots will be completely automated, from stabling to recharging.

Another noteworthy pillar of ATM's approach to the circular economy is its Sustainability Policy, highlighted in the 2017 and 2018 Non-Financial Statements and the 2019 Integrated Report. Drawing up the report, ATM used the materiality analysis process to identify and evaluate the strategic issues for the Group and its Stakeholders, identifying the priority SDGs to which the Group can make a more significant contribution. With these tools, five new macro objectives have been set.

As for decarbonization, the ATM's Plan aims to decrease the CO2 emissions in Milan by 120,000 tons per year.

Img. 34
The new depots - image by ATM



Making space for tomorrow. ATM Full Electric Plan and Sustainability Policy

Speaker: **Paolo Marchetti**

Sales, Strategy, Innovation and Sustainability Director at ATM



Img. 35
Urban Public Transports (bike and bus) - image by ATM

The second objective is people and community empowerment, a goal to be reached engaging not only its employees, but also its Stakeholders. With this aim, In fact, in October 2019 the “**Porte Aperte**” open weekend event was organized at San Donato depot, in order to raise more awareness about ATM’s approach to sustainability and innovation.

The third objective is the **circular economy**: aware of the scarcity of resources, ATM aims to reduce as much as possible their use.

Supply chain optimization represents the fourth objective, for which specific tools need to be developed.

Finally, the last objective of ATM’s Sustainability Policy is diversity management: the Company believes that each person is a value and that working all together we can make the difference in this transition to the circular economy.

Waste as a resource: how to generate value through innovation

Speaker: **Guglielmo Carra**
Innovation Manager at A2A

Guglielmo Carra begins introducing A2A, which is Italy's largest multi-utility company dealing with different business sectors: from power generation to distribution of energy, gas and water, to waste collection and management, to the smart city.

The innovation team supports the Group in the process of continuous transformation over time. In the short term, they aim to improve the efficiency and effectiveness of their core business, while in the mid and long term, they seek for new trajectories to define new opportunities and business models for the future growth of the company.

To do this, they use different channels. For example, through scouting programs, they aim to directly engage with the worldwide ecosystem of startups and create joint projects. Through the Corporate Venture Capital (CVC) they invest in high potential startups. They also launch Innovation calls, opened to companies and individuals, to help A2A tackling the biggest challenges they face in their business.

The circular economy is an important aspect for the strategic development of the Group. A2A business model is in fact an integrated loop of services that allows to maximize the value of resources being them energy, water or materials.

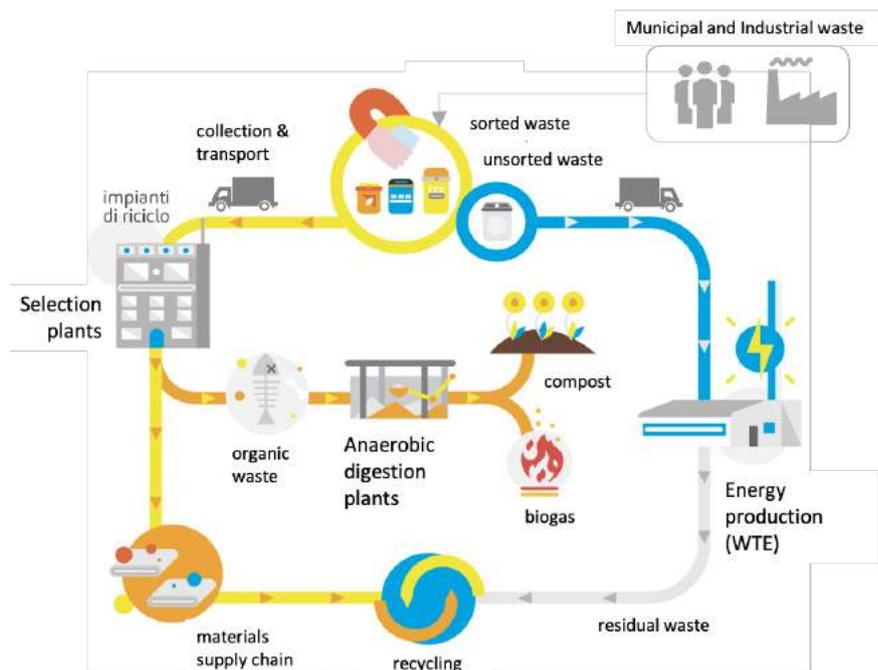
They believe that innovation, new technologies and digitalization will strongly support in accelerating the transition to the Circular Economy in different sectors, from waste management to the transition to renewable energy as well as in water infrastructures management.

As of 2020, A2A is part of two relevant networks working on the circular economy both at international and national level: the Ellen MacArthur Foundation and the Italian Alliance for the Circular Economy, with the aim to start joint initiatives at corporate level.

Then, Guglielmo focuses on the waste sector. Every year, A2A collects 1.7 million tons of waste through its waste collection services, and treats approximately 3.4 million tons of waste in their plants so that just 0,03% of the waste they manage ends up in landfills. Such great results have been achieved by constantly considering waste as a precious resource both for the company's business and, very importantly, to generate a positive impact on the communities and the territories A2A operates in.

Guglielmo shows three cases exemplifying A2A's approach to consumer waste. The **sorted waste** (glass, plastic, paper) goes to the selection plants to create clean material streams for the recycling processes.

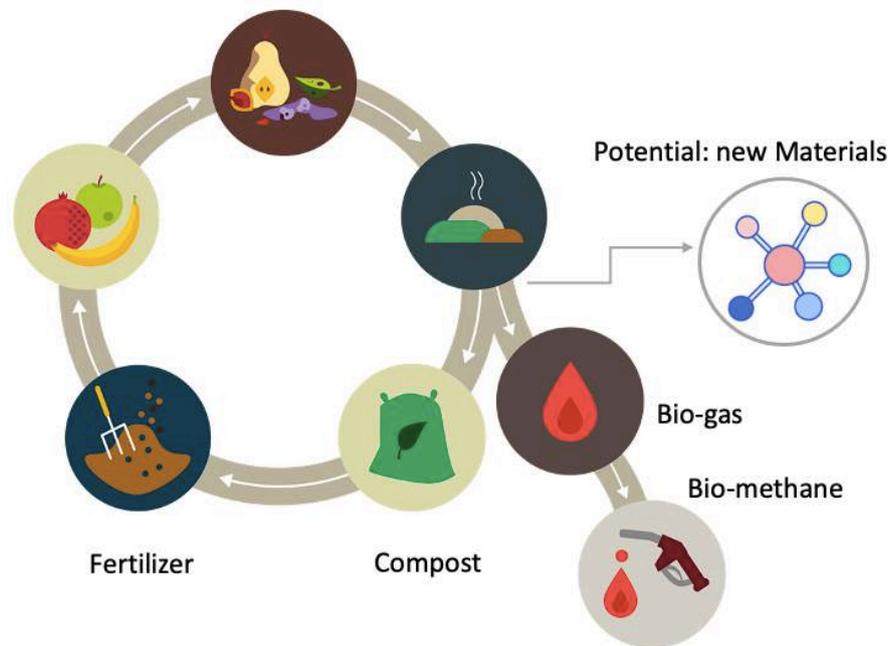
Img. 36
Waste collection and transformation - image by A2A



Waste as a resource: how to generate value through innovation

Speaker: **Guglielmo Carra**
Innovation Manager at A2A

Img. 37
Treatment of
Organic Waste -
image by A2A



The **organic waste**, through a process of anaerobic digestion, is transformed in both biogas and compost. The **unsorted waste**, instead of going to landfills, is treated within the Waste to Energy (WTE) plants where it is transformed into energy and heat.

The city of Brescia is an example of the benefits generated by the WTE plants, which produce electricity for about 200.000 families and heat for about 60.000 apartments through the district heating.

Furthermore, Guglielmo presents examples that showcase how innovation can be a trigger to transform waste into a resource. He starts presenting their project about plastic.

In 2019, the EU Commission published the Single-Use Plastic Directive establishing the targets to be reached by all EU countries over the next five to ten years in terms of the recovery rate for plastics. In Italy, there is still a relevant gap to be filled in order to reach such targets. However, this gap is lower for the city of Milan, due to both the very efficient waste collection service and the advanced sorting plants that have been built by A2A with cutting-edge technologies to manage about 100.000 tons of plastic every year.

Within these plants, the waste is separated into 12 types of plastics, with very high purity grade, creating homogeneous material streams (PET, PP, HDPE,

etc.), that can be subsequently recycled. To improve even more the capacity to control the quality of the sorting process, A2A implemented an additional layer of technology.

So, through a scouting program, they found a UK based company, Greyparrot, which is developing an integrated computer vision and AI system capable of building up metrics specifically for the waste sector.

The successful application of this technology, still at the testing phase, will allow to define the quality of the sorting and implement, where necessary, corrective measures to deliver high-quality materials to the recycling phase.

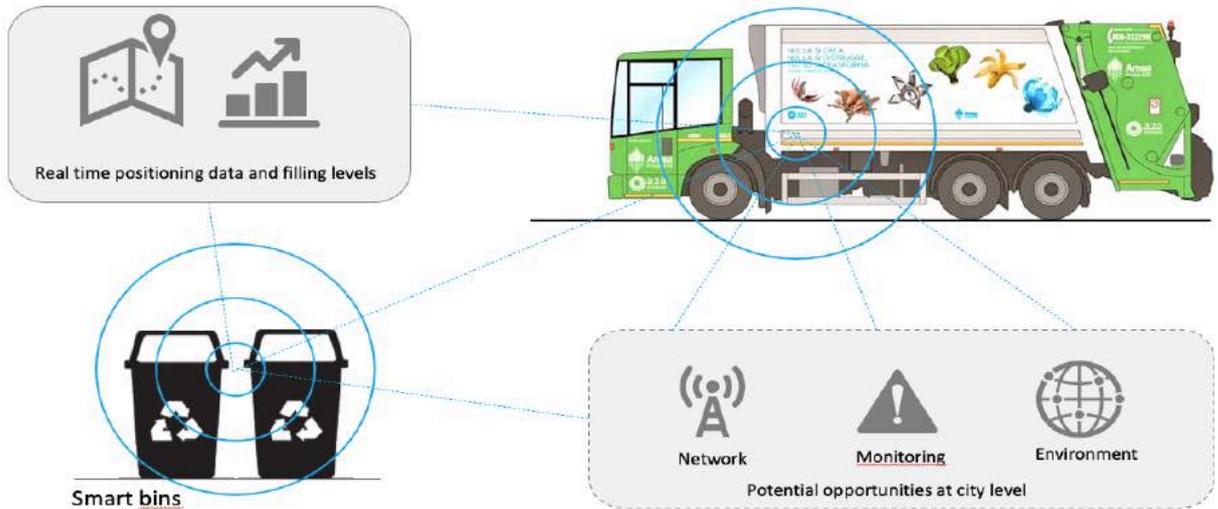
At the same time, A2A is working on technologies such as advanced robotics, to reach a higher percentage of recovered materials, and blockchain, to track waste across the supply chain and down to the waste cycle.

Afterward, Guglielmo focuses on the opportunities offered by organic waste for more circular processes. As a yearly average, in Italy, each citizen generates more than 109 kg of organic waste. A2A collects and process such type of waste in their plants, and transforms it into different products through the process of anaerobic digestion.

Waste as a resource: how to generate value through innovation

Speaker: **Guglielmo Carra**
 Innovation Manager at A2A

Img. 38
 Sensors
 and Actuators
 - image by A2A



On one hand, the organic waste is transformed into compost that can be used as fertilizer in agriculture rather than chemical fertilizers. On the other hand, it is treated to produce biogas which, transformed into biomethane, can be used as a fuel for the automotive sector.

From the innovational side, they are looking at creating additional opportunities for upcycling organic waste into new materials to be employed in different industries to make products.

Lastly, A2A provides waste collection services to large municipalities in the north of Italy. Guglielmo believes that there could be some interesting opportunities also in this space.

In Milan, A2A operates a fleet of about 1300 vehicles for waste collection and cleaning service and deployed about 15.000 smart bins in public streets. In order to track the position of the vehicles and the filling levels of bins, A2A implemented sensors that allow better planning of the waste collection service. Other type of sensors can be used in the future so to help gathering data about the environment, like noise and pollution levels, and allow better planning of the city.

The capacity and ability to collect metrics can be also used to monitor the status of the infrastructures and, in the logic of IoT systems, it could support to build up circular opportunities for future smart cities.

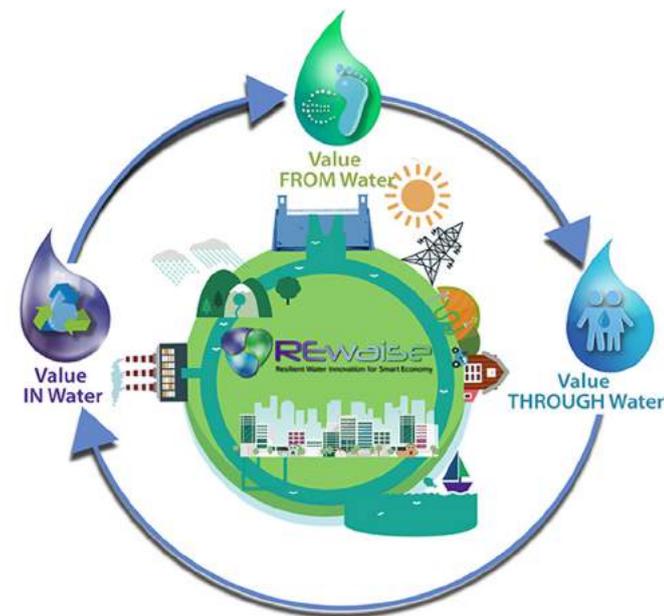
Clean water is a human right

Speaker: **Sebastian Lykke Møller**
 Business Development at Aquaporin

Water is a valuable resource for the planet and for humans, that is why the UN declared “Clean water is a human right”. But water resources are limited, and they need to be cared for and carefully used. So, Aquaporin’s goal is clean, natural drinking water for all, and the sustainable re-use of water in industrial applications.

They incorporated this protein in membranes that they apply to different kinds of filters. Applying the Aquaporin Protein to traditional filters, they create biomimetic membranes that mimic nature and are more energy efficient. The structure around wastewater is different than that of drinking water, so they need to apply different technologies and filters to do that. In order to achieve their aim, Aquaporin collaborates on different projects with several partners all over the world. One of the first projects is Circular in Space. In partnership with NASA and ESA, they have tested their filter technology by creating a circular system in Space. This is an important step in developing filtration technology to efficiently re-use water in Space Stations.

REWAISE is an EU funded project. A network of 9 living labs around Europe and involving different stakeholders, they try to understand how to extract value from waste water and create a new “smart water ecosystem”. NEWater is a project aiming to meet Singapore’s rising water demand. In partnership with the government and public institutions, they are trying to see how they can use their water with reverse osmosis filters in order to re-use water from industrial companies to create new drinking water.

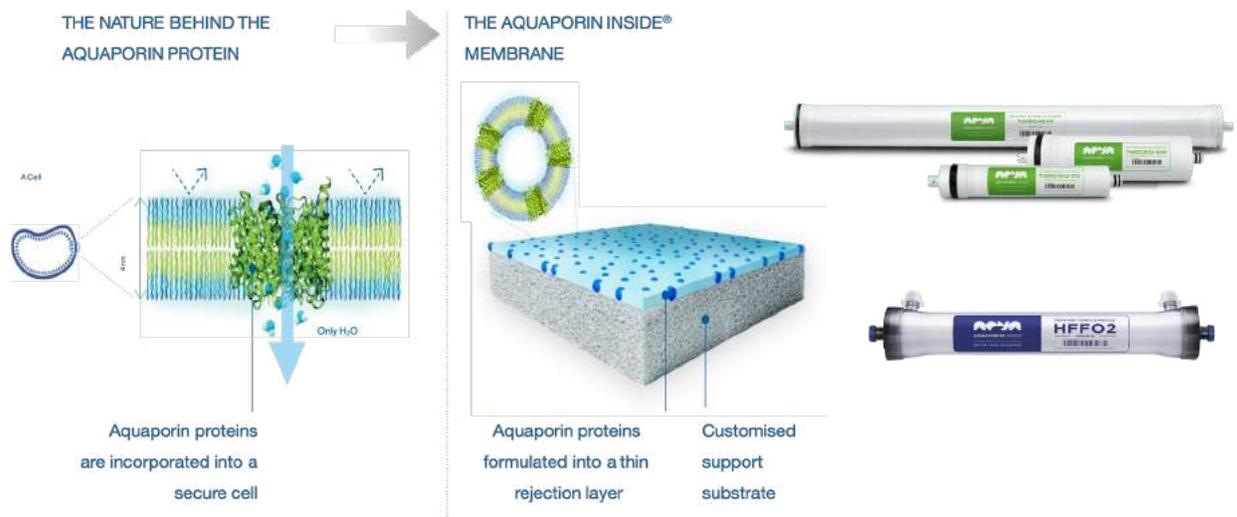


Img. 39
 REWaise project - image by Aquaporin

They adopted the Circular Economy approach since the beginning of the company, in fact, their core technology is based on nature. The Aquaporin Protein can be found in all living cells and it is the protein ensuring the transfer of water between cells.

The circular approach also needs to start eliminating some of the waste problems. So, Aquaporin aims to enable people to clean drinking water at home, directly from the tap and, at the time, they want to make it as energy efficient and neutral as possible. They are also working on minimizing the waste of water by recycling water.

Img. 40
 Aquaporin proteins, membrane and products - image by Aquaporin



Vitesy: green, sustainable and connected air purification

Speaker: **Paolo Ganis**
Co-founder & CEO at Vitesy

Paolo Ganis starts his speech presenting Vitesy, a startup of young entrepreneurs working on sustainability and wellbeing.

They have identified two main problems. The first issue is the lack of awareness about indoor pollution and its negative effects on the environment and our health. As a matter of fact, the World Health Organization argued that indoor pollution can be up to 5 times higher than outdoor pollution. This is due to the existence of several unknown contaminants generating pollution and VOC (volatile organic compounds), which are bad for our health considering we spend about 90% of our time indoors.

The second problem is related to the use of products using old polluting technologies, which are made of plastic and cannot be recycled. These products work with HEPA and Carbon Filters that need to be replaced often, otherwise the pollution goes back to the indoor area. In the last 5 years, 102 million filters have been wasted and generated 20.000 tons of trash. In their solutions, Vitesy is working on a new concept of connected wellness, thanks to the combination of nature, nanomaterials, technology and design. They have started testing the power of nature in research labs. In 2017, they launched their first product, Clairry, a natural air purifier that should eliminate 93% of VOC in 30 hours.

Clairry enhances the phytoremediation power of some plants to remove pollution agents from the air. Thanks to its sensors and its app it is also possible to monitor air quality. In 2019, they launched Natede, the evolution of the previous product, combining photocatalysis and phytoremediation together increasing its purification process. It features advanced sensors to analyze temperature, humidity, VOCs, fine-particulate and carbon monoxide. Their latest product is Eteria with new nanomaterials helping in the purification process. Adopting a circular economy approach to design their products, they use natural nanomaterials and filterless solutions to purify the air.

Every single aspect in this phase is to be eco-friendly and sustainable, they use recycled materials (no glues), so everything can be easily disassembled and recycled to give new life to the next product. Because of indoor pollution, the market is growing fast, also enhanced by the pandemic situation.

The market needs more advantageous solutions than the dominating HEPA and Carbon Filters products. Vitesy products are designed to be in perfect harmony with any inner space and they offer better performances through a harmonic combination of nature and technology, and the most important aspect is that they are filterless.



Img. 41
Clairry, the first natural air purifier - image by Vitesy

Since the very beginning, their first two products, launched through crowdfunding, received a positive response from the market and made them win several awards. They also obtained a 2 million euros investment from the EU evaluating their technology, team and growth potential.

Another important aspect of what they do in order to have an impact on the world, is the total control of the supply chain. They try to work in a small area in Northern Italy, so the suppliers are near the factory and this has a positive impact on the product quality and CO2 emissions.

They want to show, even more now for the pandemic situation, that green is important also indoors. Air purifiers working with technologies like HEPA and Carbon Filters try to do upselling with additional filters that generate waste, while they are trying to do upselling with big data and AI by giving data about the air quality to the consumer.

In partnership with the Eden Reforestation Projects, for every product sold they plant 10 trees in developing countries. It also makes customers feel part of a bigger picture that is based on green, sustainability and wellbeing.

The Circular Economy in Cities and Regions: an OECD perspective

Speaker: **Oriana Romano**

Head of Unit, Water Governance and Circular Economy at OECD

After 2 years of work, Oriana Romano announced the publication of the OECD Circular Economy in Cities and Regions Synthesis Report, which is the result of a survey carried out across more than 50 cities and regions, interviews with more than 300 stakeholders and 6 case-study from Europe.

The report shows the state of the art of circular economy related initiatives in cities and regions, obstacles and ways forward. She shared 5 key messages included in the report.

Firstly, the Circular Economy is about **economy**. While the narrative in relation to the Circular Economy to tackle climate change has been predominant, there is a strong socio-economic argument emerging analyzing several cities and regions. By 2050, the global population will reach 9 billion people, 55% of which will be urban, global material use will double, compared to 2011, with consequences on GHG emissions, **50% of which being related to materials management**.

By 2060, GDP is projected to quadruple and cities account for 60% of national GDP. The Circular Economy can bring benefits in terms of production savings (estimated at EUR **600 billion** in the EU-27 by 2030). There is a possibility of creating job opportunities, as activities like repairing, upgrading and remanufacturing are more labor intensive than mining and manufacturing. The Circular Economy can also have a positive impact on economic growth and material saving. This is what cities are considering when embarking in this transition.

Secondly, the Circular Economy is not a new concept, but it is incipient for several cities. While the economic literature developed the concept of the Circular Economy since the seventies, its application on the ground is still incipient in many cities and regions.

Looking at the results of the survey, more than half of the sample defined itself as “newcomers”, meaning that cities and regions surveyed are taking the first steps to develop circular economy initiatives. Where Circular Economy long-term strategies exists, they include policies on waste, food, energy, water, agriculture, buildings and construction, textile, etc.. The third message is to start-up and scale-up. 84% of the

surveyed cities and regions are using pilots and experimentation to start the Circular Economy initiatives. For example, in Ireland, university campuses are used as a test bed for waste prevention and smart collection, as they represent the size of a small city. The next step is to scale pilots and experimentations up to reach the benefits of the economy of scale, in order to transform them into ordinary business and no exceptions.

The fourth message is that governance is key to overcome the obstacles of the Circular Economy transition. Cities and regions argued that while technical solutions are available, the problem is how to put them in place, and how to make sure that the governance conditions are in place to implement them.

Insufficient financial resources allow for the development of small-scale projects, as it is risky to invest in initiatives bringing benefits in the long term.

The regulatory framework is still inadequate in many cases: operators of the construction sector find confusing the definition of waste and reusable products; the eco-design regulation focuses on energy efficiency rather than on material efficiency; clear rules could promote reuse of products and materials.

