Büro Berlin
Budapester Str. 31 - D-10787
Tel. +49 (0)30 586 1994 10
Fax +49 (0)30 586 1994 99
www.german-tech.org
www.tecnologietedesche.it

Ufficio Roma
Via Appia Nuova, 666 - I-00179
Tel. +39 06 39031190
Fax +39 06 39031161
info@sbs-business.com
www.sbs-business.com

European Resources Forum 2020 online

Summaries of the content of the ERF 2020 sessions

By ERF Student Reporter and SBS systems for business solutions

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Content

Opening Session

The forum started with a strong message from Prof. Dr. Dirk Messner, President of the German Environment Agency, resonating throughout the first five speeches: we are not doing enough, but achieving resource efficiency is possible.

The implementation of the EU's Circular Economy Action Plan aims to bring about change by improving resource efficiency through increasing the use of sustainable resources, ensuring less waste by targeting product design, and focussing on the potential for circularity in sectors not reaching their full recycling potential, such as the construction industry.

Staunchly put by Stientje van Veldhoven, The Netherlands Minister for the Environment, "For climate change, there is no vaccine". Although parts of Europe are on the right track, international exchange and a global circular economy alliance are also required to achieve climate goals. Existing challenges include the uneven distribution of efficient resource across Europe, global inequalities in supply chain knowledge, and demographics, such as the rising middle class, increasing projected resource use.

By means of green deals encouraging circular economies, implementing resource use thresholds on local, regional and global scales, integrating policy approaches, and achieving efficient greenhouse gas neutrality, systemic change can be delivered.

Summarised by ERF Student Reporter: Rachel Fishman, University of Bristol, UK.

Plenary session I: The nexus between resource use and climate change - Making Europe more resource efficient and climate friendly

Dr. Harry Lehmann, General Director from the Division for Environmental Planning and Sustainability Strategies of the German Environment Agency, opened the session by saying that in our present era, there are a huge amount of goals, be it the SDG or the Paris Agreement or the COPs, that we need to achieve in order to create a sustainable world. This great transformation is possible when we completely bring about a change in our economic system. His model, RESCUE (Resource Efficient Pathways Towards Greenhouse Gas Neutrality) maps various scenarios, interactions between renewable energies and raw materials, and has found that only under the 'Green Supreme' scenario, it is possible to fulfil the Paris Agreement and that is the only scenario that is fair in resource distribution.

'Resource Nexus', as explained by Prof. Dr. Raimund Bleischwitz from University College London, is the core concept of interlinkages between air, water, land, material that brings us out of silo thinking and helps to avoid the traps that a tunnel vision or dedicated focus to one or some dimensions of policies can land the system in, such as low carbon energy which can result in biodiversity loss, water risks, etc. The concept, a necessary compliment to climate action, has been developed in the last ten years at Bonn, Germany. Sustainable Development Goal (SDG) integration is a key component of resource nexus, along with proper methodology for flow accounting. Two important scenarios that the resource nexus looks at are the Shock

Scenario which tells what will happen if something critical goes wrong and the Mission-Oriented Scenario which suggests strategies and provides regular policy reviews.

Prof. Dr. Harald U Sverdrup from University of Applied Science, Norway, says that all our big global challenges of energy, raw resource depletion and environmental ruin are interlinked. His World7 tool has mapped the scarcity level of various natural resources, metals and materials and has shown that for some materials, we are already under hard/physical scarcity and for some others, we are approaching a soft scarcity territory. Substitution is often suggested as solution but limitations ensue because every amount of every element has already been booked, there can be no substitution without somebody foregoing the resource. A resource like phosphorus has no substitute. Factor X looks at the usage circularity of a resource before its loss and in the present world, a resource is used maybe one or two times before it is regarded as waste and Prof. Sverdrup has emphasised on a paradigm change to account for greater and efficient circularity.

Francesco La Camera, Director General of IRENA, has mentioned three different scenarios (planet energy, transformative and de-carbonisation) which can help create a resilient eco system. Under the first two scenarios, we can limit going beyond 2 degrees C whereas under the third model, we can limit to 1.5 degrees C. He terms end-use electrification, green hydrogen and synthetic fuels as critical factors in achieving climate and resource efficiency. To achieve zero emissions target, renewables along with less energy demand, energy and resource efficiency and use of bio energy are crucial.

All of the speakers have emphasised on speedier systemic change of the present working model, circular economy, recycling rate efficiency and closing loops in the chain, empowering consumers through better provision of information and alternative choices, integrated governance structure, stronger policies which will in turn drive the investment and decion making of policy makers. Resource taxation, levelling prices between different materials, proper reporting standards, integration of assessment tools in policies are some of the ways that the speakers have focussed on as the better implementation and achievement of our promised goals. All of them are hopeful of the New Green Deal and of the major step towards the integration of various aspects of frameworks, policies and governance structures with a grounded science-based approach.

Summarised by ERF Student Reporter: Shelly Debbarma, The Energy and Resources Institute, India.