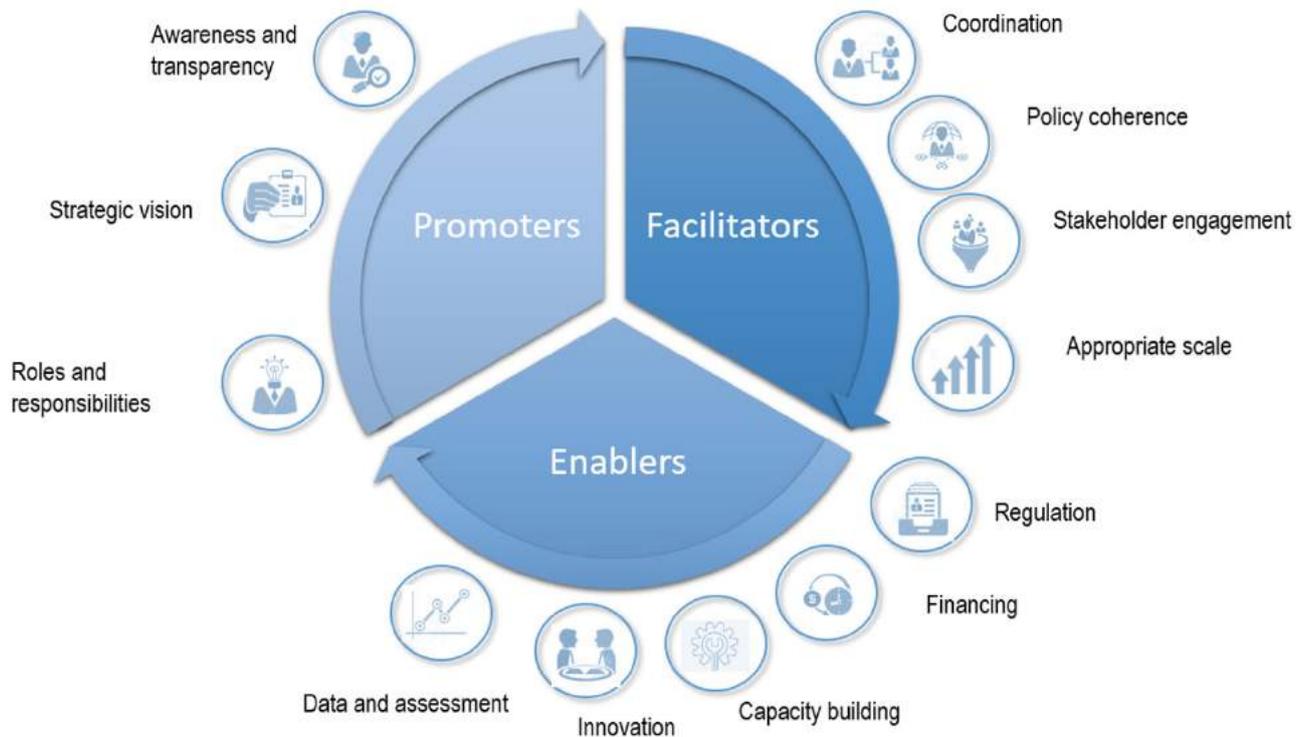
Other obstacles are represented by cultural barriers and lack of awareness: 2/3 of the interviewed cities and stakeholders are confused about the concept of the circular economy, the cost and benefits of implementing circular-related processes.

Lastly, the OECD argues that cities have a role as promoters, facilitators and enablers of the Circular Economy. Promoting the Circular Economy means for cities to lead by example, establish long term vision, overcoming policy silos and increase awareness and transparency. Cities can facilitate the dialogue across people, as the circular economy is a shared responsibility, and places, to implement policies at the appropriate scale, urban, municipal but also metropolitan and regional, and in connection with the rural areas. Cities and regions can ensure the enabling environment for the circular economy through appropriate regulation, financing, capacity building programs, data and assessment.

The Circular Economy in Cities and Regions: an OECD perspective

Speaker: **Oriana Romano**

Head of Unit, Water Governance and Circular Economy at OECD



Img. 42
Promoters, Facilitators and Enablers of the Circular Economy - image by OECD

In order to support cities and regions with this endeavor, the OECD Synthesis Report on the Circular Economy in Cities and Regions contains a Checklist for Action and a Scoreboard on the Governance of the Circular Economy for cities and regions to self-assess their level of advancement towards circular economy systems.

V-Stream: Passive Variable Geometry for Variable Nature

Speaker: **Tommaso Morbiato**

R&D Head, Co-founder and CEO at WindCity

Tommaso Morbiato starts his speech presenting WindCity, a start-up that created and patented V-Stream, a passive variable geometry turbine that self-adapts to the variable nature of fluids, wind and water.

Today, we are not harvesting all the energy that nature is offering to our cities. There is a particular wind blowing below conventional wind turbines: The Urban Boundary Layer, that is nowadays wasted. So, distributed wind energy generation is a circular chance for the Cities, where 60% of the planet lives. The technology developed by WindCity is a solution for the urban environment.

Cities could harvest energy from wind and water, but the variable flows found in the urban environment today, reduce efficiency by more than 60%. The critical point is the technological gap between the conventional off-shore and on-shore applications, where regular flow allows high production. And instead, the potential built environment applications that a variable flow offers, the conventional machine continues to switch on and off, with a low level of production.

Hence, variable flows introduce two great challenges:

- The Yaw challenge for the Horizontal axis wind turbines (HAWT): frequent changes in wind direction force the machine to keep yawing without setting up for production.
- The Pitch challenge for the Vertical axis wind turbines (VAWT): with no pitch, the machine cannot self-start; while with a state-of-art cam-driven pitch the machine self-starts, but at optimal rotation speed its production is only 25% compared to the zero-pitch.
- The ideal solution would comprise both, the no pitch and max pitch features on the same machine.

Their solution is “adapting to change” with 3 degrees of freedom that arise spontaneously during the free movement of any blade in the air or in the water: pitch, diameter and rotation. Their solution, V-Stream, interacts with the variable forces of nature and self-regulates them to maximize energy production. So, there are no external forces, actuators, servomotors or sensors. It is only equilibrium with the forces of nature getting out the maximum energy from the fluids. Their experience towards reliability stands from

the strategic installations in Garda Lake, in the North Italy, since 2018 and they will go from the lake shore to the buildings with the European project Re-cognition, where they will be able to install the turbines even on the rooftops.

Considering wind and water together is an advantage of a technology transfer, as there are many commonalities between the world of air and the world of water (because of Reynolds number similitude that is made self-evident). According to the aquatic environment tests done by the start-up, the same passive variable geometry concept, the same patent, in a turbine of similar dimensions can generate up to 10 times more energy going from wind to water.

They are now developing this technology for Blue Growth and they have this test running out by 2020 in the French laboratory. They have an impact on energy production: they can have levelized cost energy from 31 to 58 €/MWh, which is in line with the most mature renewable techs (20 to 76 €/MWh), with a payback time from 3 to 6 years. There is an impact as climate change goals: in terms of land consumption, which is 70 times less than a solar photovoltaic panel, and results in terms of energy return on energy invested, they can perform three times better than standard variable fluid turbines.

Their B2B Model includes R&D contracts, open innovation, and small modules for farm projects, because they can customize size rotors. As they adapt to nature, they want to “adapt 2 users” with system configuration. It is possible to compose the turbine from their ecosystem of adaptation products, so they can adapt to the class of wind with the rotor; they can adapt in terms of connectivity, a web app or/and IOT gateway; they can adapt for the type of support, direct support to the ground or indirect support for the rooftop; they can adapt in terms of safety, they have a standard shutdown protection or the brake that functions in off-grid and lockdown; they can also deliver energy to the battery or the grid with two different converters.

The market opportunity is very high because they can stay in the market just with a scenario where they take just a 0,6% to 1,5% share in Europe.

V-Stream: Passive Variable Geometry for Variable Nature

Speaker: **Tommaso Morbiato**

R&D Head, Co-founder and CEO at WindCity



Img. 43
WindCity Know-how and Know-why - image by WindCity

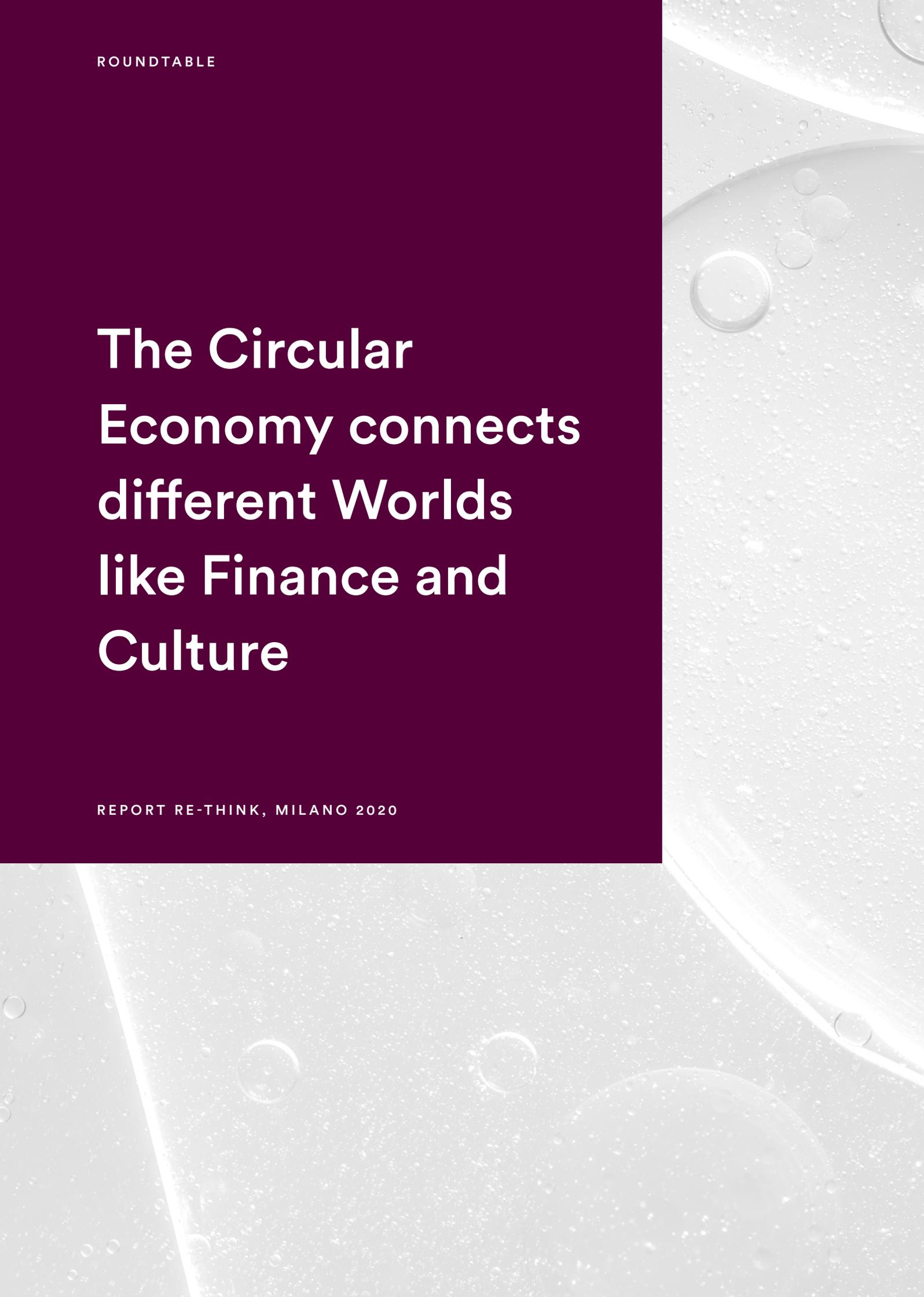
In 2016, they started with their first prototype and now, after the power converter system integration and the patent industrialization kit, they are in the pilot installations period, where they had the first early adopters (multi-utility groups and big national players for the energy sector). So, they are looking for the seed corporate period.

To accelerate the transition to the market, they have multiplied the R&D strategy: Technological R&D and Market R&D. Because they need to have two opposing, but integrated, souls to create the dynamics that bring them forward. Tommaso Morbiato concludes underlying the importance of their partners, the early adopters and the awards gained so far.

ROUNDTABLE

The Circular Economy connects different Worlds like Finance and Culture

REPORT RE-THINK, MILANO 2020



Circular Economy Supporting Ecosystem

Moderator: **Federico Luperi**

Innovation & New Media Director at Adnkronos

Stefano Martini, Head of Circular Economy Lab at Intesa Sanpaolo Innovation Center

Stefano Martini starts his speech by saying that the opportunity to work on the Circular Economy is strategic for the bank. In 2015, in fact, Intesa Sanpaolo joined the Ellen MacArthur Foundation representing the first financial strategic partner of the network. In 2018, the Bank allocated a credit facility up to 5 billion of euros (increased to 6 billion of euros in 2020) to financially support the clients (startups, SMEs, large corporates) aiming to adopt Circular Economy models. The granting of the credit is subject to five criteria that the Bank defined with the Ellen MacArthur Foundation. Supporting companies with a circular business model could generate financial impacts in terms of de-risking, since circular business models mitigate linear risks. The Bank's action also included the creation of the **Circular Economy Lab**, developed in collaboration with Cariplo Factory, in order to accelerate the adoption of the Circular Economy on the market, facilitating the dialogue between different stakeholders around it (companies, startups, research centers, academic spin-off).

These connections can create new opportunities and relations for a new systemic approach to the Circular Economy. Circular Economy Lab have developed three lines of action to support the circular economy transition of companies. The first line is related to the companies' **knowledge** about the opportunities that the Circular Economy can generate for them. The second one is related to the **connection** between the stakeholders to discuss how to implement the Circular Economy, as listening to success stories from other companies has a strong impact. The third line is about **advisory** on innovation to respond to specific needs of companies for the transformation of their business model. The circular open innovation is a service allowing companies to identify new circular solutions and technologies coming from the market, and to import them in their process more quickly and easily than developing insights.

Elena Jachia, Environmental Sector Director at Fondazione Cariplo

Fondazione Cariplo (FC) is a bank origin foundation, mainly working in Lombardy and Piedmont.

After introducing Fondazione Cariplo, Elena Jachia described the sectors they work on: scientific research, social issues, arts and culture, and the environment. To support the circular economy, they have adopted different approaches. For example, the environmental department is focusing on the plastic challenge and the issue of reducing the amount of plastic, in particular single-use plastic, often scattered in the environment. The scientific research department has launched a call for proposals related to research activities on transition models from linear to circular economy and focusing on sustainable materials and modification of reusing different kinds of waste. Further effort is provided by the Circular Economy Lab, which is participated by Cariplo Factory, together with Intesa Sanpaolo Bank and Ellen MacArthur Foundation.

For the activities FC is delivering with the "Plastic challenge" call for projects, the waste directive principles are adopted as a framework and therefore prevention and reduction are preferred to recycling. In fact, plastic production is going to double by 2025 and, although there are incredibly effective technologies for recycling, it would not be possible to recycle everything. Moreover, China – previously one of the main world recycling terminals - has closed the borders to import plastic waste from Europe. The use of plastic needs to be modified, we should not use durable materials for single use. In order to bring a change in the mentality, the call supports non-profit organizations to spread the message of modifying lifestyles, habits of consumption and way of buying things. Consumers know what is good to do, but they are resistant to change, so they need help or incentives to bridge the gap between awareness and action. Therefore, the use of the "nudge" approach is suggested, kindly pushing consumers to the right choice through messages or signs instead of prohibitions.

Stefano Peroncini, CEO at EUREKA! Venture SGR

Stefano Peroncini believes that the Circular Economy and the ESG approach are mandatory for every investor. Eureka! is a venture capital fund focusing on deep tech and investments. They consider deep technologies, advanced materials, nanotechnologies, biotechnologies or AI.

These kinds of technologies are novel and offer signi

Circular Economy Supporting Ecosystem

Moderator: **Federico Luperi**

Innovation & New Media Director at Adnkronos

ficant benefits over the technologies currently in use.

They require substantial R&D and a technology transfer approach to develop practical business or consumer applications, in order to bring them from the lab to the market. Many of these techs address big societal and environmental challenges and will likely shape the way we solve the pressing global problems. Deep technologies are what future companies and investors are seeking more and more. A 2018 research powered by Hello Tomorrow, shows that on a sample of startups, more than 1600 have a big impact on a wide variety of the UN SDGs.

The goals receiving the most deep tech attention, after good health and wellbeing, are those related to industry, innovation and infrastructure. For example, sustainable cities and communities represent 28%, responsible consumption and production 25%, climate action 22%, affordable and clean energy 80%, clean water and sanitation 30%.

Deep tech investments of venture capitalists are strongly related to the Circular Economy. The financial sector is trying to get the Circular Economy opportunity from a return point of view. For example, according to the last report of Ellen MacArthur Foundation, the last 18 months have seen a steep increase in the creation of debt and equity tools related to the Circular Economy. Some statistics about the first half of 2020, show that, on average, public equity funds with the Circular Economy as approach or investment focus, performed 5% points better than their benchmark. There are also corporates that try to invest in the Circular Economy deals, since they have faced pressure to reduce their single-use plastic packaging. So, they are working on open innovation schemes, investing directly in startups or investing as limited partners in other funds.

Katiuscia Terrazzani, Managing Director at Ayming

Ayming is an international group moving from Northern America to major European capitals. They provide consultancy in innovation and creative financing, advisory and compliance and property tax. They believe creative financing could be an economic response to the Covid emergency, in order to continue innovating and planning goals for companies.

To do so, on one side, they need competencies and, on the other side, economic resources. The measures implemented by the Italian government, like Cura Italia and Rilancio, are examples of a short term response to the urgent liquidity needs of companies, but long-term perspectives and responses are needed as well. For example, the financing tool of R&D tax credit for 2020. With Confindustria, they are pushing to increase the rates for the eligible costs and they are trying to give a long run view to this instrument sticking only to 2020, today. Last, they try to understand if it is possible to use the credit and transfer it to the bank, which is already used for 110% superbonus.

However in the use of creative financing, there are some barriers; first of all, there is a lack of information. So, during the lockdown, their aim was to inform companies on the creative financing the government was putting in place. Secondly, as complexity is a barrier to the use of these instruments for companies, they try to explain how it works in terms of beneficiaries and type of financing, for example, if there is a fund or credit, which are the eligible costs. Ayming is there to help companies to use this tool and leverage on it to enhance innovation. Creative financing has also green aspects since business sustainability is not anymore a choice, but an obligation.

Generally, the Green New Deal has the Circular Economy as a key pillar and it is linked to innovation. Horizon Europe, which will be the next instrument after Horizon 2020, will be the research program helping companies in reaching funds.

At a second level, one of the Recovery Fund's missions in Italy is the green revolution and it gives guidelines on how to leverage the financing resources. Katiuscia Terrazzani concludes by saying that in Italy, we need to make this transformation more concrete with the support of governments, firms and institutions.

Luca dal Fabbro, VP Circular Economy Network

According to Luca Dal Fabbro, in terms of business, the Circular Economy will evolve in different directions. Firstly, the necessity to shorten the supply chain. As demonstrated by the pandemic, we had a shortage of supply covered by China in Europe (for e.g. masks, breathing devices).

Circular Economy Supporting Ecosystem

Moderator: **Federico Luperi**

Innovation & New Media Director at Adnkronos

One way to shorten the supply chain is to make sure that a portion of supply comes from the close areas, reducing therefore the consumption by using recycled materials could be a way. Secondly, there will be restrictions on emissions, like CO2. This is an underestimated problem in the business arena. Italy, for e.g., is the second industrial country in Europe and industries like steel, cement, paper or tides, consume a significant amount of energy and produce a lot of CO2.

The EU Commission will issue the restrictions on emissions, hence we need to foster R&D efforts and define projects to capture CO2 emissions through Circular Economy technologies. The Circular Economy will be a must and, if applied in a smart way, it could be an opportunity to make money.

The cultural change is a challenge in the application of the Circular Economy. The culture and knowledge of the Circular Economy need to be spread and communicated. On the Circular Economy, Italy is at the top as there are more circular economy companies compared to other countries. The Italian circularity index is among the highest in Europe. The reason is a necessity, as Italy is poor in raw materials, so recycling is a need. We need to create new European champions on Circular Economy and this is the aim of Luca Dal Fabbro's fund: to buy and launch Italian companies in the international arena, as most of them are national or regional.

The Circular Value Fund is the first Italian fund on the circular economy and it is the first one in the world measuring its partners by the impact of their investments on circularity. With the metrics of circularity defined with ENEA, at the purchasing moment, they measure the circularity index; when they sell a company, the circularity index should be improved according to the objectives identified before. This is the first fund paying the partners in the function of their circularity index by adopting the Environmental, Social and Governance (ESG) approach. Big companies and funds will help to move from a marketing approach, towards a more realistic and meritocratic approach to the environment. The climate change and ecosystem crisis can have worse consequences than Covid-19. A cultural change is needed and everybody should work in this direction.

Paolo Naldini, Director at Cittadellarte Fondazione Pistoletto

Paolo Naldini brings concrete examples of what they teach and learn at the Accademia Unidee.

The first example is the shifting, in the Isle of Skye in Scotland, from the economy of salmon farming to seafood and seashells. A collective and a community brought together this idea because salmon farming was totally unsustainable for the environment and the future sustainability of the community.

As the water was highly polluted, through this project, they moved to farm seashells, as they clean water. More than 10 restaurants of isle and the Tate Britain Restaurants, nowadays, don't cater anymore with salmon farms, but seafood, in this area.

Another project they are implementing in Biella is matchmaking, combining supply and demand. On one side, there are several abandoned land plots worldwide, and on the other side, there are people in need of land in order to mitigate their own sufficiency or start up a micro-enterprise. Through the creation of a database and the conditions of these land plots to be offered, free of charge, to those who need to cultivate and farm them, they created the "Let eat be" community in Biella.

The second scheme is about fashion, since Biella is the capital of the wool industry worldwide. They put together a number of companies and fashion designers engaged in sustainability under the platform BEST (bio ethical sustainable think-thank) where it is possible to find innovative and award winning ideas.

Furthermore, they are trying to keep architecture local and easily circularly. They focus on rice to build houses seismic-wise and insulating-wise in terms of temperature and sound. These are ambitious and utopist ideas, but in order to shift from linearity to circularity, we need to also cultivate imagination that is exactly what culture is concerned about. We need tools to do that, like symbols, narratives and a new language.

MATERIALS

The first Step in reaching Circularity begins with Materials

REPORT RE-THINK, MILANO 2020



Material Balance: a New Material Table without Waste

Speaker: **Ingrid Paoletti**

Scientific Coordinator at Material Balance Design

Ingrid Paoletti starts her speech presenting the research group she is leading at Politecnico of Milano: Material Balance; the balance is intended, starting from the mass equation, as a law of conservation, so the matter can be transformed, created but never destroyed. The perspective is conceiving matter as something continuously transformed and even if it changes it is not necessarily something that will become waste.

It is a completely different perspective, they are not designing and leaving something apart, but they are thinking from the very beginning of all the elements put in the design process. So the mass equation in science works like $INPUT + GENERATION = OUTPUT + CONSUMPTION + ACCUMULATION$ and the idea is that the input could be what we design, the generation is the tool we use to design and make things, the output could be the products, the consumption is the energy and the accumulation is what we have to take care of to think that it's something that stays inside the process, and the accumulation can also have a positive impact, it can be heritage, knowledge, something that stays and not necessarily waste.

In this perspective, the idea of balance is a sort of provocation. Somehow in design the idea that what we design has also a balance from a point of view of physiological impact, the symbolic impact of materials is not only a linear process where we transform matter. So the big question is "How can we rebalance this impact on earth?" There are many balances we can think of: physical/technical; physiological, performative, but also semantic/symbolic because the archetypal idea of materials can alter the idea we design and think of them; it is not only thinking of biobased because also our perspective changes as well.

Then Ingrid Paoletti showed 3 examples of the activities Material Balance carries on in the Politecnico. The first one is working with acoustic problems, anticipating the decision in the design process with computational tools but also thinking at using bio-based and natural materials. There is no just one material able to solve these problems, but a combination of materials. Acoustic is a very important for humans and how they feel in a particular environment. What Material Balance has done is trying to couple wood

materials, mainly with different geometrical shapes, with cork. The result is a sort of "sandwich" put in different chambers to understand the performances, trying to think what it would mean to use a traditional material like wood together with cork, thinking of a new possibility to work with surfaces. Putting together traditional materials that are used for performative acoustic together with an absorption material, cork, that is very easy to work with C&C machines. In this way different possibilities are put together: design and material system that can adapt to the environment, or using material that we know where it comes and that can be eventually disassembled if we don't need it anymore, in order to increase the performance of the environment. Then Ingrid Paoletti showed a picture of the surface they have worked with using the cork, thinking of how it could behave in a specific environment.

The second example is based on microalgae and concerns the idea of making an innovative indoor air quality system. This prototype was exposed at Triennale Milano some years ago. Microalgae make a photosynthesis much higher than superior plants and it is a liquid, able to be shaped as you want. What has been done is designing a sort of filter that has inside a bioreactor with microalgae that can embed the nature inside an artificial system blurring the boundaries between what you think it's natural, artificial and built environment. This is a key issue in designing like thinking that there is no real boundaries between what is built, what is natural and what is artificial because these three are merging and that is a structure that can be both indoor system or outdoor system, it compensates CO₂ and now they are testing air quality and the different types of pollutants.

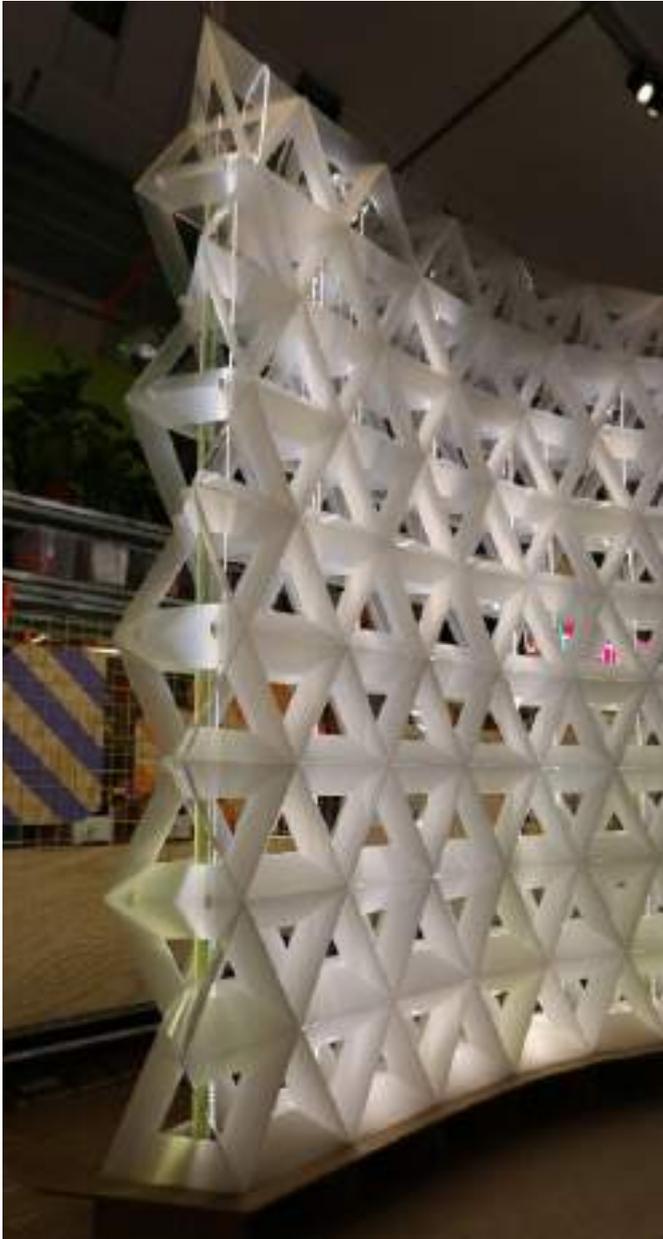
The third project concerns biobased materials, coupling them with existing possibilities of digital fabrication. The idea is to use mycelium, even though it has low resistance, coupling it with lattice structures, very resistant from a geometrical point of view. Putting these materials together their limits are compensated.

In Material Balance they always try to make some tests and measurements to understand if what they are doing has a meaning. Afterwards Ingrid Paoletti showed some minimal surfaces made of lattice half

Material Balance: a New Material Table without Waste

Speaker: **Ingrid Paoletti**

Scientific Coordinator at Material Balance Design



Img. 44
Innovative indoor air quality system - image by Material Balance

filled with mycelium. The leitmotiv is always putting together systems, ideas and also something that is already existing with something new. In conclusion Ingrid Paoletti says that they are changing the material culture and that we should foster a material culture adaptive to environmental issues that, while embedding purpose, creates a new eco-cultural niche as a guide to design continuously ready to change, thus creating unexpected and emergent material systems where everything is thought as waste from the beginning.

Overbooking of Circular Materials

Speaker: **Marco Capellini**
CEO at MATREC

Marco split his speech in 3 chapters. The first one, called **“We can’t change what we can’t measure”** is an extremely important topic that allows us to understand how the design of a product can measure the efficient use of resources. Why it is important to apply circularity measurement models? First of all, because Circular Economy must offer us tangible results in order to quantify the resources used; second, because it enables companies to define improvement strategies. Third, to communicate clearly the results obtained, fourth, to quantify the economic cycle of resources used in the context of input and output process.

As Matrec, they are developing different projects to measure the circularity of the product: furniture, fashion services, food and others with particular attention to the type of material used. Generally they face 2 problems: many companies don’t know about Circular Economy business models and they think circular economy is just recycling waste; many companies don’t know how to apply the circular economy to product or services. For this reasons, Marco has designed a roadmap that let companies get a first view of circular economy and understand which KPI should be used for a metric definition.

This roadmap could be an opportunity to understand the approaches to follow in a product circularity measurement project and choose the most coherent route to apply to products.

The best solution would be consider all these aspects but this requires a lot of time and expenses. It is important to contextualize the product step by step, trying to improve the scope of measurement. For example, it is possible to start with a qualitative approach and then move on with a quantitative approach. For Matrec, the quantitative approach is the best solution to obtain a tangible measurement result. In the first phase it is important to define the resources to be considered (materials, energy, water, emissions etc.). Which is the priority for the project or for the company? The final extent of the measurement may include just the product or also the packaging or the completed production supply chain.

In the input and output approach it is important to consider the five pillars of Circular Economy, classify and quantify the input and output resources and,

after the assessment phase, identify the critical points for improvement. The decision to certify or validate the approach can give you more credibility in the marketplace. The most important KPI for a measurement projects are the economic ones. It is essential to know if you are discussing the circular economy or circular diseconomy. In the measurement of product circularity there are many variables strictly related to product sector and type. The choice of KPI is essential for achieving functional results in the improvement project.

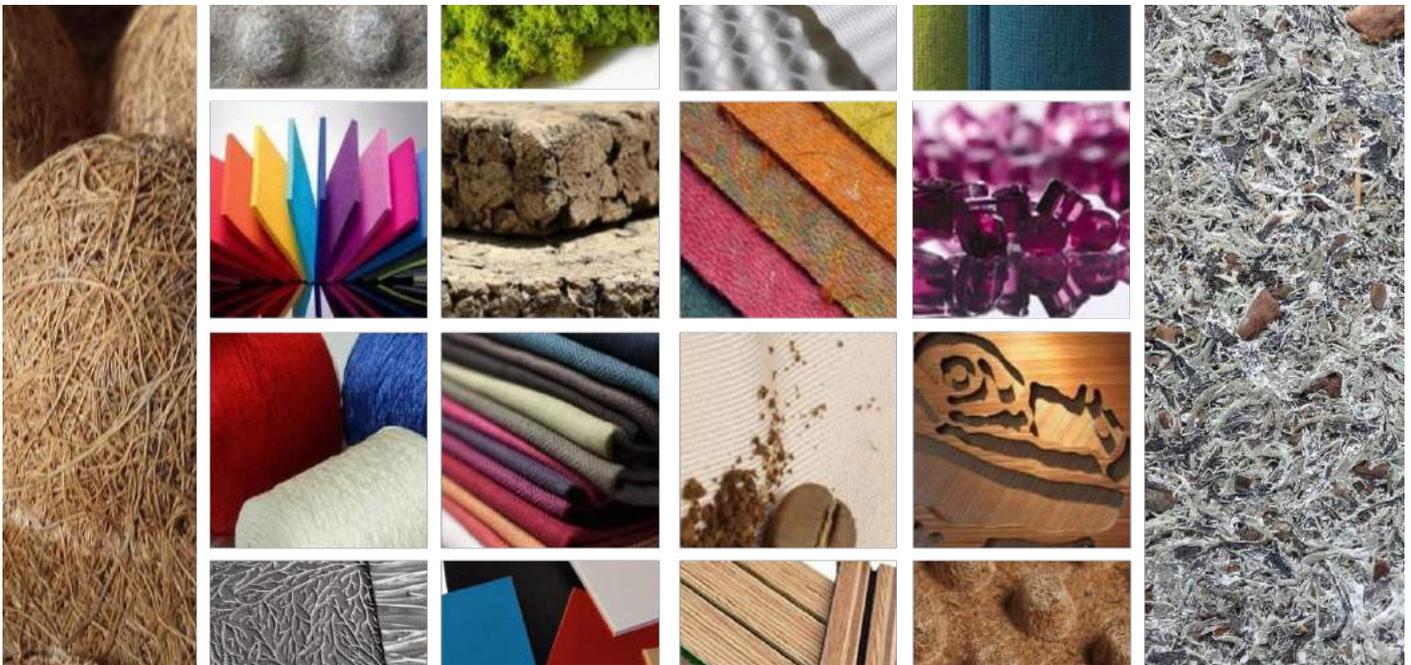
In chapter 2, called **“Materials Chef”**, Marco reminds that in recent years we have seen new proposal for circular materials, recycled materials, materials from renewable sources, biomaterials. The new material proposal in some cases takes traditional waste, shared it and mix it with binding agents; in other cases, only organic raw materials are used. All these activities are positive because they are going in the direction of a circular economy strategy. Afterwards, Marco, gave an example; for the sake of argument he stated we have 4 styles of cuisines: a cuisine of traditional materials, where the ingredients are traditional such as plastic waste, food waste, biomaterials from sugar cane; novel cuisine where the ingredients are seafood waste, egg shells, cocoa shell; a family run cuisine with handmade materials and the ingredients are a mix of traditional materials and new materials, but the commercial appeal is based only on some specific applications; the last one is the amateur cuisine that concerns the experimentation with different materials in search of results.

All of these activities are fantastic but there are 2 main problems: there are too many proposals for materials in the market. Some of these material proposals made with recycled materials or from renewable sources use binding agents that don’t let the materials to be recyclable or biodegradable at the end of their life. Can we define these materials circular? Do we need these materials? These are problems for the circularity of materials and the circularity of the product that uses these materials. Too many times a new material is designed without considering how long it will be used.

First of all, it is important to assess if we need to design this material and how it will be used, and if there is a technology that ensures its circularity at the end

Overbooking of Circular Materials

Speaker: **Marco Capellini**
CEO at MATREC



Img. 45
Circular Materials - image by Matrec

of its life.

Unfortunately, according to Marco, we can't always solve the problem we create. The choice of a material is only part of the circularity strategy and this choice has to necessarily be related to the design of the product and its end of life.

Today, before designing a new product it is essential to choose the material that ensures product circularity. At the end of the chapter 2, Marco asked himself and all the audience if in a circular world is the material that design the product or is the product that designs the material.

In the last chapter, “**Today the world is circular**”, Marco invites everyone to think about the future, imagining the first day where the world is circular. How many materials will be available in the marketplace? Will it be possible to buy something, or will all the products be available as services only?

Marco concludes his speech suggesting to look at the finishing point and decide the best strategy and the best road, but sometimes it is also correct to look back from the finishing point toward the starting point. In this way we can get a different overview of the road to be followed.

Bioplastics in the Circular Bioeconomy Perspective

Speaker: **Giulia Gregori**
 Strategic Planning and Corporate Communication Manager at Novamont

Giulia Gregori started her speech by introducing the concept of soil. Why talking about soil? Because the ambition of Novamont is to develop and ecodesign products with the idea of putting at the center innovative solutions for specific sectors, especially those more in danger and at the same time vital for our life and planet. This is exactly the case of soil as it performs a number of vital functions for life on earth but we know very well that now 33% of global soil is degraded. It is also estimated that in the past two centuries the organic carbon in soil has decreased by 8% globally. The 20% of the surface of the European Union is subject to erosion at a rate of 10 tons/ha*y. Every year in Europe there is a loss of productive land of 1000 km² and the area with a high or very high sensitivity to desertification in Europe has increased by 177.000 km² in less than 10 years. How to find solutions to this problem? An effective way can be the circular bioeconomy. As Barry Commoner said in 1971 “In every natural system, what is excreted by one organism as waste is taken up by another as food.

They think that the use of compost from urban organic waste can be a valid support for bringing the organic matter back to soil restoring its fertility. Applying compost in the soil is one of the main ways of

capturing carbon from the atmosphere and to stock it in the soil.

Nowadays in Europe, due to pollution, more than 64 million tons of organic waste is not recycled, representing a huge waste of resources and opportunities. Biodegradability could be one of the possible solutions for this problem, developing products that could give solutions in different environments (soil, water, composting) where the risk of accumulation of products could be higher. With respect to biodegradability, Novamont thinks that the correct approach is the circular bioeconomy, but also thinks that companies have an important role in society, not only developing products, but also protecting the environment and having a social impact. In 2020 they have decided to change their statute to become a benefit company and a certified B Corporation. They are international leader in the bioplastic sector and in the development of biochemicals and bioproducts obtained from the integration of chemistry, agriculture and environment.

Research and innovation are the key factors of their growth, they invest 5% each year in research and more than 20% on their people works in development and innovation activities. Patents are one of their key pillars: they have more than 1800 patents and patent applications. Their approach to circular bioeconomy is based on 3 main pillars: **reindustrialization** of no longer competitive sites thanks to proprietary technologies first in the world in order to create biorefineries integrated with the territory and interconnected with each other; the second pillar is the development of **low impact value chains** through the valorization of marginal land not in competition with food production, integrated in local areas and connected with the biorefineries; the third pillar concerns product and value chains, conceived and designed to provide **unique and sustainable solutions** for specific environmental and societal problems closely related to water and soil quality.



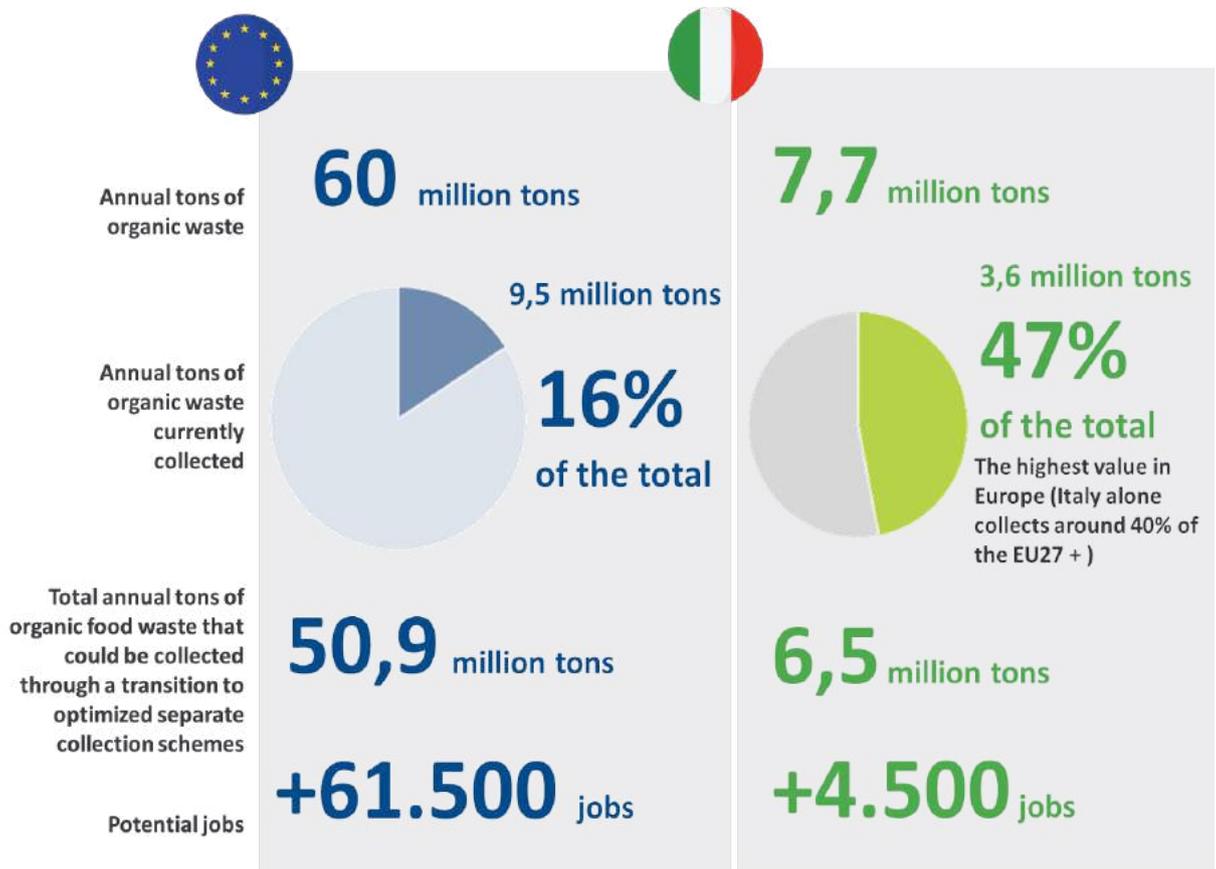
Img. 46
 Main application sectors for Novamont products’
 - image by Novamont

One of their solutions is Mater-bi, a controlled bioplastic that is a result of a constant innovation towards attaining the highest and most stringent quality standards. They checked their materials internally and in close collaboration with external international bodies to assess the renewability and biodegradability of

Bioplastics in the Circular Bioeconomy Perspective

Speaker: **Giulia Gregori**
Strategic Planning and Corporate Communication Manager at Novamont

Img. 47
Organic Waste in Italy and Europe - image by Novamont



their products according to the international standards.

The materials developed by Novamont are employed in specific application sectors. Their most recent result, attained in collaboration with strong industrial players at the Italian level, is the first multimaterial packaging for long-life food products, with a high barrier effect to oxygen and water vapor. The replacement of this kind of food packaging with compostable solutions brings a benefit in terms of better management of food waste both within large-scale distribution and in the domestic environment. It is therefore possible to have high quality performance and a positive environmental impact. In this way, Italy can really play an important role at the international level.

Recover Ingredients: from Food By-products to Cosmetic Ingredients and Plant Fertilizers

Speaker: **Alessio Adamiano**
Associate Researcher at ISTEC CNR

Alessio Adamiano and Michele Iafisco are the co-founders of the startup named Recover Ingredients where they research, develop and produce innovative materials from the Circular Economy of food by-products that are able to replace materials that generate environmental concerns both in the cosmetic and the agricultural sectors. The presentation is divided in two parts, the first regarding **Circular Cosmetics Products**, and the second regarding **Circular Agronomics Products**.

Starting from the circular cosmetic products. According to Alessio today's consumers' awareness is at its historical peak, particularly in the cosmetic sector where the demand for green and natural products is constantly growing. To meet this demand, cosmetic companies are constantly looking to replace synthetic ingredients in their formulas with new and natural ones. Some of these products contain some of the most critical ingredients whose replacement can result to be very difficult due to the lack of natural alternatives.

He proposes the example of **sun care products** where the active ingredients, the so called the UV-filters, are considered dangerous for human health by FDA and ECHA. According to these agencies 3 out of 4 sunscreens on the market contain chemicals which are potentially dangerous to people's health. These chemicals can be dangerous for the environment as well, especially on coral reefs. In this perspective several nations have started to ban the use of sunscreens and sun-blocks from their territory (e.g. Hawaii).

Another ingredient in urgent need of replacement is microplastics. Here Alessio refers to small plastic particles intentionally added in personal care products as technical ingredients. However, from 2020 the ECHA strictly banned from Europe microplastic in the cosmetic sector and there is the will to enlarge the ban to all the synthetic polymers by 2025 as well. This means that a great amount of materials is in need of a quick replacement but there is not a valid natural and sustainable alternative yet.

So, differently from macroscopic plastic waste, such as plastic bags floating on the water surface, UV-filters, microplastics and internal polymers in cosmetics are invisible. It is a similar situation as the Iceberg,

Alessio says, where the underwater invisible part is much larger than what is visible. Indeed, microplastics are a much bigger threat to our health and to the environment as well especially to the marine environment which could be now recognized as the sink of all these produced chemicals. Moreover, Alessio continues, it is mainly in the marine environment that the invisible chemicals contained in the cosmetics can damage a precious ecosystem like a reef. This could also result in a bioaccumulation of chemicals in the trophic chain and come back to us as food. This is the reason why at Recover Ingredients they research, develop and produce natural cosmetic ingredients from the circular economy of marine biomasses.

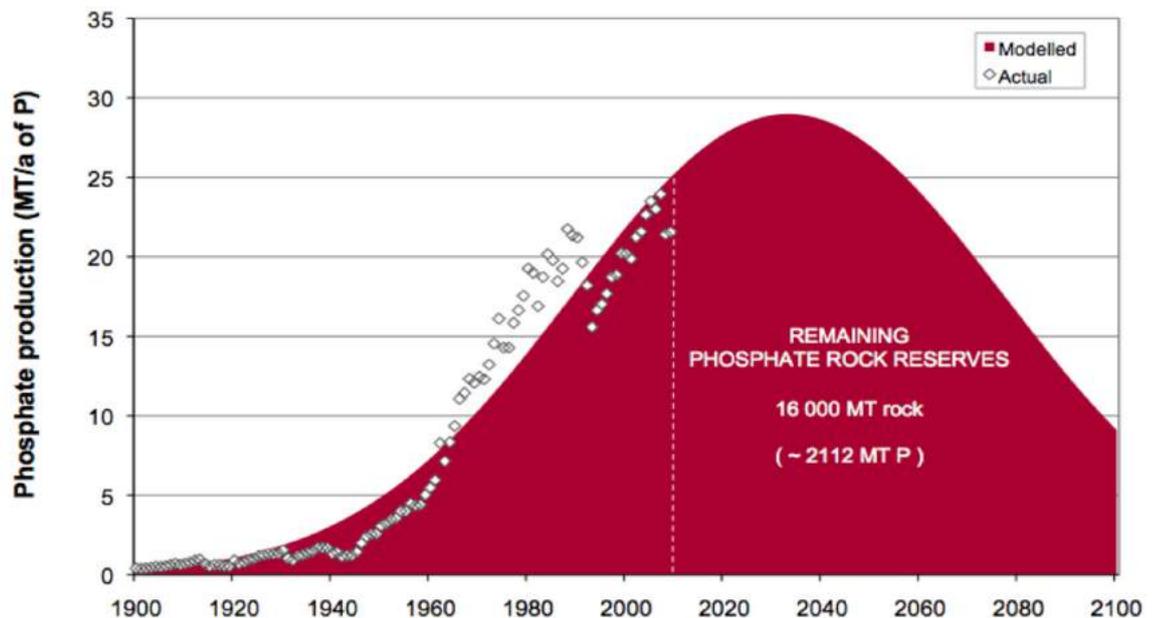
The Recover Ingredients philosophy is "**From the sea to the sea for the health of the consumers**". Indeed, the material they propose emerge with high eco and bio-compatibility with a safety profiling line with the most stringent International standards and with high cosmetic performances. Another reason that encouraged Recover Ingredients to use **marine biomass** is that great part of it is neglected from valorization processes. He proposes fish as example of it. In fact, as Alessio claims, only 40% of fish is consumed as food while the other 60% is used as by-product that goes to the pet and feed industries. However, in this by-product, there is a great quantity, up to 100 kg each tonne of fish, of high purity minerals, high purity of Calcium Phosphates which get completely wasted when used for animal food industry.

Similar is the case of seashells for which their by-products are not marketable (e.g. broken shells, too small or long time dead) and end up directly in the landfills. This means, as in the case of fish, that per every tonne of seashells 300 kg are considered as by-products and are landfilled. Once again, this results in a great amount of calcium carbonate that goes completely wasted. Alessio insists in talking about "wasted" because, as he highlights, poor synthetic Calcium Phosphates and Calcium Carbonate are already employed in the cosmetic field, so with a very high added value application. This is why they, as Recover Ingredients, have developed **MarineBoost**, a full natural calcium phosphate extracted from fish bones able to boost the sun protection factor (SPF) of any sunscreen formulation.

Recover Ingredients: from Food By-products to Cosmetic Ingredients and Plant Fertilizers

Speaker: **Alessio Adamiano**
Associate Researcher at ISTEC CNR

Img. 48
Phosphate production -
image by Recover
Ingredients



This ingredient has already been used in several formulations and their tests show that MarineBoost is capable of increasing the SPF factor of a formulation from medium to high while at the same time it allows to decrease the amount of UV filters inside the formulation.

The second product that Recover Ingredients has developed and Alessio Adamiano has presented is **SeaPowder** which is produced extracting calcium carbonate from marine shells with a high level of purity. Definitely higher than the one extracted from ore deposit for example. This material can be used as a technical ingredient to replace synthetic polymers in cosmetic products and Recover Ingredients is constantly testing its cosmetic performances and formulations so the TRL (Technology Readiness Level) is a little bit lower in this case.

The market for these two products by Recover Ingredients would be the global market of cosmetic product and the target is the UV filters and the synthetic polymers sectors that combined have a big share of the cosmetic ingredients market sector, with around 5% CAGR over the last three years. With MarineBoost and SeaPowder they aim to gain a 1% share of this market at the end of year five.

The main philosophy of Recover Ingredients founders is “think global but act local”, and indeed, Alessio

claims, Italy would be a great place to start a business in the cosmetic sector as it is the leader in the production of cosmetics with a very high number of subcontractors. Only in Lombardy, he says, there are 450 companies generating each year revenues of around 4 billion and every year they spend a considerable amount of money in Research and Development of new products and to innovate the products having consumer perceptions and new regulations as principal drivers. At this point Alessio Adamiano changed the subject and started presenting the other products that Recover Ingredients are developing based on food by-products for a **Circular Agronomics perspective**.

Even for this field a bit of background is necessary to understand the need of a Circular Agronomics. Indeed, our planet lived a population boom over the last 50 years and, according to FAO, global population will exceed 10 billion people by 2060. This means that food production systems will be under pressure like never before and first among all the agricultural sector which is our primary source of food. However, Alessio noted that the agricultural sector has already been under pressure for over the last 50 years by now and now this increased production has come about by resorting to intensive agriculture which consumes enormous quantities of fertilizers. Here is when the problems come out, because intensive farming wastes actually a lot of fertilizers and is deficient from

Recover Ingredients: from Food By-products to Cosmetic Ingredients and Plant Fertilizers

Speaker: **Alessio Adamiano**
Associate Researcher at ISTEC CNR



=



Img. 49
Smart P-based fertilizer - image by Recover Ingredients

the point of view of mass flows. This is evident when looking at the global trends of Nutrient Use Efficiency which is the efficiency with which plants use fertilizers. Over the last 50 years this efficiency has dropped and we have been facing the consequences of such drop, deforestation, intensive use of agrochemicals, algae bloom etc.

A particular role is played by phosphorus which is one of the three main primary nutrients of plants. And why is phosphorus so critical then? Because half of the world's agricultural soils are deficient in this element therefore it is not possible to grow anything without using a P (phosphorous) based fertilizer. A second problem is that phosphorous resources are disappearing and they are not renewable, as the main source of phosphorous is from ore deposit and the peak of phosphorous production is already expected by 2030.

However, in the recent past the price of phosphorite, the rocks from where phosphorous is extracted, has already experienced strong increases like in 2008 when the price of these rocks grew by 70% in just 14 months, pushing some nations, like China, to put huge export tariffs on phosphorous. Furthermore, the majority of phosphorous sold in the world comes from only one country, Morocco, creating a strong dependence among countries like the ones in the EU

which barely have this resource in their territory. As a consequence, it is fundamental to develop a circular economy of phosphorous. In this respect the main sources of phosphorous from the Circular Economy are three: manure, sewage sludge and meat and bone meal. What is the difference between these 3 resources of phosphorous? First of all, the quantity of phosphorous that is already recycled. For instance, the amount of recycled manure is already 100%, sewage sludge 40% and meat and bone, instead, very low about only 6%.

However, the most important distinction that makes this difference in recycling even more critical is the content of phosphorous in each of it. Indeed, in manure it is very low just around 1-3%, sewage sludge almost 4% and meat and bone meal up to 15% (five times higher).

We should also remember that meat and bone meal are a high pure resource of phosphorous so the level of contaminants is very low especially heavy metals. So, why are meat and bone meal less recycled than manure? Because bones need longer period to degrade so the release of phosphorous will be slower as well which makes it not available for plants. Therefore the majority of animal bones are incinerated to ashes and this causes an additional problem, in fact phosphorous remains in the ashes and one part of it is

Recover Ingredients: from Food By-products to Cosmetic Ingredients and Plant Fertilizers

Speaker: **Alessio Adamiano**
Associate Researcher at ISTECCNR

extremely soluble and is quickly washed out by rains from the soil and causes pollution problems such as water contamination, algae bloom and others. The remaining part is instead highly insoluble and feeding the plants with this phosphorous soil would lead to a progressive loss of soil quality, once again an environmental problem.

This is why Alessio and Michele, the Recover Ingredients team, developed Smart P. It is a material obtained from the conjugation of hydroxyapatite, synthetic or natural, with humic acid, synthetic or natural. Smart P is a phosphorous based ingredient for the production of NPK fertilizers that owns the ability to release phosphorous in a time fashion manner exactly when the plants need it. The shell of humic acid in fact is able to mobilize the phosphorous of the bones in the soil and makes it bio-available for the plants. Moreover, thanks to the shell of Humic acid Smart P interacts positively with plants and modulates the release of nutrients according to the vital cycle of the plant itself. According to their experiments on corn plants Smart P has a much better performance than traditional P fertilizer at already half the concentration.

Alessio showed a bar chart where Smart P is compared to a product highly used in agriculture, Superphosphate, supporting the positive results of Smart P. In a last experiment, salt was added to the soil, to put corm plants under stress. In this condition the benefits of Smart P with respect to the traditional P fertilizers are even more evident. Finally, Smart P can work in conditions in which traditional fertilizers could not.

The market for Smart P is the “Speciality” fertilizers Market. Another application of Recover Ingredients material, and in particular calcium carbonate extracted from shells, calcium is the photoprotection plants. Due to climate change, for instance, farmers in North of Italy, France, Spain and other parts of the world have a huge need of protecting the vineyard during the hot season. In fact, it should be considered the frequency of heatwaves are already causing a great loss of grapes and it will double by 2050. And we can use Calcium carbonate not only on grapes but also on fruits to protect them from sunburns.

Recover Ingredients roadmap: CNR spin-offs, two pa-

tents pending, proof of concept of our materials.

Recently CNR approved the foundation of the company. Right now they are closing a deal with a big Italian chemical group for an equity investment, and in the future they aim to build their first pilot plant for the production for the materials. After that, they will certify and commercialize their products.

Rice for Architecture

Speaker: **Alessio Colombo**
CTO & Co-Founder at Ricehouse

Alessio Colombo starts his speech by presenting Ricehouse, which was first founded as a start-up company in 2016. However, already in 2019, 15 of the materials they produce were introduced in the European market, 2 patents application were obtained and so far, 90 construction sites have been using their materials. In 2020 Ricehouse has become a Benefit Corporation that is able to address final positive impacts on society and on the environment and in September 2020 Impact Hub (world's largest network for Impact at scale) and Riso Gallo (one of the largest rice mills in Europe and among the oldest Italian rice growers) invested in the company.

Finally, over the last years the company has received numerous prestigious awards at the European level connected both with the technical characteristics of the materials, the circular approach and the overall engagement of the company.

Ricehouse was born in Northern Italy in order to tackle the problems deriving from the building and construction sector. This is, indeed, responsible for 40% of the energy consumption in Europe, the generation of around 36% of CO₂ emissions and of 1/3 of all the European waste. Moreover, according to the Sick Building Syndrome (SBS) around 40% of all the materials used in the construction sector are categorized as hazardous.

The main idea of the company was developed when looking also to another local problem, since they are located where 90% of the Italian rice is produced and here they noticed that every autumn rice fields are burned creating a great amount of CO₂ emissions. This is the reason why the company decided to talk with local and rice processing farmers in order to study and understand how what was considered as a problem could actually become a source of value. In fact, the Ricehouse team found out that from 1 hectare of rice cultivation, seven tonnes of rice, part of which is later eaten, and ten tonnes of by-products like rice, straw, husk and clay are produced. The point is that all the residues generated from rice cultivations need to be dismantled every year anyway.

It is in these by-products that Ricehouse saw the opportunity to create 100% natural construction materials to build an entire house.

A wholesome house that derives from nature and at the end of its life will return to nature in a circular way. As most people know rice is the most consumed food globally, it grows in all the 5 continents and in more than 130 countries, which means that the potential of its by-products is incredibly enormous. However, the by-products are barely used in the sector due to their very low calorific value. Simply taking a look to the Italian case, for instance, there are 230.000 hectares of rice fields cultivated every year and according to Ricehouse calculations this could result in around 50 million total square meters of buildings that can be constructed yearly.

Therefore, Alessio together with the Ricehouse team have been developing products which are necessary to compose an entire house. Among these there are, for instance, insulation materials based on rice, straw and husk; plasters; finishings for internal and external use; creeds and panels.

The proposed materials have a high thermal insulation performance, high inertia to fire, high durability and high acoustic performances. The finishes are highly aesthetical and adapt to all the types of species. Furthermore, Ricehouse materials are easy to pose in fact they use traditional construction methods. Thanks to this innovative idea the company has created a new form of economics on a social level by transforming possible wasted by-products into a new source of value.

All the materials produced by the company are 100% natural, formaldehyde free and derive from the short supply chain. In fact they come from the rice field and can be used not only in the construction sector but for the design and fashion sector as well. The circularity of these materials continues at the end of their service life when from the construction site they can be transformed into compost or used for the creation of energy.

Ricehouse mission is also aligned with 8 of the 17 SDGs (3 Good Health and Wellbeing; 8 Decent work and economic growth, 9 Industry Innovation and Infrastructure, 11 Sustainable cities and communities, 12 Responsible Consumption and production, 13 Climate Action, 15 Life on Land, 17 Partnership for the goals) and it is constantly divulgating their work through

Rice for Architecture

Speaker: **Alessio Colombo**
CTO & Co-Founder at Ricehouse



Img. 50
Example of a Ricehouse installation - image by Ricehouse

webinars and public events.

Taking a look at the company business model, Alessio underlined how they consider themselves as a focal point between farmers, industrial and commercial partners and how through quality protocols they are able to coordinate the whole supply chain. Moreover, the company is able to commercialize both the single product that is patenting and branding in the name of Ricehouse and, on the other side, through the collaboration with industrial and commercial partners the entire passive Ricehouse under the brand RISORSA too.

As mentioned above, RISORSA is a brand of Ricehouse and is considered just like a near zero energy building “rice” house which has been conceived as a natural ecosystem and durable in time. Up to now the company has been able to construct 16 RISORSA houses, the majority of which in Italy and one in Switzerland. Their approach to RISORSA is inspired to the one of MUJI HUT.

Some of the clients they are working with are international companies in the energy sector like A2A and TERN, the advertising sector like IGPDecaux and in the rice production sector with Mundi Riso. From the fashion sector there is Save the duck and from the furniture sector there is PORRO. In addition, Ricehouse is also engaged in projects for new and residential buildings and in the activity of renovation of public buildings.

To conclude, a final project on which Ricehouse is focusing is the development of 100% natural construction materials for 3D printing with the clay based patented material which resulted in a first house worldwide almost entirely printed with natural materials.

What do a Pencil and Fashion have in Common?

Speakers: **Susanna Martucci**, Founder Alisea -**Perpetua**
Alice Fortuna, Sustainability Communications Manager at WRAD Focus Design

Susanna Martucci is an entrepreneur whose job is to extend the life of materials. She has always worked in sales and communication and after 12 years of experience in a large Italian company, in 1994 she founded her own: Alisea. She was in the business of creating promotional “gadgets” made in Italy. However, a little over a year, products made in China arrived on the market and competing became impossible because they had unbeatable prices and looked exactly as the products she was making. She was risking of going out of business and leaving 20 people unemployed.

One day of that same period she found herself in a bar where an acquaintance gave her a small notebook as a gift. When she opened it she read “no trees has been cut down for the production of this notebook”. This suddenly took her back to 1982 when she was on a train and by her side two university professors were having a conversation: “we are all sitting on a huge landfill, it’s a ticking bomb, a huge problem for future generations but also a great business opportunity for those who will be able to seize it”. However, in 1982, in Italy, nobody had a clue what household waste recycling actually meant.

Then, the intuition to avoid the Chinese competition came. She asked herself: “Why don’t we give a new life to waste?”. Therefore, she started speaking to her clients’ marketing departments and asked to see the waste their companies were producing. Thanks to the production managers she could walk through their production processes and she could learn about the technical data sheets of the materials.

This is the moment when at Alisea they realized how, through creativity, all waste could become the protagonist of a fascinating story to tell. In fact, it was 1996 and from that intuition Alisea found a unique collocation on the market, becoming the only operator in Italy that has made of the recycling and reusing of materials a form of corporate identity.

In the last 25 years Alisea has really worked with all sorts of materials: dismissed car tires, car reflectors from the automobile industry, disposable tableware and post-consumer plastic bottles. They have recovered tons of printed paper, crazy amounts of PVC used for advertising billboards and wasted textile materials from the processing of awnings.

All these materials have been repurposed to create hundreds of objects for the home, office and personal use, not only limited to B2B world but also to B2C. Through their creative processes they have been able to generate numerous advantages for all the players involved: for the people at Alisea, for their clients, for the entire supply chain of their suppliers and above all for the environment and for people, by keeping materials out of landfills and into the value chain through a circular approach to design.

Fast forward to 2012. Susanna received a phone call from Cristina of Tecno E.D.M., a Turin-based company that manufactures graphite electrodes and produces 15 tons of graphite powder waste per year whose inevitable fate was the landfills. This is when Susanna asked herself, what can we do with this material and how can we extend its life? Back then, the only thing she knew about graphite was that it is usually used to make pencils. Therefore, she started studying and learning with Vittorio, CEO at Tecno E.D.M., everything about this fantastical material. For instance, in addition to being a pigment and having writing properties, it is also an excellent electrical, thermal and acoustic conductor; it is an abrasive but at the same time a lubricant and it acts as a protective shield against electromagnetic waves.

Susanna decided to look for a pencil manufacturer who could help her create a pencil based on Tecno E.D.M.’s wasted graphite powder. This is when she decided on becoming the only pencil manufacturer in Italy: an incredible opportunity for Alisea and for their clients, as long as the pencil becomes a manifesto that speaks of innovation, change, sustainability, design and future.

Like a daughter, after nine months, Perpetua the pencil was born, not a simple pencil but a disruption in an industry that has created pencils in the same exact way for hundreds of years. Perpetua is a beautiful black monolith, no tree has been cut down to produce it, it does not use glues or varnish, it does not get your hands dirty when you use it, if it falls it does not break and is made of 80% recycled graphite, saved from the landfills.

What do a pencil and fashion have in common?

Speakers: **Susanna Martucci**, Founder Alisea - **Perpetua**

Alice Fortuna, Sustainability Communications Manager at WRAD Focus Design



Img. 51
Perpetua - image by Alisea

Alisea patented both the material with which it is made – Zantech - and the production process and they deposited the design of the architect Marta Giardini, as she created Perpetua with a flat side so that it wouldn't roll away when placed on an inclined surface. Perpetua has been a starting point that encouraged Susanna to rethink the way she worked. It encouraged her to do research and to explore the extraordinary characteristics of graphite.

While talking Susanna jumps to 2015 when she was taking part to an event where entrepreneurs, companies and start-ups talked about the “concept of time”. During the event she got struck by one of the last speeches. A young oncologist from the University of Padua says: “The time in my profession is very different from what we have been talking about today. We measure the time that remains, the time none of you ever think about”. Another bullet to the heart.

Up until that moment she had been focusing on extending the life of materials. But what about her time? At the time she was 57 years old, with a huge wealth of connections and knowledge and she understood that it was the right time to share it. Therefore, she began looking for someone to share all this knowledge with, an entrepreneur or a businesswoman who had the same entrepreneurial DNA as she.

This is when she meets Matteo Ward, 27 years old,

with an incredible career in an important and iconic multinational fashion brand who just quit his job to pursue a dream. His dream is to change the fashion industry starting from education. She recognized herself in him and decided to help him in his project and to open the doors of her company and experience to him and his team. That chance today became a focus design company and innovative start-up whose name is WRAD.

WRAD is then presented by Alice Fortuna (Sustainability Communications Manager at WRAD Focus Design). WRAD is a focused design company dedicated to catalyzing positive change through education, innovation, design and communication. Indeed, when Susanna and Matteo (CEO and Co-founder of WRAD) met the only question she asked him was: I have tonnes and tonnes of wasted graphite powder that I am trying to get out of Italian landfills by producing pencils, but with 15 grams per pencil I will never make it, so, is there a way for you to use this incredible material in the textile industry?

This is the moment when WRAD took the leap and started doing some in depth research about the possible applications of graphite powder to the textile industry. Surprisingly, they found out that Romans used to dye textiles with a dark and precious mineral which was graphite.

What do a pencil and fashion have in common?

Speakers: **Susanna Martucci**, Founder Alisea
Perpetua Alice Fortuna, Sustainability Communications Manager at WRAD Focus Design

Their research also revealed that, in a small town in Southern Italy named Monterosso Calabro, there used to be a graphite mine and that the local old women had the tradition of dyeing textiles with graphite powder. Therefore they went to Monterosso Calabro and met these women who have kept teaching this method through family generations for years. For this reason, the WRAD team decided to spend some days with them and to learn about the traditional dyeing technique. They took the knowledge and reinvented it in a new circular economy dynamics using the same graphite that Susanna recovered for Perpetua.

After two years of research and development, Perpetua together with WRAD patented a new material called G_Pwdr technology, a dye that uses wasted graphite powder otherwise destined to landfill as a substitute for chemical pigments.

The first product that has used this technology is the GRAPHI-TEE which is the first t-shirt dyed with recycled graphite powder. GRAPHI-TEE has quickly become a symbol of how tough symbiotic approaches, through partnerships and through a common objective there is the great opportunity to activate very interesting synergies that can give life to objects which have never existed before.

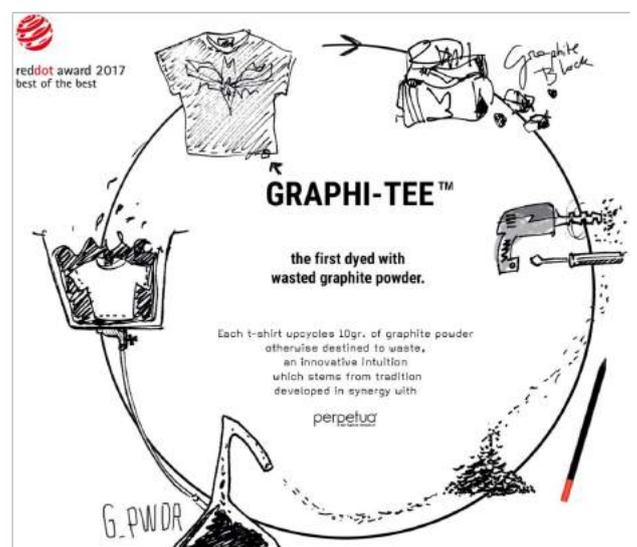
Therefore, what has the project given life to so far? GRAPHI-TEE has been the first object born from what is now called the “Endorsed by Perpetua” program. Through this program Susanna’s company opens the

door to whoever (architects, painters, entrepreneurs etc.) has interest in further studying, exploring and developing the opportunities that can come from this material. In addition, Susanna provides her 25 years of expertise, knowledge and contacts to make sure that new objects can actually be developed and produced starting from the recycled graphite powder.

For instance, a company is using recycled graphite as an ink for printing, another one is developing glasses made with the same material as the pencil so, in this way, the person who is wearing the glasses don’t get marks of graphite on his/her face and hands and at the same time if she/he is in a bar and needs to write something down could easily use the glasses as a pencil.

This case shows how, with a different mindset and a different approach to design, to creativity, to materials we are able to create completely new objects and also to generate a lower environmental impact. Alice concluded her intervention with a Renzo Piano’s quote that goes “It is the young people who will save the planet. Young people are the messages we send to a world we will never see. They do not climb on our shoulders, we climb on theirs, to get a glimpse of the things that we will not be able to see or live”.

Img. 52
 Graphi-Tee
 - image by
 WRAD



The Lightness of Marble

Speakers: **Francesca Pievani** and **Alice Zantedeschi**
Co-Founders of Fili Pari

How could marble be light? This is the question Francesca Pievani and Alice Zantedeschi, Co-founders of Fili Pari tried to answer with their presentation. Fili Pari is an innovative start-up born from the desire to create a new deep connection between the Italian territory and the textile sector and Fili Pari concept starts from the marble, a natural typical element of the Italian territory.

Since ancient times marble has been used in art, architecture, design and represents a cultural, economic and geological heritage. It can be considered as a symbol of beauty and “Made in Italy” in the world. In form of powder marble is usually used in the chemical, cosmetic, pharmaceutical and food industry due to the calcium carbonate contained in the stones.

However, marble was never used in the textile sector if not as an aesthetic inspiration through a print that reproduces the veins of the stone. On the other side, there is the stone industry that manage a great

amount of material with a consequent impact on the morphology of the territory and on the local and global environment. For instance, in Italy, every year, the stone industry produces more than 3 million tons of leftovers with a high costs of disposal and the necessity to find a new solution. As a response to that Fili Pari was born.

The company has developed cutting edge technologies for the enhancement of marble powder by transforming waste into an opportunity and in full respect with the circular economy.

Therefore, Fili Pari has activated a cross synergy between two sectors that have never communicated with each other before in order to create materials that can be used also in different fields. On one side there is the stone industry and on the other the textile industry with the purpose of creating a new material that will be applicable to other sectors as well.



Img. 53
Marble - image Fili Pari

The Lightness of Marble

Speakers: **Francesca Pievani** and **Alice Zantedeschi**
Co-Founders of Fili Pari



Img. 54
Fili Pari application sectors - image by Fili Pari

They, as Fili Pari, patented MARM\MORE, a waterproof, windproof, breathable and abrasion resistant semi-finished product that could be coupled with any type of natural, artificial or synthetic fabric. The technology is also suitable as an external layer of the garments.

Why choosing marble then? There are many reasons that pushed Francesca and Alice to think of marble in such an innovative way. First of all, the color, because the color depends on the marble they choose and marble gives a completely natural color replacing the use of chemical agents that are harmful to the ecosystem. Second, marble improves the abrasion resistance performance because with MARM\MORE if abraded it does not polish like the classic membrane on the market. Last but not least, the soft touch, because thanks to the calcium carbonate the material has a very soft touch feeling.

Each of these sectors has its specific requirements and needs several months of research and development to bring MARM\MORE to the requested standard. By now Fili Pari has planned to introduce

MARM\MORE in interior and footwear sector already next year.

Finally, Fili Pari is incubating in POLIHUB which is the startup accelerator of Politecnico di Milano and is also a partner of the company. They won several awards such as the Worth Partnership Project which is a European contest, they were finalists at Premio Marzotto in 2018. Fili Pari project and story have obtained visibility and have been published in various magazines and television channels as well.

Design with a Future

Speaker: **Arendse Baggesen**
Co-founder of SMALLrevolution

Arendse Baggesen starts his speech by presenting SMALLrevolution, a Danish start up that works with recycled plastic and transforms recycled plastic in a nice design. The point is that plastic production has increased rapidly so if we continue this way we will produce around 600 million tons of plastic waste by 2034 and, as Arendse says, this is a terrible outcome. For instance, in Denmark they produce 300.000 tons of plastic waste and only the 15% is being recycled. It is horrible with respect to the environment and the planet so it is necessary to change this curve of new plastic production and to innovate and increase the amount of recyclable plastic.

The solution they developed is more a little revolution! They designed a hybrid company where they can give to plastic waste up to seven lives. They do that by transforming plastic waste into elegant and cool circular design and they enable companies to turn their own plastic waste into design products.

Who is behind SMALLrevolution? Arendse is one of the founders and she has a background in political science and works with strategy and policy development within the UN but also with the Danish Central Administration and the Ministry for business. Together with Arendse there is Mie as co-founder. Mie has a background in sociology and communication and works with city planning, design and project management.

During the intervention, Arendse presents one of the objects created by SMALLrevolution, a small stool made 100% of recycled PE plastic. It is made out of rotational molding and it is one-piece product which means that there is no mixing of various types of plastic because in this way they want to be sure that the product can be recycled once again even if not for being a stool again. It is also a very robust design which got certified for playgrounds so that kids can also play with and on that and it will not get destroyed.

In addition, at SMALLrevolution they know exactly the origin of the plastic waste used. What is amazing with recycling plastic is that there are already qualities within the original product so, for instance, there are UV-filters and pigments in the original product, and when you understand those qualities you can actually develop new products that suit well to those

qualities. Therefore, SMALLrevolution does not add any pigments or colors to their products in fact they are 100% recycled plastic making it a completely circular product and design.

What makes SMALLrevolution unique is that they are always trying to reduce their CO2 footprint and their clients' and companies' CO2 footprint. Moreover, they know that when 1kg of plastic waste is recycled the generation of CO2 emissions will be half that when producing virgin plastic. They are the first design company to guarantee 100% circular production, they know the origin of the plastic, they have a scalable production and they have been able to make circular production profitable. With this startup they can show that circularity and profit can actually go hand in hand.



Img. 55
Recycled Plastic - image by SMALLrevolution

Their next big step will be the development of a more digital platform by firstly creating QR codes for every product in order to know exactly what the product is and it is made of and where the plastic waste comes

Design with a future

Speaker: **Arendse Baggesen**
Co-founder of SMALLrevolution

from so that customers are able to get this info as well. Therefore, they will know the traceability of the products.

At the moment at SMALLrevolution they are developing podiums that will be available from 2021 and will be available in all the major boutiques and shops around Europe. Moreover, they will move towards new production methods with the aim to make sheets as well so they can create thin products. However, what is the most important thing for them is that they will go from “Nice to have” products to “Need to have” products such as for refugees camps or emergency areas where they can make smaller shelters or provide something that is actually needed and not being just a circular design company.



Img. 56
SMALLrevolution product - image by SMALLrevolution

The New Porous Carbon Material “Triporous™” - Made from Rice Husks and its contribution to solving Social Issues

Speaker: **Seiichiro Tabata**
Triporous Technology Leader at Sony

Triporous is a brand new porous carbon material Seiichiro and his team developed from rice husks, and during his presentation he explained what it is and how it can contribute to social issues.

First, what is Triporous? In 1991, Sony commercialized lithium-ion batteries for the first time in the world. Triporous was developed in the process of exploring new electrode carbon materials for lithium-ion batteries. In the project, they were looking for biomass containing silica as a raw material. They had a lot of knowledge about the procedure of artificial high-performance porous carbon for battery derived from resin/silica nanomaterial.

That is why, they decided to focus on rice husk as a raw material. Taking a look to the manufacturing scheme of Triporous from rice husk it is important to highlight that a large part of rice husk, about 20% of the total weight, is silica. Therefore, they have to carbonize the rice husk, and then, etching the carbonaceous material off silica by a basic solution. Then, the porous carbon gets activated by steam, and finally, results in the generation of three kinds of pores. By the way, sodium silicate generated from this silica removal process and they recently used it to develop a new functional material called “Zeolite”.

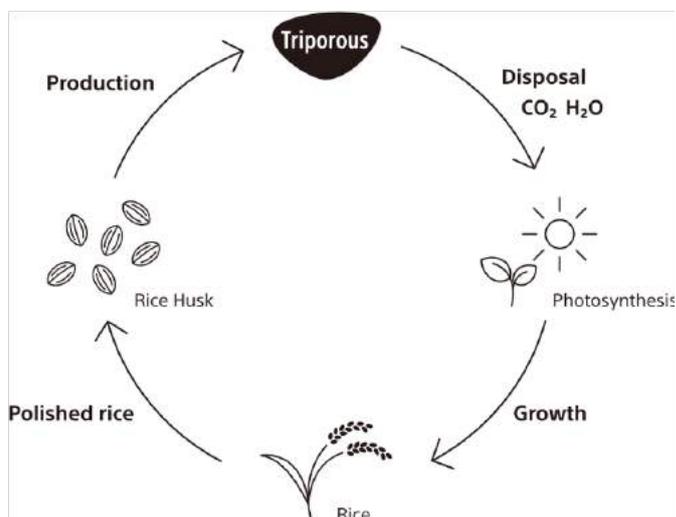
Triporous has not only mesopore but also a unique large macropore. Conventional activated carbons doesn't show large pore structure as Triporous does. Conventional activated carbon mainly consists of micropore below 2 nm. However, Triporous has 3 kinds of pore, micropore, mesopore and macropore and this is why they named it “Triporous”.

When looking at Triporous, it is visible the presence of larger “macro” and “meso” pores which in typical activated carbon, derived from coconuts husk, are not as large. Microscopic pictures also clearly indicate the difference between the pore structure of Triporous and the conventional activated carbon.

One day, Seiichiro discovered unique adsorption phenomena from Triporous. He shows a picture in which it is visible the dye adsorption experimental after the addition of various materials. There is an aqueous solution containing dye before the addition of materials. The ones in which they added conventional

activated carbon remained blue. However, the solutions were Triporous was added, became transparent, completely clear.

After the discovery of unique adsorption phenomena of Triporous, their goal changed from investigating new electrode materials to developing a new adsorbent material. Their new mission at the time was to provide people and society with a comfortable life with Triporous that can purify water and air.



Img. 57
Triporous process - image by Triporous

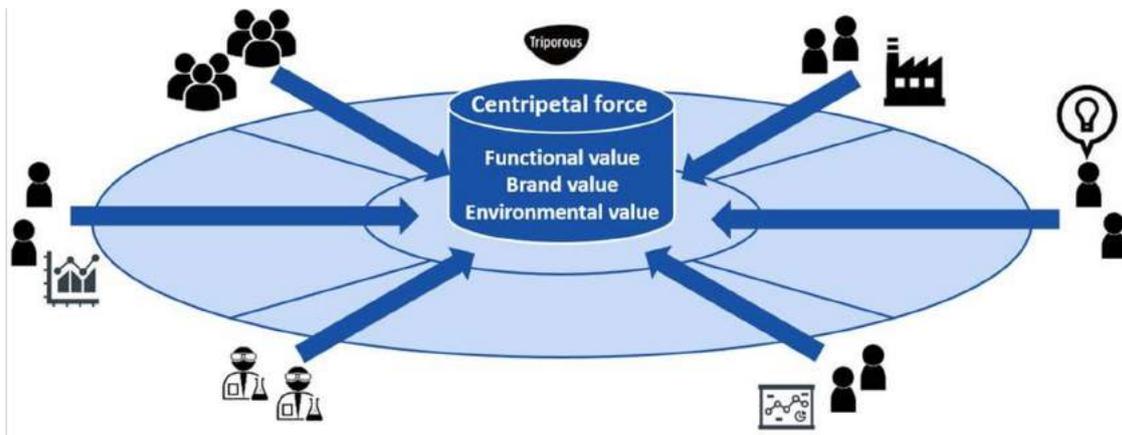
Indeed, Triporous has three unique adsorption properties. The first unique property is quick adsorption. A comparison of adsorption of ammonia gas and dye molecule between Triporous and activated carbon showed that Triporous adsorbs ammonia gas responsible for body and pet odors six times faster compared to activated carbon.

Second, Triporous can adsorb organic substances of various sizes. In fact, Triporous adsorbs over twice as much high-molecular weight organic pigments and 3 to 8 times more allergens than conventional activated carbon. They were also able to confirm that it is capable of removing more than 99% of viruses and bacteria.

The third property of Triporous is large volume reagent impregnation. Triporous filter indicates more than twice the service life of activated carbon when used in air purifiers and for industrial filters.

The New Porous Carbon Material “Triporous™” - Made from Rice Husks and its contribution to solving Social Issues

Speaker: **Seiichiro Tabata**
 Triporous Technology Leader at Sony



Img. 58
 Open Innovation of Triporous - image by Triporous

Some cases, in which Triporous has been used, are a detergent from a Japanese pharmaceutical company, a body-soap, the air purification in the showcase of founding prospectus of Sony and for the preservation of a cultural property of world Heritage Byodoin Temple in Kyoto. More recent applications of Triporous are on parker and sox, keeping the cloth free from smell and in a detergent for men.

How can Triporous contribute to social issues? Through Triporous, Sony is working on solving social issues and is contributing to Sustainable Development Goals adopted by United Nations. Triporous helps to contribute to the recycling-oriented society by the utilization of discarded rice husk, and contributing to SDGs Goal Number 12. Over 100 million tons of rice husks are estimated to be discarded worldwide every year, and about 2 million ton are discarded within Japan alone. 100kg of Triporous can be generated from 1 ton of rice husks. By recycling this huge mass of discarded rice husks, Triporous can contribute to recycling-oriented society and the realization of a circular economy.

Production of Triporous is also a new way to reduce open burning and to contribute to climate change mitigations and to SDGs number 13. According to FAO of United Nations, more than 400 million tons of biomass, including rice husks, is currently disposed of annually in the world by incineration, such as burning in the field. Short-Lived Climate Pollutants, generated by open burning, are said to be one of the causes of climate change, and there is a strong need for countermeasures against them.

Sony will expand Triporous technology as a new way to use the rice husk in the world and contribute to climate change mitigations. Through its adsorption properties, Triporous contributes to cleaning water and air, and to SDGs Goal Number 3, 6 and 11.

According to a report by the WHO, 2.1 billion people around the world are struggling with access to safe water, and approximately 7 million death are due to the exposure from both outdoor and household air pollution. Indeed, Triporous can remove more than 99% of viruses while activated carbon cannot. This property would be particularly beneficial in developing countries. Triporous can also adsorb Volatile Organic Compounds responsible for particulate matter and photochemical smog. Through Triporous, they contribute to the world’s access to safe water and to the improvement of air pollution.

In order to introduce Triporous to society, Seiichiro and his team are promoting global open innovation with various research institutes and companies in Japan and overseas and they aim to increase the value of Triporous with functional, brand and environmental aspects.

Their goals are to solve various social issues by utilizing Triporous, and contribute to environmental improvement and mitigation of climate change. The production of Triporous is a new way to reduce open burning and air pollution. And finally, it can adsorb many kinds of pollutants and solve water and air problems.

Nanotechnologies for the Protection and Endurance of Surfaces

Speaker: **Marco Stefanini**
Phoenix Materials - EPM

Marco speaks of nanotechnologies and more specifically of Nanocoatings. He will answer to the questions: What are Nanocoatings? What are the possible applications and what are their properties?

Phoenix Materials develops, produces and markets products and treatments that are nanotechnology based. Here, they believe that, as every previous technological revolution, nanotechnology will radically influence every aspect of people's life. Therefore, Phoenix Materials proposes itself as a pioneer of this technology thanks to its know-how and deep specialization in the creation of these types of materials.

At Phoenix Materials they believe that technology and innovation will get closer and closer to people in order to make life easier while keeping an eco-friendly approach, which is a very important quality of Nanocoatings. Therefore, their mission is to apply nano-technological solutions with the aim of improving existing products and materials (also a very important quality of Nanocoatings).

Why Nano-technology? Its name derives from nanometers which is the smallest scale ever realized by men, it is even smaller than bacteria and viruses. Nano-technology, given the fact that works on such a small scale, gives the possibility to plan new materials and introduce innovation to scales where product characteristics and performances can be more influenced and developed to their highest capabilities.

One specific application of Nano-technology for these purposes are Nano-coatings. Nano-coatings are very thin layers that can be applied on almost any

kind of surface. They are so thin and so small that they cannot be seen or touched. At the beginning they are liquid compounds and once they are applied to the surface they solidify and take the form and extension of the surface itself.

Why do they apply them if we don't see or touch them? Well, because they have amazing properties such as protection from corrosion, protection from UV rays, they are self cleaning and they have depollution effects as well.

An example of Nano-coatings is Nanopure which is the most eco-friendly of the Nano-coatings, since it has the power to eliminate negative and harmful compounds present in the air and on the surfaces it is applied on, and it plays a fundamental role for the environment and human health. The depollution effects are due to a chemical process called photocatalysis. Photocatalysis is a chemical process inherent to Nanopure: when sunlight hits Nanopure, sunlight gets absorbed and activates a chemical oxidation process. This process is able to decompose a huge quantity of harmful compounds and convert them in harmless mineral salts and water vapour. It happens because the Nano-molecules that compose Nanopure work as catalysts.

Nanopure has many functionalities thanks to this chemical process; for instance it has an antibacterial function because the membrane cells of organisms, viruses and bacteria present in the air and on the surfaces are killed and then converted into water vapor and mineral salts.

Img. 59
Nano Protect Molecules



Nanotechnologies for the Protection and Endurance of surfaces

Speaker **Marco Stefanini**
Phoenix Materials - EPM



Img. 60

Main application fields of Nano-coatings - image by Phoenix Materials

It also has anti-pollution effects because the harmful compounds present in the air get disintegrated and decomposed into mineral salts when in contact with Nanopure. Moreover, it has the ability to remove smells and prevent the growth of mould and microbes, often responsible for the occurrence of allergies, headaches and breathing difficulties. Finally, it is self-cleaning because Nanopure has the ability to decompose the organic dirt that settles on the surface itself.

Another example of Nano-coatings is NanoProtect which brings new properties to the surface it is applied on. It plays a fundamental role in the protection of our properties, as it is able to increase its resistance to both environmental and human damages. This is thanks to its binding property with any type of material. Its effects last over time. One of these properties is called “super-hydrophobicity”, thanks to which water doesn’t attach to the surface but slips off it. This is thanks to the nano-molecules that compose NanoProtect, which are based on silicon dioxide which react to humidity existing in the air and form a really thin layer of glass that has extremely resistant characteristics.

During the exsiccation phase, it uniforms a grid spontaneously on the surface, on the application, and it leaves a lack of imperfections and it is impenetrable to liquids. NanoProtect has also anti-corrosion, anti-vandalism (because acrylic paints do not get in touch with the surface itself) effects, it prevents the formation of ice and stains (so it is also very easy to clean), it has electric inertia making it completely inert to any passage of electric current, it absorbs UV rays and it prevents the passage of possibly toxic substances to surface.

Other examples are Non-slip and Anti-vandalism Nanocoatings. Non-slip Nanocoatings create a nano roughness on the surface able to repel completely any type of liquid by increasing the friction coefficient making the surface not slippery. This type of Nanocoating can be very useful in light of the regulations that require surfaces to have a certain friction coefficient, for instance Legislative Decree 81/2008 which requires that offices’ floors must be free of protuberances and cavities and must be fixed to steady and non-slippery.

Therefore, Non-slip Nanocoatings allow having offices compliant with the applicable law. Anti-vandalism Nanocoatings on the other hand are specific for the graffiti problem because a stain from permanent markers, paint, sprays and similar products don’t get in touch with the surface itself and they are not visible and can be easily cleaned up. We can apply Nano-coating, as Marco Stefanini says, almost everywhere and almost on every kind of surface thanks to their properties, including, for exemple, the ones that need deep cleaning and sanitization. or those where we usually spend most of our time, like offices or homes.

Phoenix Materials has developed an application of high quality and long lasting treatment over time. Application is divided in two phases, the first one called Reclamation which is aimed at the total restoration of the surface through the removal of any form of dirt.

The second phase is the Treatment which depends on the extension and the geometric complexity of the surface itself. There are three types of applications: manual (it needs the use of specific ultra-microfiber cloths), by spraying (run with paint systems) or mechanical (run with specific machinery like roto-orbitals or single disc machine).

How to measure material use and progress towards circularity?

Speaker: **Jacco Verstraeten-Jochems**
Lead Business Strategy at Circle Economy

Jacco begins his speech by answering a fundamental question: why they, as Circle Economy, have started measuring the Circular Economy? It all started by looking at how the economic growth has been significantly exponential since the Second World War and how other types of related parameters have also been growing. For instance, the activity of Material extraction, CO2 emissions, water scarcity and biodiversity loss have experienced a significant growth as well. Circular Economy aims to mitigate that and close the created gap. It looks for finding a way to foster economic growth while minimizing material use and all the negative impacts associated with that.

This is why, in 2018, Circle Economy started to measure, as a company, how you can actually monitor the circularity of the global economy and after that, they also introduced the method to measure the circularity of a nation state and of a company. According to them, **if you can't measure how circular you are you can't improve on that.**

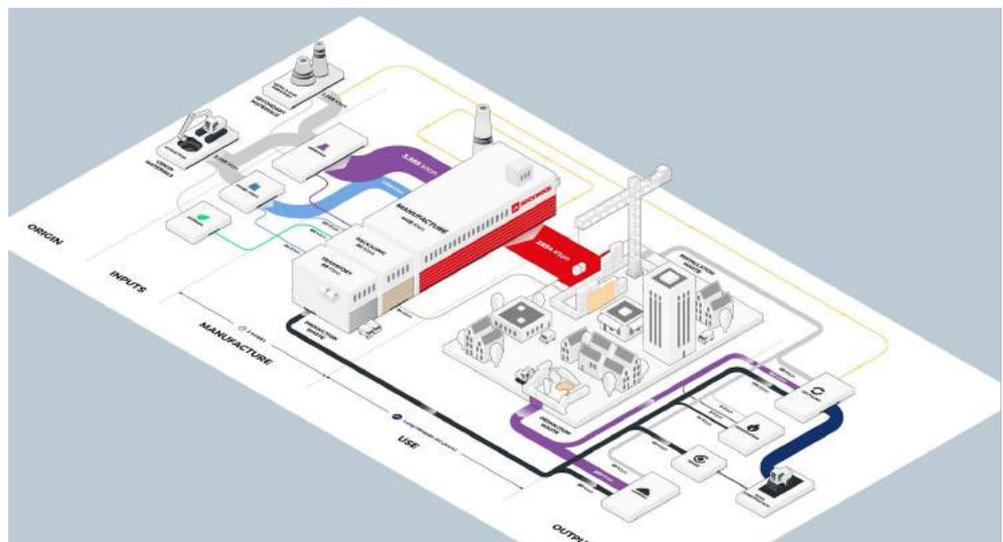
At the moment, they found out that people are not still very aware of how urgent the situation is. However, when looking at the global economy there are estimates of 25 to 50% of circularity globally. What they found out, instead, is that only 9% of the global economy is actually circular, so only 9% of our materials on a yearly basis is cycled in many ways: reused, composted, recycled and so on. This means that the rest 90% of materials on a yearly basis are actually lost, landfilled, incinerated, they disappear and with it also a great economic value gets lost.

So, how have they applied the measuring of circularity to a company? Jacco presents the results they had for the Danish company Rockwool, which is one of the biggest producer of insulation materials for buildings. Basically, half of the buildings in Europe have Rockwool insulation materials in the walls or on the roofs. Rockwool company asked them: How really circular the Rockwool company is and how can we measure that? So, after a couple of months of research Jacco and his team created a picture of the company material flows through their value chain. Indeed, it really starts with the origin of the materials, where they are mined or at urban or industrial stock where waste is mined. After that, they flow through the entire value chain: they enter in the Rockwool factories and then in cities till arriving at their end of life where either will be cycled, landfilled, incinerated or handled in other ways.

They started from the origins of the material and they found that actually, Rockwool, was performing quite well there. The company already had quite a share of secondary or recycled resources they used, much more than on a global average. Moreover, Rockwool also designed their products in a way they were actually quite well recyclable. If they would get their materials back they could recycle almost up to 100% of their products and this can be considered as a quite high rate if compared with others.

Therefore, Rockweool was performing quite well upstream, but then at the end of life their performance changed.

Img. 61
Example of value chain analysis -
image by Circle Economy



How to measure material use and progress towards circularity?

Speaker: **Jacco Verstraeten-Jochems**
Lead Business Strategy at Circle Economy

In fact, Circle Economy team found that the circularity of the value chain was hampered by the fact that most of their products were being landfilled or recycled in low value applications. This brought Rockwool really down in the metric.

This analysis was, indeed, very helpful for them in order to start improving their value chain performance and to convince also other value chain partners, especially the ones dealing with products end of life. They really need to improve on their collection and sorting methods and just basically send the materials back to the up road. Rockwool presented these metrics also to governments encouraging them to improve the situation.

Circle Economy has been measuring circularity for about four years now but since last year more metrics and more standards have actually arrived. However, they all have different approaches whether there is the Ellen MacArthur Foundation introducing the Circulytics tool or the World Business Council for Sustainable Development introducing the CTI Tool or from the Global Reporting Initiative. These are different metrics and approaches for different uses.

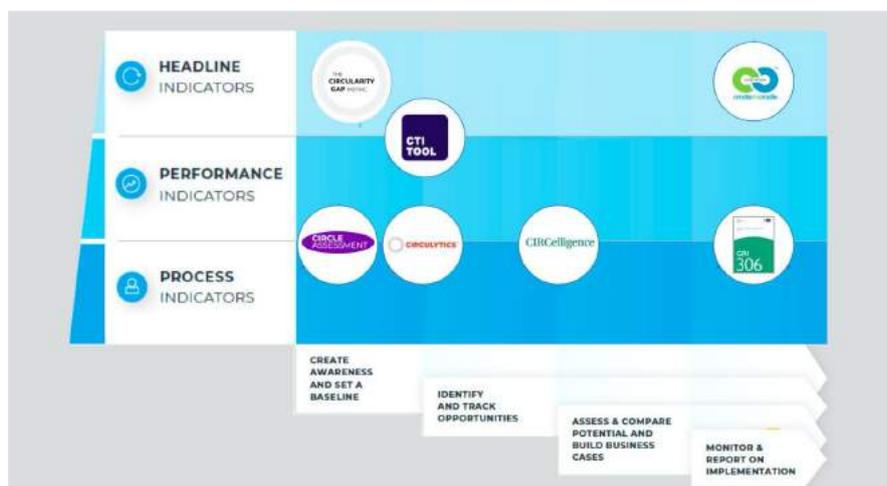
There are metrics for every step of the journey, from creating awareness among your peers, your customers and your colleagues to identify opportunities, to build business cases or to validate your results. For each step you need a different metric and tool being developed currently. And they are also quite different if we look at the types of indicators that they use. Some of these, for instance the gap metric, is a headline metric that tells you how circular you are and no

further details are given with it. There are also tools that focus on giving you performance indicators, so you will find a lot of indicators for each step of your value chain whether you are reusing a lot of renewable energy or renewable resources, if you are using a lot of secondary resources or the recycling products, so it would give much more granularity on the physical elements of your material flows. And then there are those tools that really focus on the process, so they help to measure how much you have been doing to implement the change whether that's creating awareness on your employees or setting KPI's for business units, if your customers attitude towards your products has really changed and they are demanding for more green products etc. These indicators don't directly improve the circularity of your business but they tell you where the blockades are for further improvement.

When plotting the different types of metrics you can see that some of them are really cross board, for instance The Circularity Gap metric and the Cradle to Cradle one focus on headlines or the GRI standard that includes a lot of performance and process indicators and it is really well shaped to help you monitor and report on your progress. While Circulytics from the Ellen MacArthur Foundation is much more alight to grab the attention of the audience and to create awareness, they set the baseline but not too many details are given in this one.

Circle Economy has published a report about the various existing circularity metric in order to guarantee a little bit of clarity about which tool should be used when and how you can have it for your business.

Img. 62
Types of Indicators
- image by Circle Economy



Rifò – Circular Fashion Made in Italy

Speaker: **Niccolò Cipriani**
Founder of Rifò

Niccolò Cipriani is the founder of Rifò which was legally constituted in 2018 in Tuscany, and over the last year it has had a significant growth mainly in the market abroad (Germany, Benelux, Japan and North America). Their aim is to take back a traditional system that could solve some of the problems existing in the textile industry such as overproduction and overconsumption. Overproduction means that we produce more than what people actually buy and overconsumption is about buying more than what people usually need. As a consequence to that producers and consumers create a big stock of clothes that in the end are not worn. There is no sustainability in that because when producing a garment, a shirt or a t-shirt a great amount of resources is used, such as water, and it also generates pollution by using chemicals and dyes.

Therefore, the idea was to bring back a tradition to create a circular model inside the fashion industry. For doing that Rifò collects all the clothes and textile waste in collaboration with local realities. Clothes are selected by colour and shred into new fiber and then, with this new fiber, a new yarn is generated. The new yarn is later used to make new Rifò clothes, which are recycled and recyclable and that are all made in Prato's textile cluster.

During his speech, Niccolò shows some important savings that resulted from using recycled cashmere. Recycled cashmere with respect to a virgin one can have an environmental saving of around 80%. In particular, this is due to the fact that selecting the clothes by colour let them avoid the use of dyes and other chemicals and this choice results in being the

most sustainable part of the Rifò business. Rifò started its activity online with a crowdfunding campaign but soon moved to the offline part as well. In fact the offline world was considered important in terms of collecting points such as NaturaSì shops and also in terms of retailers. The entire business was firstly promoted online but moved also to offline stores so that people could find their products, try them on and buy them. At the moment there are more than 100 shops selling their products both in Italy and abroad (Germany mainly) and they have a strong presence online through social media, Google bands and collaborations with blogs and influencers.

Niccolò and his team are building a sustainable brand because they are the first in a collection system online where people can contribute to the circular process by giving their clothes in exchange for a coupon code. They have exclusive supply agreements in Prato and this is also why Rifò is able to offer a sustainable product that is competitive and with an accessible price mainly for recycled cashmere. At the same time, they want to incentivize their customers not to buy more than what they need so they don't do sales or black Friday. Generally, they do pre-sales so that people can take a discount if they contribute with their goods to the production.

Niccolò concludes his speech by saying that at Rifò they believe in a world where every waste can be a resource in terms of production and in terms of people as well. In fact they have a social project too for which every two euros of an online order goes to social NGOs and, in this way, Rifò is able to socially bind their production to the territory.



Img. 63
Used clothes - image by Rifò

TECHNOLOGY

Emerging Technologies are Overturning the Concept of Waste and Optimizing the use of Resources

REPORT RE-THINK, MILANO 2020

Circular Economy: Why Technology does Matter

Speaker: **Davide Chiaroni**
Full Professor at Politecnico of Milano

To illustrate the central role played by technology in the development of the Circular Economy, Professor Davide Chiaroni started his speech with a description of the current linear economy model. In this model, it is possible to distinguish three main phases: the pre-use phase, where value is added to raw materials, the use phase and the post-use one, when the value of the good is commonly destroyed.

The basic idea of the Circular Economy is to extend the useful life of valuable resources, increasing both the time people can actually use a resource and the value retained in materials during the post-use phase. The latter is possible by creating additional loops. The three phases of the linear economy can be matched with three pillars of value of the Circular Economy, which are: the value creation phase during the pre-use, the value transfer phase during the use of a good and the value “capture” phase in the post-use. According to Davide, a paradox emerges from the current Circular Economy discussion, the Paradox of the “capture” phase.

When talking about the value creation phase, we can find many researches, practices and ideas around the concept of design for X. So, in the pre-use phase we are very well equipped in terms of the number of methodologies to follow. The value transfer phase is sufficiently covered as well, as many models based on the paper use or paper performance already exist and are employed during this phase. However, as claimed by Davide, we are still far from having tackled in

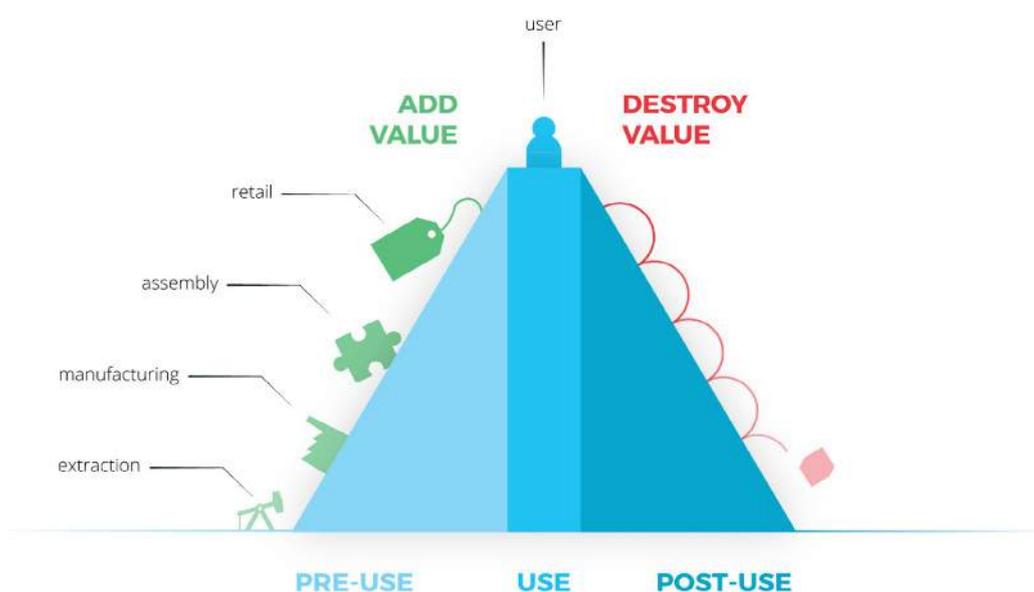
a proper way the value “capture” phase, which is the most critical part of the overall Circular Economy’s approach.

Indeed, to appreciate the real value of the resource and so to maintain the promise of the Circular Economy, everything designed in the value creation phase has then to be captured in the post use phase.

To make this possible, the value “capture” phase requires a constant real time measure of the status of the resources. This measure needs to be multi-dimensional, in the sense that it has to consider: who is using the good, what is the status of the good, its position, for how long it has been used, its interaction with the ecosystem where it is located, its performance level, etc. Only after measuring all this information and clarifying the status of the resource, we are able to decide which action is more suitable to maximize the value of the resource (for instance, by intervening on maintenance, connecting the resource to other actors of the value chain, etc.).

Every time we are establishing which action is the most appropriate, we are solving a trade-off between the value of the resource at a certain moment and the available opportunities. This means to take into account which actors of the value chain we are really connected with. Indeed, the real potential of a resource also depends on the real available connections, which usually change over time.

Img. 64
Add Value vs
Destroy Value
- Achterberg,
Hinfelaar and
Bocken, 2016



Circular Economy: Why Technology does Matter

Speaker: **Davide Chiaroni**

Full Professor at Politecnico of Milano

Without an appropriate design of the post-use phase, and so without keeping track of all essential information, a resource could really be wasted.

According to Davide, this is certainly a matter of technology. To avoid waste, we need IT, IOT, analytics, virtual representation of the good, cyber physical system to act on the product. At the present time, all the mentioned technologies are available, so it is not a matter of lack of technical knowledge.

What is missing is a model in the value “capture” phase that could keep the ecosystem updated on what is happening to the resource. By now, products are designed with the purpose of being remanufactured, but a track to know exactly when remanufactured them is not kept.

Davide believes that a post-use model requires to truly interact with the Circular Economy ecosystem and create “connections” with the other actors of the circular value chain, particularly those in the “during use phase”. To be coherent with the Circular Economy approach, the model also needs to be “integrated” in the revenues stream, so in the revenue model, allowing users to benefit from the value “captured” as well.

Of course, also a cost/benefit balance in the design phase is required to properly understand which technologies are necessary to maximize the value-capture

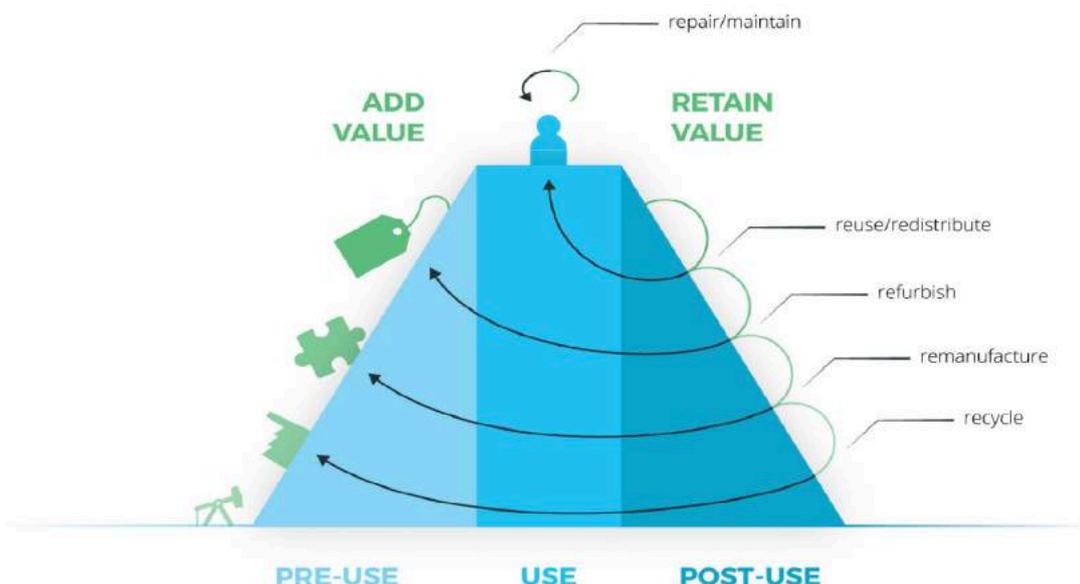
phase and how to keep them updated with the last innovations and the life cycle of the product.

According to Davide, in the modeling of Circular Economy, we have moved from the use phase of a good to its design phase, putting a lot of effort in creating more circular goods. However, designing goods with a longer useful life would not make them really last more if the value-capture phase is not properly planned. Therefore, what is currently crucial is to “swing back” from the pre-use phase to the post use phase, having a clear view of the journey of the good.

Moreover, it is necessary to move from design to measure, so not just designing for but measuring all the variables that are keeping align the design with reality. Finally, there is the need to move from the advertising part, so design and promote the customer a certain model, to the technology that helps to keep this model alive. This means that the final phase and the technologies employed in it, require as much attention as the design phase.

To conclude, Davide stresses that in a Circular Economy technology matters, especially the one that keeps resources alive over the life cycle of the product.

Img. 65
Add Value vs
Retain Value
- Achterberg,
Hinfelaar and
Bocken, 2016



Digital Technology Roadmap to Enable the Circular Economy

Speaker: **Shyaam Ramkumar**
Circular Innovation Expert at Tondo Lab

Shyaam Ramkumar focuses his speech on how digital technology can form a roadmap to enable Circular Economy.

Since the latter half of the 20th century we have seen an increasing digitalization of the world. A proof of this huge exponential digitalization is visible, for instance, by comparing the amount of world information stored in a digital format. Indeed, in 2014 this percentage overcame the 99%, while in the 80s it was less than 1%. We are currently experiencing the beginning of the fourth industrial revolution, with incredible advancements in different kinds of technologies that are changing our reality (AI, digital fabrication, IoT, etc.).

Especially this year due to Covid-19, we have seen an accelerating trend towards a more digital society, increasingly moving in the direction of online working, online learning and online socializing. This trend has huge implications for governments, companies and citizens, creating a new normality in a post-covid world. This increasing use of digital technology has actually a huge positive trend to enable the circular transition as well. Technology allows for greater knowledge sharing and collaboration, insights and analytics to support a better use of assets and resources and improved wellbeing for all.

As highlighted in the Circular Economy's "DISRUPT" framework, incorporating digital technology is a key element of the Circular Economy, especially with regard to how resources could be optimized and connections between actors among the supply chain could be strengthened by using digital online platforms. During his speech, Shyaam focuses on four kinds of technological solutions: digital platforms, blockchain, big data analytics and artificial intelligence. It is relevant not only to understand how these technologies are contributing to the Circular Economy, but also how they are connected to each other.

Many digital platforms have been recently developed, creating the foundation to enable greater connection and collaboration to advance the Circular Economy. Through them companies, governments and citizens are able to exchange knowledge, share assets, reduce transaction costs and some of the inefficient market failures for second-hand resources, wastes and

products. The constant use of digital platforms is also generating a great amount of data and insights in terms of: patterns of the use of resources and wastes, the demand and the supply of second hand goods.

An example of this is Floop2, an online marketplace that enables companies to increase and valorize their existing assets, services, knowledge and skills by sharing them with other businesses under a given price. The platform really opens new opportunities for collaborations within companies and is gathering data on what are the biggest resources required, who has the biggest needs and who has the resources to provide them.

Thinking about the creation of these platforms, it is important to manage and store all of this information in a secure way, while providing them to the different stakeholders. The blockchain can provide a decentralized way to manage and store this information, allowing greater transparency in terms of the origin of a product, resource use, authentication, and tracing supply chain issues. In addition, digital tokens through the blockchain can also incentivize positive behaviours by companies and consumers, really driving the circular transition forward.

An example of this is Bext360, a company that uses blockchain to make the coffee supply chain more transparent and socially responsible. The company has installed in different farms the so called "bextmachines", through which information on the harvested coffee beans enters into the blockchain. In this way it is possible to analyse the quality of beans, allowing the company to focus on the less efficient farms. It improves transparency, as it traces where the coffee beans came from, which roasting company was involved and how it finally ends out into consumers' hands. Moreover, by tokenizing the beans the company was able to quickly pay the farmer in cryptocurrency, providing a faster and more equitable payment solutions to these farmers, a common issue in the coffee supply chain.

Through big data analytics and the use of advanced techniques (text analyzing, data mining, predictive analytics, machine learning etc), it is possible to analyze the great amount of data generated by platforms and stored in the blockchain, highlighting, for

Digital Technology Roadmap to Enable the Circular Economy

Speaker: **Shyaam Ramkumar**
Circular Innovation Expert at Tondo Lab

instance, how to optimize resources in the production process. An example of this is the company Intellerts, which provides data science and big data analyst solutions. They worked with the city of Zaanstad in the Netherlands, analyzing 136 million records of housing data. In the Netherlands, many buildings are built on wooden piles, foundations that need to be constantly repaired and maintained.

how to devote resources to maintain these foundations. The company developed a predictive model based on different databases (water data, soil data, the building stock data etc) and identified which buildings were at risk of foundation damage. The model was eventually able to indicate how the city should devote its resources in times to avoid the risk of foundation damage.

The city was facing some difficulties in managing

Img. 66
The Disrupt Framework - image by
Circle Economy



Digital Technology Roadmap to Enable the Circular Economy

Speaker: **Shyaam Ramkumar**
Circular Innovation Expert at Tondo Lab

Img. 67
European Policy
Centre



The advancement in artificial intelligence joint with big data analytics, is leading to the development of models and algorithms that are able to learn from experience similar to the way people do. Many are the possible applications: designers could use AI to design products; retail could use dynamic pricing; installing automation for manufacturing, for sorting, for disassembling products in a more efficient way; even entire cities could be redesigned to be less environmentally harmful and more socially equitable. An example of a company using AI effectively is Zen Robotics that has developed an automated waste sorting management system called Zenbrain.

It analyses waste using sensors and robots that make decisions on how to sort the waste, based on material type, colors or shape, allowing to sort faster and more efficiently. Compared to common manual processing, it is a safer and faster option.

Moreover, once wastes are sorted, it is much easier to reuse and to recycle them more effectively. To enable the mentioned technologies to support the transition to a more coordinated roadmap it is crucial to understand which are the linkages between them.

This approach was also recommended by the European Policy Centre and the European Commission in the report “The Digital Circular Economy”, released by the European Technology Centre.

The report highlights the strong interconnection between the digital and the circular economy agenda, and how this interconnection is critical for the acceleration of the Circular Economy and the implementation of the Green Deal.

Shyaam concludes by remarking on the importance of identifying how these technologies can come together to support a more circular transition. In other words, it is necessary to ensure that the mentioned solutions are actually sustaining the circular and sustainable developments that we want in our society, rather than making our linear economy simply more efficient.

Tech for Humans: sustainable models for Business and the World

Speaker: **Pietro Lanza**

General Manager of Intesa (IBM Group) and Blockchain Director of IBM Italia

Pietro Lanza explains how the transition towards the Circular Economy and sustainability involves an alternative economic system, that is gaining popularity and interest. For this reason, he believes that the Green Deal creates opportunities for businesses where technology and digital innovation play a key role.

According to Pietro Lanza, what we are experiencing is a new industrial revolution that is based on exponential technologies, such as IoT, AI, cognitive computing and Cloud. These technologies are growing at a global scale and allow companies to move towards new business models, enabling the Green and Digital Transition to a Circular Economy. The technology sector is then becoming a key player in redesigning businesses for Italian mid and big-size companies. Indeed, the supply chain of many industries, as for instance the automotive one, are becoming more complex.

To unlock the potential of a Circular Economy, it is possible to recognize seven essential steps. First of all, it is necessary to understand and leverage the usage of IoT platforms. The second step is about focusing on the right data and analyzing them. This step is usually supported by AI combined with Machine Learning. The next one is about rethinking the operations, an area in which they are deploying a lot of effort, helping all their clients in redefining

their processes from the product design to the supply chain, and the overall industrial processes. In this step blockchain, augmented reality and optimization of the processes through innovation are often used.

As long as we are living in an interconnected world, it is then important to leverage open platforms to connect in real time actors across all the network. The blockchain is an example of a connected ecosystem.

Another crucial step is to create and sell an experience through big data which is essential to analyze product life cycles, and more recently they also discovered the importance of e-commerce platforms for the access to goods and services. Next, communication and empowerment will make the supply chain more efficient, using cloud services. Finally, it is necessary to learn and readapt, and so to leverage the data visualization across and together with virtual reality.

These seven steps leverage on exponential technology, that is assuming great importance to IBM. Today these technologies make 50% of IBM revenues, globally around USD 80 billion, while a few years ago they did not even exist. This gives a picture of how fast they are growing and how important they are becoming for every big tech company, including IBM.

Img. 68
7 steps to implement the Circular Economy - image by Intesa (IBM Group)



Tech for Humans: sustainable models for Business and the World

Speaker: **Pietro Lanza**

General Manager of Intesa (IBM Group) and Blockchain Director of IBM Italia

DIGITAL TRANSFORMATION IS OUR FUTURE



Img. 69

The Roadmap to Digital Transformation - image by Intesa (IBM Group)

The question is: how can we make these exponential technologies real for businesses? Intesa (IBM Group) tries to include more and more of those technologies in the older industries they are working with, starting from leveraging these tools to build, operate and grow a more interconnected ecosystem.

Joining new business networks and accessing a heterogeneous environment supports the discovery of solutions to critical industrial challenges. To deploy Digital Innovation, Intesa has developed a digital innovation model. The methodology used could be one between design thinking, co-innovation, agile and DevOps. The competence areas are user experience, intelligent supply chain and smart manufacturing that are making the supply chains more efficient.

The methodology Pietro Lanza focused on during his presentation is Service Design Thinking, which is often used by Intesa to accompany their clients from

the product design. Design Thinking is a framework for identifying the end users' real needs, combining creative and analytical steps. The steps are observation, reflection, testing and prototyping. Moreover, the KPIs they introduce and consider from the beginning phase are more and more based on Circular Economy principles.

Intesa is actually leading a process to become a Benefit Corporation and Circular Economy is for sure the lighthouse they have been inspired from in order to deeply change their organization and to create a different model of the company.

To conclude, Intesa believes in the innovative business approach linked to sustainability, innovation and Circular Economy. The company has introduced these new approaches in its own organization and processes, also aiming to build a more sustainable ecosystem with its partners and clients.

A Dating Site for Materials

Speaker: **Maayke Aimee Damen**
 Founder at Excess Materials Exchange

Maayke Aimee Damen is the founder of Excess Materials Exchange, a digital platform and marketplace where companies can exchange their excess materials.

Maayke starts her presentation by posing two questions: what percentage of products we buy ends up as waste within six months? What percentage of material value is lost after a single use? The answers are respectively 99% and 95%, much more than what most people would expect. In addition, resource extraction is on the rise and it is projected to increase even further.

At the same time, products on the market are becoming increasingly more complex. Moreover, estimations show that based upon the current state of technology and known reserves we have mined most of the accessible (technologically and financially) resources left in the earth's crust. While demand for resources and the complexity of products is increasing, most of the European countries import raw materials.

Focusing on the city of Amsterdam, the native land of Maayke, a great amount of materials is coming from countries outside Europe, as China and Russia. Given possible economic and political tension mainly being independent on import is a risky choice. On the other

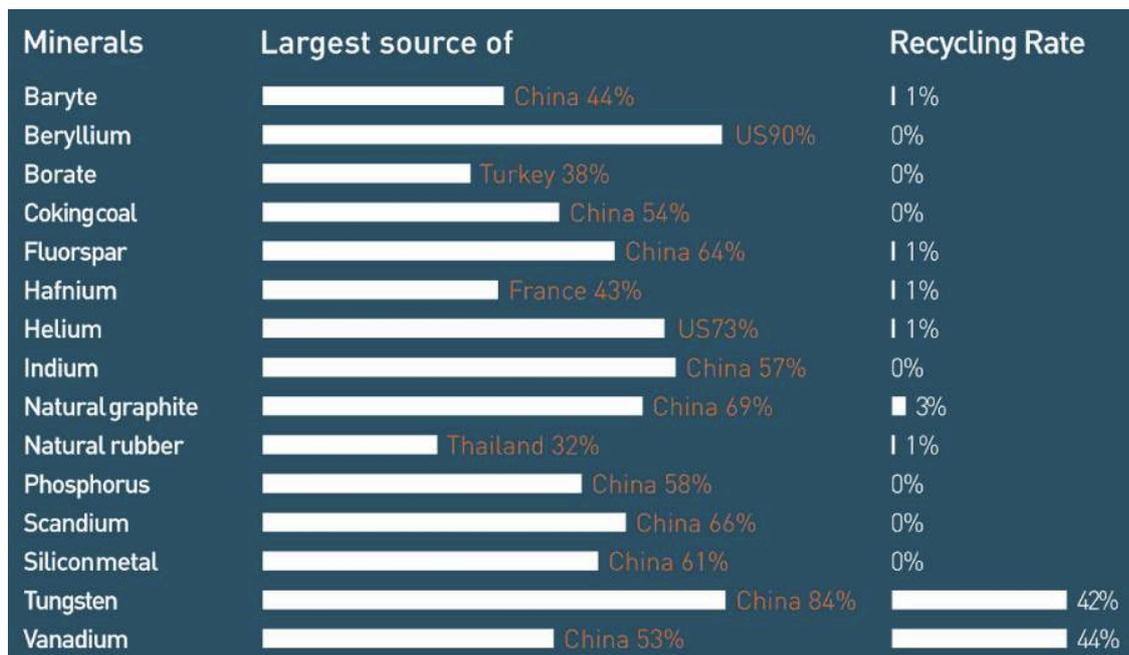
hand, the recycling rates of these materials are very low. Even though we have already mined many resources and we are very dependent on other countries for imports, concrete actions on this topic have not been made, and instead the worldwide waste mountain is expected to grow by 75% in 2050.

The ultimate goal would be reaching a 100% percent global circular economy, in which resources are infinitely cycled across different sectors without having a negative environmental impact, but at the moment the world is only 8.6% circular and there's a lack of relevant tools to bridge this gap. The question is about what we need to reach the target of 100%.

To exchange materials on a large scale, information about the quality, quantity and locations of the materials is needed, but, by now, there is not a structural manner to collect and exchange this information. With the Excess Material Exchange, Maayke and her team provide a platform where companies can sell and buy any type of excess material.

The digital marketplace functions like a dating site. It matches the supply and demand of materials and products and at the same time matches the materials with their highest valuable reuse option, selected according to its financial and environmental impact.

Img. 70
 Eu's Critical Raw Materials (P + Magazine, 2020)
 - image by EME



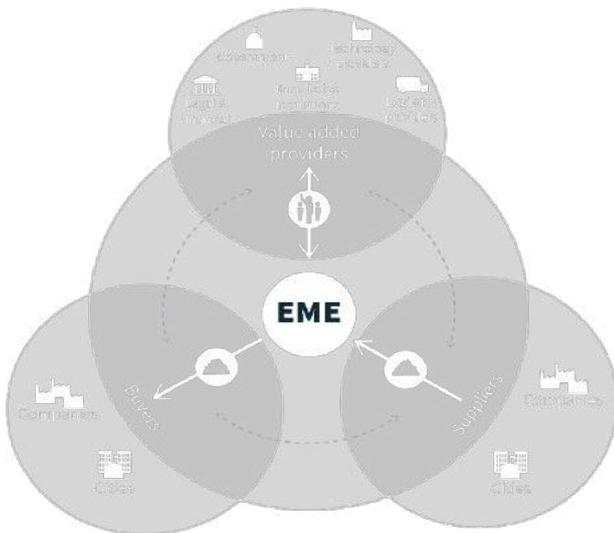
A Dating Site for Materials

Speaker: **Maayke Aimee Damen**
 Founder at Excess Materials Exchange

To start this process, it is necessary to give to all the products and materials around an identity, similar to the ingredient list on food products.

Products now receive an “identity” in the form of a “resource passport” on the digital platform.

The information contained in the passport is, for instance: what the product looks like; which materials it is composed of, where it is located; who is the seller; what is the functionality; who is the actual owner; the financial value, etc. The resources passport is attached to the actual physical product in the form of a QR code or an RFID chip. Next, they add AI, so they think in networks and that is how they look for the most optimal matches. The AI also supports the matchmaking process between different sectors, because often the highest value match is found between different sectors and not in the same one.



Img. 71
 Excess Materials Exchange Platform Functioning - image by EME

As proof of this, a match was discovered between the plastic bottle industry and the carpet industry. Indeed, it is possible to recycle Polyethylene from plastic bottles’ PET and use it as a component for the carpet industry. The AI is essential in the matching process, due to the great amount of data that can be taken into account.

Another example of integration between different sectors is orange peels that can be an ingredient for soap, because they contain limonin. At the same time, the white part inside the peels can be used for animal feed or biogas. However, the most optimal combina-

tion is the one that exploits both the extraction of the limonin and the fibres, resulting in a 50% reduction in cost and 99% reduction in carbon emissions.

As the last example, consider railway tracks. Right now in the Netherlands, the used tracks are usually sent back to China to be re-melted, while they could still be used in other functionalities. Indeed, in the Netherlands, they are used as support beams in buildings or quay walls. In this case, the most optimal match would be to use them as a support beam.

The financial value at the end of the life of this product increases four times and the carbon emissions are reduced by almost 83%. In the pilot program, Excess Materials Exchange’s team collaborates with ten companies, like Philips, Schiphol, Sodexo, ProRail etc. In collaboration with them, they studied 17 materials’ streams and investigated if there was a higher value destination for them, instead of the one where they were currently going. Final results were much better than what initially expected. Indeed, they’ve created matches with a potential added financial value of 64million euros.

At the same time, these solutions would: save enough energy to light the streetlights in Paris for 5 years; save enough carbon emission equal to all inhabitants of Amsterdam driving to Milan; save enough water to fill 860 Olympics swimming pools. These incredible results really give hope on the effects of a “circular revolution”.

Harvesting Flexibility to Support RES Penetration

Speaker: **Enrico Pochettino**
 Head of Innovation Department at IREN

Increasing the share of renewable energy sources (RES) in electricity production means creating a more flexible power system. In his speech, Enrico Pochettino illustrates the challenges linked to an increased RES penetration and the solutions developed by IREN. IREN is an Italian multi-utility company operating in different businesses, including green management, production and distribution of electricity.

Many are the challenges that the European Union will face in reaching by 2050 the target of more than 90% of renewable sources in energy production. Even though a common target is fixed, it is not yet very clear what are the actions required to make RES widespread in our countries and the production mix. Moreover, it is important to highlight that the increment in this share will be entirely covered by non-dispatchable renewable sources, such as wind power and photovoltaics, also called Variable Renewable Sources (or VREnergy). The integration of a high rate of renewable energy sources means a deep change in the management of conventional power plants, which need to be more flexible in order to cover the energy demand peaks.

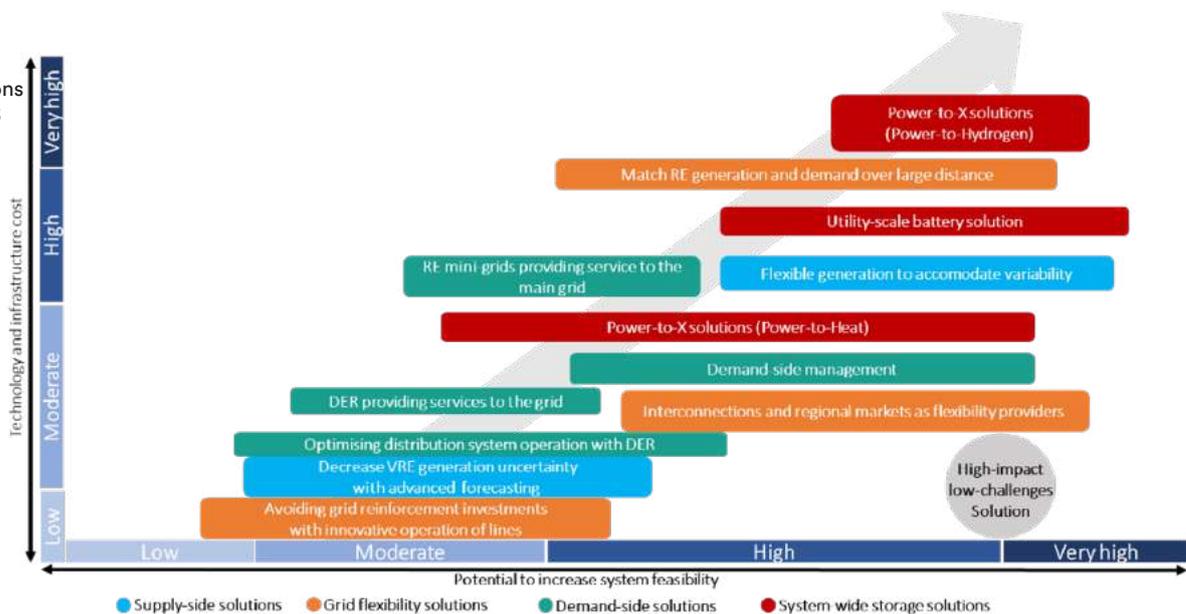
For instance, in April 2020 in the South-Area of Italy, the production of electricity from wind and solar panels in some hours of the day was higher than the energy demand and if such surplus was not transported to other areas or if conventional power plants

could not reduce their load, there could be a risk of curtailment. On the same day, the demand for electricity in the North of Italy exceeded the supply. Luckily, Italian grids were already very well connected and so differences in demands and supply in April could easily be managed. However, these scenarios are going to increase in the future, along with the rise of renewables share.

Moreover, the electricity taken from the national transmission network by the distribution network has clearly diminished between 2010-2017. This phenomenon is stronger in the central hour of the day, where about 49% of the peak reduction was achieved due to the diffusion of the distributed generation, such as solar and wind power plants. This means that part of the electricity is no more flowing in the transmission network, that is the one managed by Transmission System Operators, but it is generated inside the network, making this kind of energy source even more difficult to control.

To increase the share of renewable energy, our production mix does not need new kind of sources, but new services and tools to make the system more flexible also on the demand side. For instance, it is forecasted that to balance demand and offer, in 2050 4.5% of electricity will be stored in batteries.

Img. 72
 Flexible Solutions to Support RES (IRENA, 2019)



Harvesting Flexibility to Support RES penetration

Speaker: **Enrico Pochettino**
 Head of Innovation Department at IREN

To answer this challenge, we can use classical solutions linked to the grid shape, so tools regarding grid flexibility solutions, or some others such as the ones connected to batteries and storages, not only with the classical methods but also with the Power to X solutions, so the transformation of power into another kind of energy like power to heat, utility-scale battery or power to gas or to hydrogen solutions. Even though transforming electricity into gases still faces issues under a remunerative point of view, as it is a very specific kind of technology, it is developing considerably fast.

In order to participate in this market of demand response for instance, in the industrial sector, IREN can manage the integrated water cycle by using the pumps in order to fill the tanks only when it is asked to consume more electricity or stop them when it is needed to reduce the load.

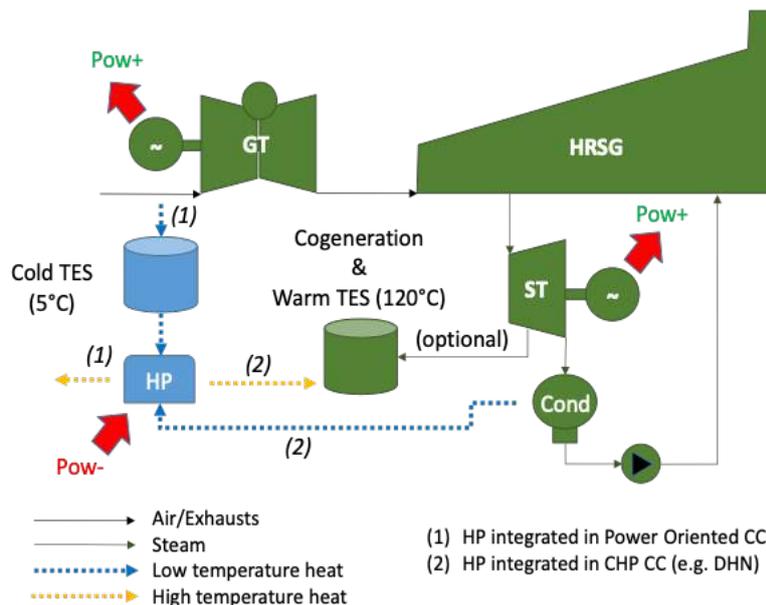
They can also manage the wastewater treatment system with all the electric appliers according to some specific requests from the grid. Moreover, solutions are possible and already exist also in the civil sector. For instance, in France electric heating systems are widespread among houses to cover the surplus of nuclear energy production and help the transmission system operator. Also electric vehicles with logical vehicles to grid could be used to store electricity, so when it is connected they can either be charged or discharged in order to help the grid.

Finally, Iren is working as a partner in many European, national and regional projects, to test new storage solutions. For instance, the Store&Go Project will demonstrate three innovative Power to Gas (PtG) systems located in Germany, Switzerland and Italy. The project aims to validate the technical and economic feasibility of integrating the PtG technology with innovative systems of energy generation and distribution.

Another example is the Pump-Heat project, that aims to increase the flexibility of traditional fossil fuels power plants in order to satisfy the electric grid's needs to compensate the increasing fluctuation of VREs energy supply. The CHESTER project is a thermal solution (Power-to-Heat-to-Power) that integrates heat pumps, latent heat storage systems and organic rankine cycles (ORC) to store green electrons. The eVolution2G project tests the vehicle to grid devices for electric balancing.

Finally, the Planet project develops a decision support system for policy makers and players (as DMS aggregators) to facilitate the integration of RES through synergic coordination between multiple grids and networks. This last example reveals how much the RES integration will be supported not only by energy technology, but also by digital technology such as AI. For this reason, in the future new players in coordinating the national and international energy systems will assume a central role.

Img. 73
 The Pump-Heat project - image by IREN



How Demand-Response contributes to a Circular Economy

Speaker: **Simon Bushell**
 Founder and CEO at Sympower

“A Circular Economy entails gradually decoupling economic activity from the consumption of finite resources and designing waste out of the system. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural and social capital”.

Starting from this quote from the Ellen MacArthur Foundation, Simon illustrates how flexibility, such as demand-response, contributes to a Circular Economy. To do so, he starts by explaining the functioning of the electricity systems. In this system, demand and supply of electricity always need to be balanced. In each country, the electricity grid operators are responsible for keeping this balance. In Italy, the grid operator at the national level is Terna, while at the local level we have other actors such as Unareti (Milan) and Areti (Rome).

Maintaining the grid balance can be challenging. For example, the UK often experiences fast and high peaks of electricity demand at half time during football matches, when millions of people simultaneously turn on kettles to boil water to make tea. This sudden peak in electricity demand is equivalent to turning on two entire coal-fired power plants and, at the moment, this is exactly where this electricity comes from in the UK.

This is an incredibly inefficient, expensive and polluting way to address demand peaks because these plants then always have to be on standby for such

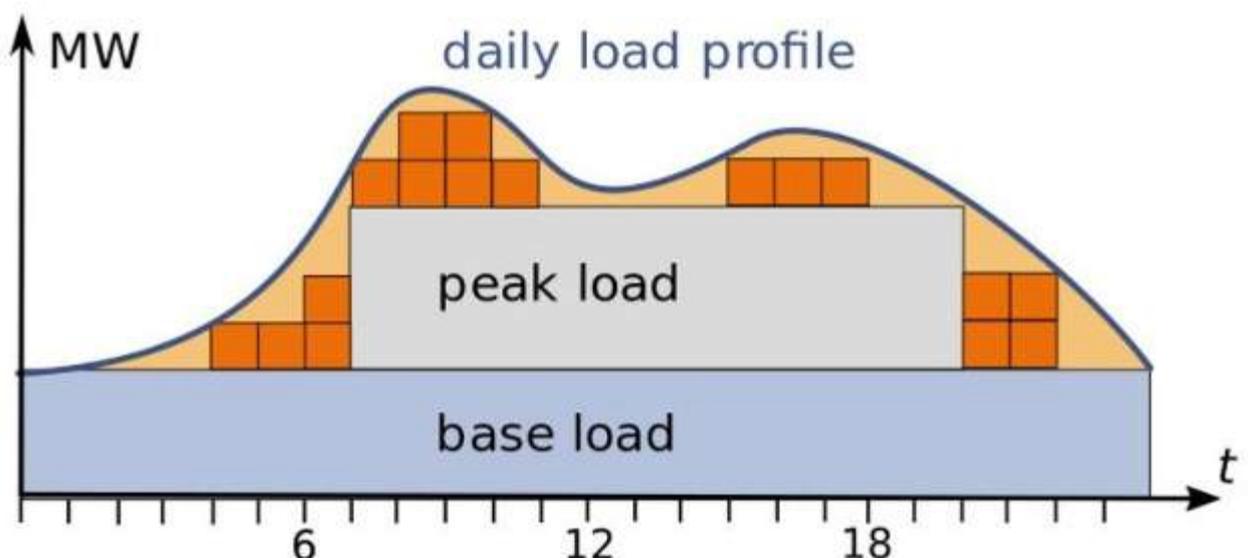
moments.

As more renewable energy of intermittent nature (such as sun and wind) replace traditional sources of energy, this becomes a growing concern due to the increasing mismatch between demand and supply of electricity from renewable generation. This transition to renewable energy resources is also accompanied by a transition to electrical transport and mobility, making the demand for electricity even more variable. To achieve the 30% renewable energy generation by 2030 target set by the EU, we must find new ways to address both peaks of energy demand and electricity surplus. Here is where demand response plays an important role. Simon suggests an alternative way to respond to peaks in electricity demand rather than burning more coal and gas.

To maintain a constant overall electricity consumption, we can turn off some assets and use the saved energy for something else. For example, if someone wants to turn on a kettle, it is possible to recover the necessary electricity by turning off a supermarket's fridge for a few minutes. This is the basic idea of Sympower's software solution, which connects flexible assets to the energy market to address short-term balancing problems in energy markets.

Sympower connects appliances to a cloud-based platform and when the grid is under stress, automatically

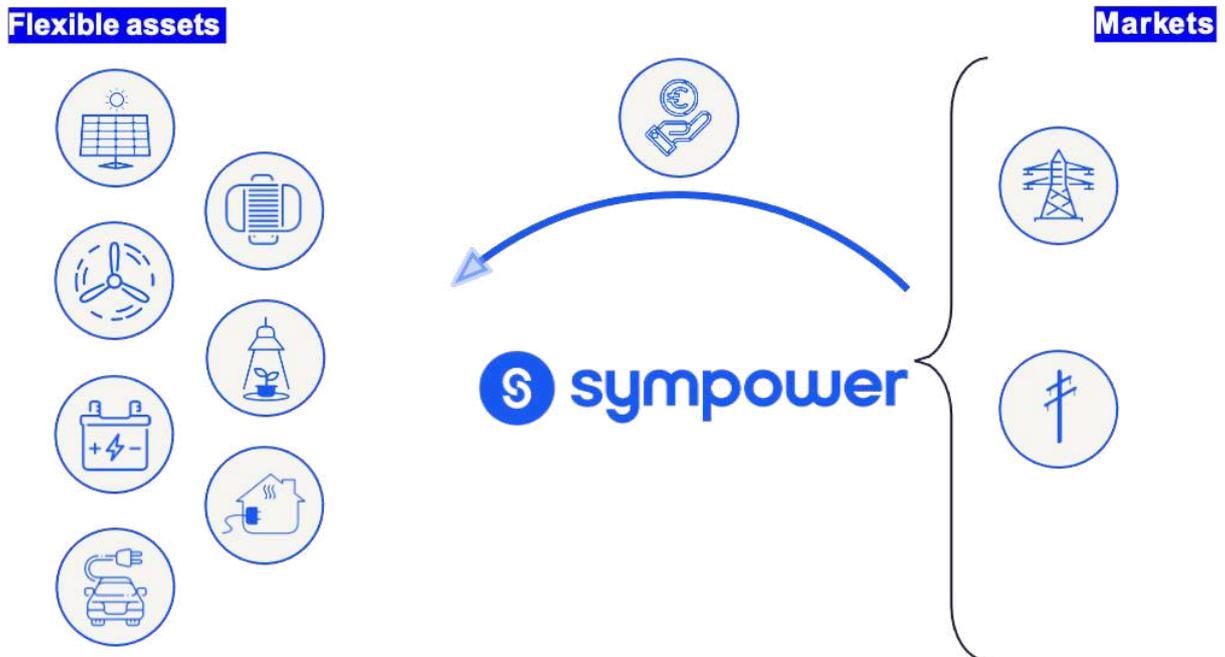
Img. 74
 Electricity daily load profile - image by Sympower



How Demand-Response contributes to a Circular Economy

Speaker: **Simon Bushell**
 Founder and CEO at Sympower

Img. 75
 Connection between flexible assets with energy markets - image by Sympower



adjusts the consumption of the appliances. By aggregating appliances in many different locations, it is possible to have the same effect as turning on coal- and gas-fired power plants.

At the same time, the owners of the assets (in the previous example, the owner of the supermarket) benefits from this practice, not only by reducing their energy consumption and carbon footprint but also by generating extra revenue, as they get paid for offering this service. Sympower is currently working both with companies in very traditional industries, such as greenhouses, paper industries, wastewater, buildings, as well as, more modern ones, such as electric vehicles and data centres.

Sympower's services enable electricity systems to rely less on fossil fuel plants for balancing purposes, by allowing to turn off at least the less efficient fossil

fuel plants, which are also the most polluting, and gradually phasing them all out in favour of a larger share of renewable energy resources and move towards a 100% renewable electricity system. Sympower provides grid balancing service to grid operators in The Netherlands, Finland, Sweden and Israel. The platform software is completely developed in-house.

Sympower is an independent player in the energy market, which allows them fast and unrestricted scaling of the services and partnerships. Sympower is strongly driven by the mission to fight climate change and to speed up the energy transition. Sympower is currently looking for partners in Italy such as energy suppliers, energy consultancy companies and industrial companies that want to exploit their existing assets to provide flexibility to the national grid.

3 Ways IoT Supports the Circular Economy

Speaker: **Daniel Lux**
CEO and Co-Founder at Seluxit

Daniel Lux explains how the Internet of Things can support the transition towards a Circular Economy.

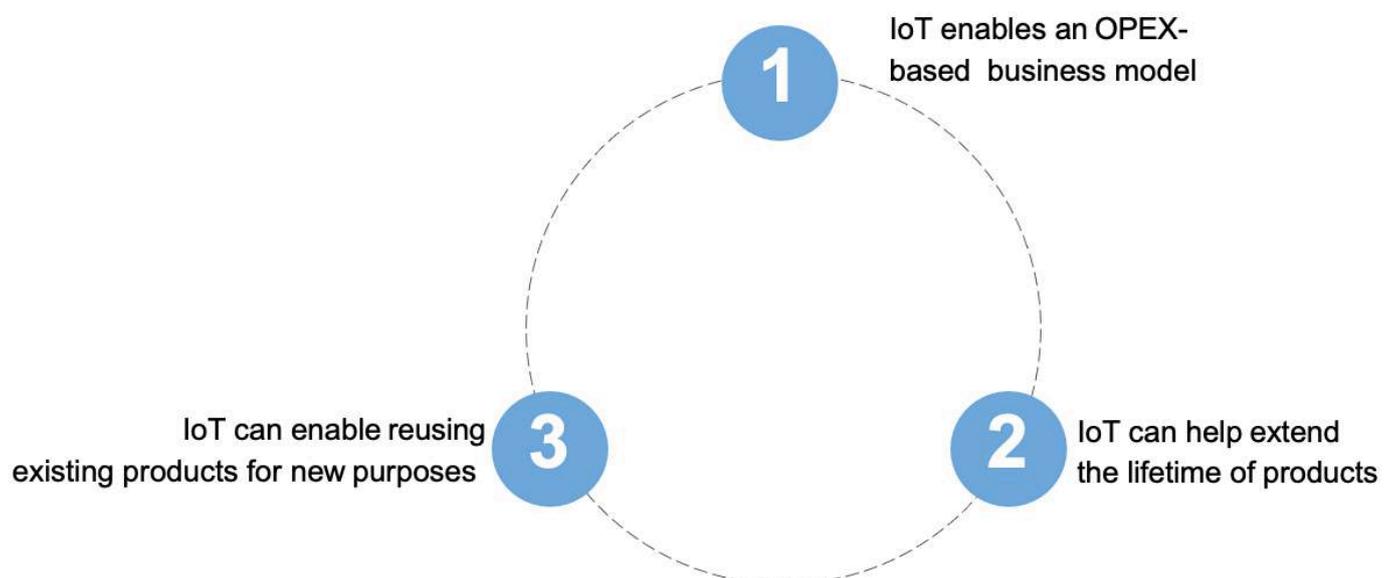
Lux starts his speech by briefly presenting his company Seluxit, where he is CEO and Co-Founder. Seluxit was founded in 2006 in Aalborg, Denmark, with the initial purpose to use advanced technology for energy savings. Today, the company is a full-service IoT provider specialized in providing quick IoT solutions to help its customers to reduce risk and time-to-market. By connecting devices to the internet, it is possible to optimize systems and save resources. Seluxit works with various European companies such as Gardena, Husqvarna Group and eBZ. They have also worked with the Italian project CURA during the COVID-19 crisis.

According to Daniel Lux, IoT can significantly support the transition to the Circular Economy, enabling the continual use of resources and waste reduction. To realize this transition, a change to the current manufacturing and economic paradigm is necessary. The traditional manufacture of machines has a capital expense business model (CAPEX), which means that in every purchase the firm transfers all the rights on the product to the customer, who gets a fixed ownership. As long as all the ownership is entirely transferred, manufacturing companies are usually interested in cutting production costs as much as possible while

increasing sales, often also by implementing planned obsolescence practices. As a result, the quality of the goods is poorer and many products are not repairable, so at the end of life they will be simply dumped. Recycling is not taken into account because designing for recycling is actually more expensive.

On the other hand, an Operating Expense (OPEX) business plan could overcome these limits. In this case, the ownership is not completely transferred because products are shared between the firm and different customers. This means that the manufacturing company does not only earn from the sale of the goods, but also from the service provided by the product. This change would lead to an improvement in products, in terms of quality, reparability and recycling at the end of life.

An operational expense paradigm would support a Circular Economy by enabling the sharing of products. The IoT, thus, plays a key role in the sharing economy, because it enables monitoring the use and the quality of the shared products, in order to predict maintenance and to extend their lifetime. Moreover, the IoT postpones the end of products' useful life, as new functionalities can be added over time, which can even enable adapting products for entirely new purposes.

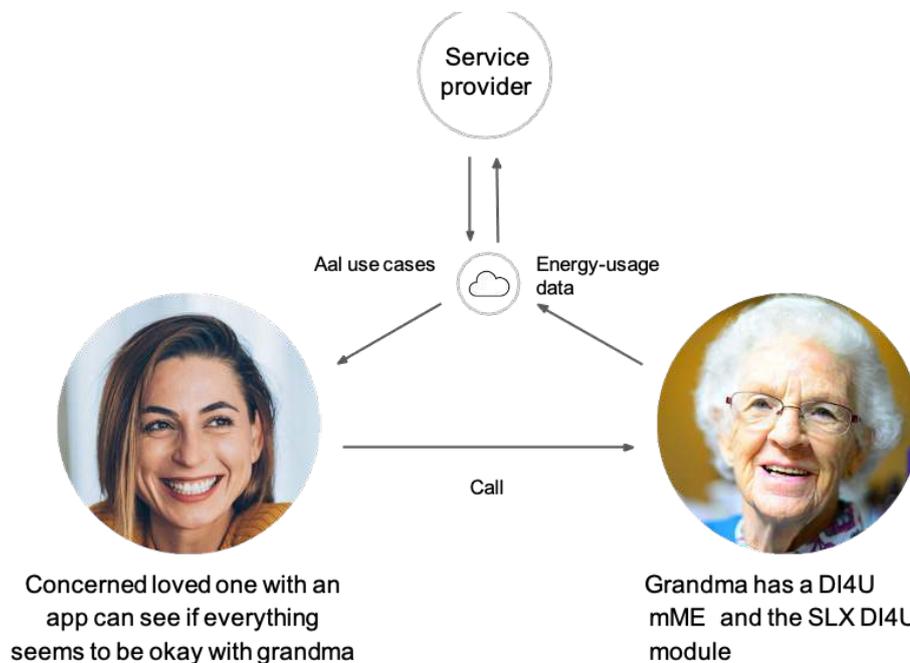


Img. 76
3 ways IoT supports the Circular Economy - image by Seluxit

3 Ways IoT Supports the Circular Economy

Speaker: **Daniel Lux**
CEO and Co-Founder at Seluxit

Img. 77
Elderly Care
Solution - image
by Seluxit



To better explain the discussed approaches, Daniel Lux made the following example: imagine you purchase a washing machine. As long as planned-obsolescence practices are common, we can predict that by spending 200€ the machine will last about two years, while by spending 300€, it will last three years and so on.

An additional option is possible under an OPEX business model. In this framework the customer pays 10% of the product's value each month, creating a recurring revenue stream for the manufacturer. In order to continue this revenue stream, the firm is motivated to extend the lifetime of the product through maintenance and repairs. In this way, the customer will have a continuously functioning washing machine.

In principle, maintaining the proper function of products is more advantageous and less expensive than buying new products or repairing seriously damaged products. Moreover, you can also expand the useful lifetime of products because you can check for liability. For example, through the G sensor you can actually check if the damages caused to a car, for example, were due maybe to an irresponsible driver, and so saving the firm from repair expenditure due to "bad" behaviour.

IoT could also be applied in the context of adapting

existing product infrastructures for novel and socially beneficial uses. For example, you can use residential electricity meters to monitor the elderly who would like that service. As we all have certain patterns of energy usage, we can use the energy usage data to ensure that our elderly loved ones have healthy behaviour patterns. If they make coffee every morning at 9:00 and then suddenly make it at 3:00, it could be a sign of early dementia. If they don't make coffee at all, perhaps they have an ailment.

A final way of how existing products could be employed for new purposes is, for instance, by unbricking old mobile phones that would otherwise be discarded for use as IoT sensors, in order to collect data such as GPS location, vibration etc.

To conclude, IoT supports circular economy through three main ways: enabling an OPEX-based business model; helping extend the lifetime of products and reusing existing products for new purposes.

AI Innovation for Waste Management

Speaker: **Mikela Druckman**
CEO at Greyparrot

Through her speech, Mikela Druckman explains the impact of artificial intelligence (AI) on waste management, starting with a brief introduction of Greyparrot, the startup she co-founded in 2019.

Greyparrot is a start-up based in London specialized in waste recognition software to monitor, audit and sort waste at scale. Their mission is to digitize waste streams to increase transparency and automation, providing much more information to the stakeholders in the ecosystem. The start-up aims to empower waste managers, producers and regulators with better data analytics, in order to enable the transition to a Circular Economy.

When looking at the Circular Economy, the main three concepts that emerge are, of course, reduce, reuse and recycle. Greyparrot focuses on recycling, identifying various challenges around this activity, such as waste contamination, expensive manual sampling and sorting, and huge lack of data insight on waste composition. The consequence is an opaque and inefficient waste process which is causing a loss value from waste management's chain. Different macro trends have been also driving change in the waste management industry.

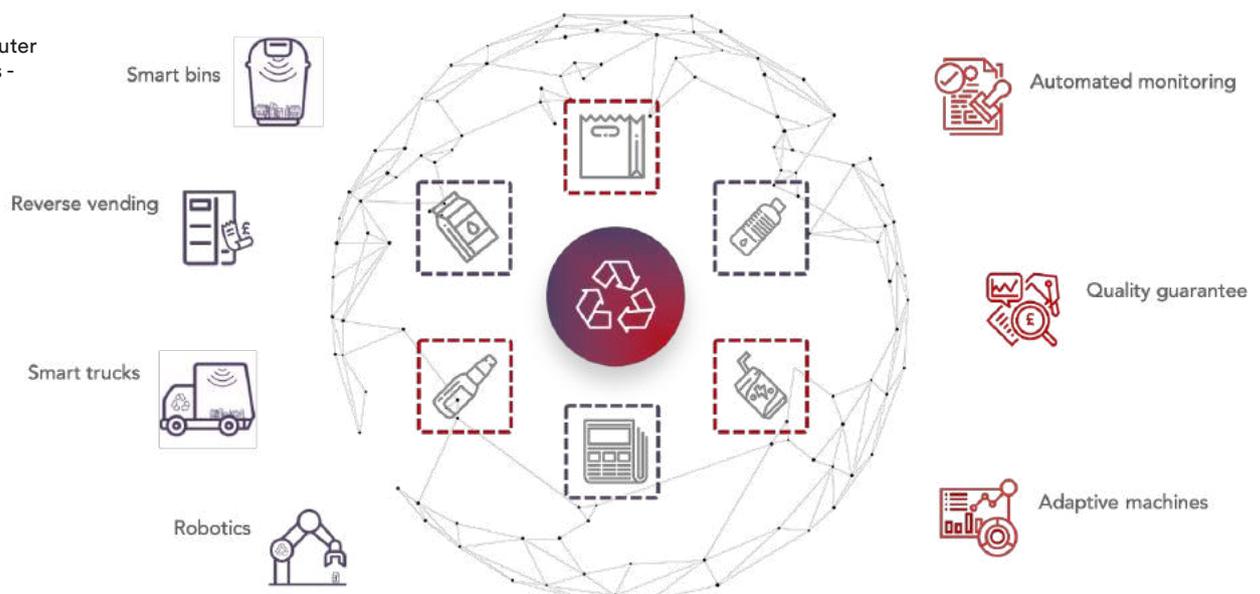
Firstly, China has banned plastic waste imports, which means that western economies need to create more pure waste streams and more quality from waste recycling.

Secondly, especially in Europe, ambitious regulations and targets have been set to increase the recycling rate, making efficiency automation the real key to meet these requirements. Moreover, key stakeholders as brands and the producers of packaging and products are committing to recycling and circular products, pushing for better information on the waste and recycling products.

Limits can be found all across the waste chain, starting from waste collection, where refuse is highly contaminated due to a lack of education and targeted feedback. Then, reliance on manual sorting is an inaccurate and expensive process. Overall, we measure less than 1% of the waste, ending with opaque information on pricing and quality risk. An AI-based computer vision has the potential to solve problems at each step of the chain, starting from using smart bins, reverse vending machines to track contamination, smart trucks that can monitor the flow of waste and optimize the routes of trucks to better guide them, and finally robotics and AI in the sorting process.

Then there are adaptive machines based on the flow of the incoming waste, quality guarantee and of course automated monitoring of these flows. This is currently possible thanks to huge advances in AI and computer vision specifically. Indeed, AI systems are now able to mimic and almost match and surpass human capacity in visual recognition.

Img. 78
AI-based computer vision functions - image by Greyparrot



AI Innovation for Waste Management

Speaker: Mikela Druckman
CEO at Greyparrot

One of the main solutions developed by Greyparrot is an automated waste monitoring system, where they analyze thorough AI vision large waste flows on moving conveyor belts in those recycling and sorting facilities. This is composed of three elements: the monitoring unit which is a camera system placed on top of the conveyor belts; AI computer vision which analyzes the different materials, the shape, the brand, the reflection exactly like a person would do and they translate this data into live dashboards so that can provide pricing by quality certified waste flows and even dynamically adjust parameters for these sorting plants and this can actually be integrated also in other types of hardware like robotics, trucks etc.

The final element is the actionable insights to waste managers. The data provided by the AI intelligence in real-time can be used for various purposes along the flow of waste.

Summing up, the key areas of impact are: monitor incoming waste to adapt machines and provide accurate feedback to waste producers (input stream); detect impurities guarantee quality; monitor residue line to capture valuable materials going to landfill (output stream). These systems can measure accurately the composition and therefore the value of waste, helping waste managers to optimize their quality. The system enables waste plants to: reduce cost through digitizing the audit process; increase revenue by increasing the quality and the volume sorted; mitigate risk by detecting contamination and inform regulation by tracking the flow of waste.

Greyparrot's projects are not exclusively based in the UK, but also in other countries, such as South Korea and Italy. With respect to the latter one, the start-up is supporting the composition analysis of PET lines to inform pricing. This methodology provides purity guarantee for buyers. In the UK they are monitoring commercial waste, in particular residue lines to reduce plastics, paper and cans, which are all valuable materials, to go to landfill. Having information in real time allows workers to react and recuperate those valuable materials.

Another project in the UK is measuring plastic lines in a facility to recognize brand's waste in order to support Extended Producer Responsibility. In this way

firms have information about where their products are going.

To conclude, AI technology is essentially enabling the transition to smart waste management and that means three things: moving towards data driven waste management, which allows us to take decisions in real time by giving information on the feed and the quality of the waste stream; substituting manual processes with automation to increase plants efficiency; improving the transparency of the chain, both for policymakers, regulators, brands and for everyone involved into the Circular Economy. The availability of transparent information plays a key role to reach the right target for a Circular Economy.



Img. 77
Waste Monitoring System - image by Greyparrot

Achieving Sustainability of an Upstream Giant field with Digital Transformation

Speakers: **Gianmarco Rossi**, Production Engineer at ENI - **Luca Cadei**, Deputy Plant Manager at ENI - **Danilo Loffreno**, Data Scientist at ENI

In their speech, Gianmarco Rossi, Luca Cadei and Danilo Loffreno illustrate how to achieve sustainability with digital transformation. To do so, the main features and functioning of the digital tool developed by them to improve and forecast energy efficiency are presented.

Energy efficiency, that basically means use less energy to obtain the same or better service, plays a central role in reducing the physiological increase of energy consumption and for a circular economy. Moreover, an increase in energy efficiency leads to significant reductions in CO₂ emissions. Focusing on some results of this asset, in 2019 thanks to energy efficiency initiative 73ktons of CO₂ were saved, an amount that could be converted to natural gas vehicles. The natural gas conversion is estimated to provide about 20.000km per year, which corresponds to saving the same amount of CO₂ emitted by 27.000 cars per year. How can we do that? First of all they start from relevant plant upgrading like steam generation and so on. However, at the moment, the production team is focusing on monitoring, change management and digital tool. Data results show that the saving from stationary combustion CO₂ is increasing every year and advanced digital tools could support the management of this increment.

So, what is the team actually doing? They are predicting the stationary combustion CO₂ Emission Index (short-term trend of the energy efficiency index) and suggesting the optimal actions to manage an upstream production plant. In order to do that they use a top-down monitoring approach that goes from the production plant where it is possible to understand and predict the general behavior, then to the function unit level (oil, gas, sulphur etc), to the equipment level using KPIs and finally to identify specific controlled variables on which it's possible to act.

Focusing on the technical feature, the predictive algorithm development employed follows the typical steps required to build an advanced analytics model. It was firstly necessary to prepare the data (data cleaning, handling missing value and resampling), to perform a feature engineering (autoregressive, seasonal and exogenous feature generation) and a feature selection followed by a model selection and a hyperparameters search. These steps were necessary to improve the prediction capability of the model. The

prediction results combined with additional data as the KPI discrepancy ranking, gave to the user an overall picture of the current emission status of the plant.

Indeed, the outputs of this model are the Energy Efficiency Prediction Index for the following hours, the emission status of the plant and the percentage variation of the prediction. Thanks to this model, when an anomaly in the condition of the emission index is detected, a ranking list of the most impacting equipment of the plant is provided, with percentage variation over the mean value on the previous, 1, 7 and 30 days. This analysis is also combined with KPI discrepancy ranking to prioritize the equipment on which the technician should focus on. This continuous monitoring supports corrective actions in real time.

So, what does the digital tool is to detect an anomaly in energy consumption, foreseeing the increase of the KPI and to indicate the equipment associated with the bad performance. The production engineer easily checks the parameters and trends, knowing in advance on which unit to focus. Actions to reduce energy consumption are then implemented and monitored.

The tool is also very useful to restore the optimal status after a variation in the operating conditions. To give an idea of how this tool would work in a more common scenario, it is possible to imagine it as a model to monitor electricity consumption in a house, collecting data from devices such as fridge, washing machine etc.

The model basically warns us on the most consuming equipment, basing this evaluation on historical data. The digital tool is very useful in day by day activity and the main requirement for its implementation is having access to plant data.

Indeed, the main advantages are related to the significant reduction of CO₂ emissions obtained while granting the highest level of production, increased sensibility of the site operations and a validated improvement towards neutrality target. The digital solution can be easily customized and scale-up to perfectly integrate with typical circular economy flows, minimizing their energy consumption and maximizing the conversion from waste to product.

Themis, Innovative technology for waste treatment

Speaker: **Pierluigi Berna**
Marketing Manager of Themis Industries Srl

To conclude the technology session, Pierluigi Berna introduced Themis, an innovative waste solution and one of the finalists of the Innovation Call organized by Tondo.

Themis' mission is to develop, design and construct highly technological plants and solutions, in order to support the circular economy and reduce the environmental impact caused by massive waste production.

In 2018, Themis patented an innovative technology to manage production waste, as wastewater, sewage, industrial sludges and, particularly, food waste. The performance of the machine is impressive, as it is able to reduce the original volume of waste by 70% up to 90%, while obtaining distilled water. This result is achieved with a minimum Opex and environmental impact. Indeed, the process does not produce any emission in the atmosphere and it works with a minimum amount of energy.

It is also able to recycle water which is very important from a logistic point of view for factories. In addition, the process is fully automated and tailor made, designed specifically on customer's needs. The machine combines four different processes (evaporation,

drying, mixing and granulation) and it is placed directly at the end of the production line where waste is generated, offering the possibility to treat waste on site. The solution is very versatile, as it can operate in different kinds of industries and for different kinds of waste. Moreover, it allows for a significant monetary saving in terms of disposal waste expenses and a great benefit for the environment as well. Themis is not just a project, but existing units are already working. For instance, operating machines can be found at the Themis' headquarter in Legnano (MI).

A big project started in July 2019 has been completed in collaboration with a tannery industry. Indeed, during the production of leather products, a significant amount of water (200 m³ of water every day) is usually employed. Thanks to Themis, the distilled water obtained through the waste treatment could be used again as an input in the same industry (194 m³ of water will be saved and recycled per day). This constitutes a concrete example of circular economy. Moreover, also the solid and dry waste generated by Themis are potentially recyclable.

Img. 78
Themis WRC
Machinery



Aknowledgements

For the event organized we thank all the speakers, and all the people who supported the organization in different ways, in particular the students of CIMO from ALMED, and the people of the Tondo team. We also thank the moderators: Federico Luperi, who moderated the round table, Mario Bonaccorso and Laura Maria Ferri, who moderated the agri-food session, Celia Guimaraes, who moderated the cities session, Giacomo Biraghi, who moderated the materials session and Andrea Signorelli who moderated the technologies session.

Thanks to all the partners of the event and the patronages received. A special thanks goes to Esselunga and Intesa (IBM Group), as main partners of the event, and to Cariplo Foundation, the General Consulate for the Kingdom of the Netherlands in Milan and Adnkronos for all their support.



PROMOTER &
ORGANIZER



MAIN PARTNER



MAIN PARTNER



PARTNER



PARTNER



MEDIA PARTNER



PATRONAGE



PARTNER



HOSTING PARTNER



PARTNER



PARTNER



PARTNER



PARTNER



PATRONAGE



PATRONAGE



PATRONAGE



PATRONAGE



PATRONAGE



INNOVATION PARTNER



VENTURE PARTNER

GRAPHIC PARTNER

Tondo is a non-profit organization that actively encourages the transition towards an economic and industrial system that is restorative and regenerative. Tondo's mission is to support the implementation of the Circular Economy, by turning it into a daily reality. The main actions that Tondo is carrying out to achieve its mission are:

- Expanding and spreading the **culture and knowledge** about the Circular Economy, through studies and researches;
- Developing an **ecosystem** to support the Circular Economy through events that engage numerous actors operating in the Circular Economy;
- Implementing “pilot” **projects** in specific and relevant areas, that involve corporates, startups, institutions and other organizations operating in the Circular Economy to test possible solutions.

Tondo is a bridge between corporates, institutions, universities, research institutes and every citizen who wants to give a contribution in sustaining the application of the Circular Economy.

Tondo's purpose is to encourage innovation and entrepreneurship in the Circular Economy field, which are essential elements for the paradigm shift requested by the Circular Economy.

Knowledge

Knowledge and its dissemination are among are Tondo's core activities. The association ascribes among its main activities to monitor, study and analyze the Circular Economy through updated data about the national and international situation, articles drawn up by experts in the field, studies about the Circular Economy's key elements, trials and applications in progress to encourage the disclosure of replicable best practice. Besides, Tondo conducts studies and analysis which aim to define and disseminate a clear and long-term vision about how to implement the Circular Economy in specific areas, which are considered more relevant or critical.

Ecosystem

Tondo created the “Re-think Circular Economy Forum” format, which proposes events or webinars designed to stimulate critical thinking concerning some elements of the current economic industrial system, by showing a vision of the macro trends, possible Circular Economy's evolutionary paths and main projects developed. Also, practical paths are indicated, capable of leading to innovative and entrepreneurial activities that might have positive impacts on the local and national system.

Projects

Tondo develops projects to promote the implementation of the Circular Economy, by involving different actors operating in a specific supply chain, to create circular models. The focus of the action lies in relevant and critical areas, where the involvement of multiple actors is necessary to develop a circular approach. Among those projects, Tondo represents the reference point between different entities which have the same purpose: the implementation of the Circular Economy. The projects have the purpose to develop trials and applications of new circular models through the use of innovative technologies.

Tondo Lab

Tondo lab is a company recently created by Tondo's team to support corporates and startups in designing and implementing circular solutions.

Tondo lab simplifies companies' journeys toward the Circular Economy by sharpening the knowledge about the Circular Economy, by fostering the implementation of innovative projects within an organization, and by supporting the collaboration between different business actors.

Specifically, the activities carried out by Tondo lab are:

- **Assessing the circularity level** of products and businesses by using internationally recognized methodologies. The assessment identifies all the materials flowing in, through and out of the business at the product level or at the department level to measure circularity;
- **Organizing workshops** with the aim of identifying ideas and projects that can enhance the circularity level of companies, and training classes that contribute to closing companies' knowledge gaps in specific areas;
- **Designing and evaluating projects** to increase the circularity level in business activities and production processes. Tondo staff act as project managers by supporting and managing the implementation of these solutions from the idea validation stage to the actual launch in the market, also leveraging its network of entrepreneurs and partners;
- **Supporting the innovation journey by matching circular and innovative startups** with potential partners. Tondo lab identifies the most relevant circular solutions in specific sectors and selects the most promising start-ups and SMEs to provide the perfect value-creating collaboration between circular innovators and corporations in order to foster Circular Economy.

Finally, Tondo lab also supports corporations in the design and implementation of the appropriate **communication strategies** with the aim of showcasing their Circular Economy approach.

Disclaimer

The report was developed by Tondo team who recorded the interventions made during the 2 days of the event and transcribed this report, adding the part of the premise and the initial executive summary. Every single intervention has been reviewed and approved by the speaker himself before publishing this report. In this way, Tondo received the approval from the speakers to proceed with the publication and is not responsible for what it has been declared by them, who remain individually responsible for what is declared or shown during the speeches at “Re-think - Circular Economy Forum “.

The report is free and it can be downloaded on the “Re-think - Circular Economy Forum” website: <https://re-think.today>



**Re
think**
*Circular economy
forum*



Tondo APS
Via Vigevano, 18
20144 - Milano (Italy)
Web: tondo.tech
Mail: info@tondo.tech