Parallel session 1: Resource efficient and circular design - from niche to mainstream

The session started with Harri Moora from Stockholm Environment institute who pointed out the most important elements when it comes to policies that should support transition toward circular economy and design. These elements are:

- The whole life cycle of clean and clear material
- Design and production
- Policies that support long use and consumption of products
- High quality of recycling to allow the clean and clear material to enter product cycle
- Well-functioning waste material

However, there are not enough legal pressure on consumption side. There is a lack of developed legislation mainly voluntary instruments like public procurement. This is the biggest gap of the circular policies.
For the future, the new circular economy action plan will take into consideration the approach looking on the previous gapes and barriers. He ended up by saying that "understanding the political and legal system is amongst the essential skills if you want to be successful in circular design".

Aino Vepsälainen from design forum Finland and Ronja Scholz from technical university Berlin, talked about the importance of design for the circular transition and product and service design. To talk about circular design, we should also take into consideration sufficiency and consistency. The idea is to keep every single product and component of the material in its highest potential of the value. Products are used as long as possible, maintained, recycled and therefore, they need to be designed differently because all these procedures need different handling.

Aino added that If a product is supposed to be mainstreamed it also has to be attractive, appealing and to bring value to the customers. That cannot be achieved without good design.

Joan Prummel from Rijkswaterstaat Environment, The Netherlands, said that the aim of the design in the system is to influence the use phase by creating the proper product that can be used as long as possible and also influencing collecting and recycling industries by using the right material. A product is circular when we arrange it to be circular, designed in the right way. So, design is as important as other domains. However, a product is not circular by design but by our own behavior and what to do with it. Behavior enables circular economy.

Summarised by ERF Student Reporter: Naoures Hmissi, ELTE university, Budapest Hungary.

Parallel session 2: Modelling the nexus between resource use and climate change

Ullrich Lorenz of the German Environment Agency, who chaired the session, started on the note of the complexity of the nexus between greenhouse gases and climate change. The nexus is an endogenous/exogenous complex model and the complexity needs to be conveyed to policy makers.

Kai Neumann of Considio GmbH, Germany, presented both quantitative, which looked at sectoral, national and global models, and qualitative models which were participatory exploratory models. The qualitative model explained the Lock-In Effect that arises when each system is waiting for the other system's support and none progresses within the system. The models say that there is enough material for transition though less amount of high grade material is available and overall economic benefit is derived despite rising energy prices in future years. Another interesting phenomenon that was explained by the models was the Rebound Effect that would come into effect when there is a shift to renewables by some countries thus, resulting in a decline in fossil fuel prices which would in turn influence other countries to expend and use the abandoned fossil fuels. He suggests starting implementation of renewables from now on, working on own countries and supporting other countries later as some of the actionable points. He ended on the note that "Models are something to work with", that they are not an absolute prediction of the future or that we should be deterred by assumptions we have to work with.

Dr. Stephan Lutter from Vienna University, showcased the Multi-Regional Input-Output Modelling which considered indirect or virtual flow or footprint. This model, in turn, is an effective way of motivating consumers by educating and making them aware of issues that they are directly or indirectly influencing and progress of resource efficiency. The SCP-HAT model looks at SDG monitoring in that it has helped countries learn of the extent of their footprint contribution as well as helped policy makers of UNDP, induvial countries in various policy framings and analysis. He has mentioned three key factors for the improvement of this model- uncertainty analysis, thematic (water, energy) coverage and increase in sectoral and product coverage within the model.

Elena Rovenskaya, who is Program Director of the International Institute for Applied Systems Analysis, approached modelling through the public policy planning lens. She starts out by saying that 'models should be agile, reliable and relevant' to cope within our VUCA (acronym for volatility, uncertainty, complexity and ambiguity) world. The first such model is 'agent-based modelling of people's behaviour' which is people-based and behaviour-determinism centric, showing the feedback mechanism. The 'stock-flow consistent models of economic incentives' focusses on policy evaluation and has found that the risks get smoothened in the future anticipating climate sustainability. The 'risk-adjusted optimisation for robust solutions' concludes that optimal solutions are input-sensitive.

There is a huge amount of data at the public level but that data is only meaningful when it is accessed and used as per need. The complexity of data must be made meaningful to the layman by presenting smaller understandable pieces of the larger data set incorporated into the model. Also, it is important that the models are used for the purpose it has been set up for. Assumptions have to be made of the larger data set to make them fit with the models as well as the models have to be upgraded with changing times to reflect the variability in the data. Finally, it has been emphasised upon by the speakers that a top-down as well as

bottoms-up approach to modelling is required and an exchange of data and modelling systems between the publicly funded and privately funded scientific institutions.

Summarised by ERF Student Reporter: Shelly Debbarma, The Energy and Resources Institute, India.

Parallel session 3: Towards resource efficient and sustainable chemistry

Chemicals are everywhere – which is why a sound management of chemicals is one of the main cross-cutting issues not only for resource efficiency, but also towards achieving a sustainable development. Parallel Session 3 discussed this link focusing on innovation in production processes and business models as a main driver for the green transition of industries producing and using chemicals.

Dr. Thomas Jakl, Deputy Director General at Austria's Ministry for Climate Action, put it this way: "Nobody wants to own a chemical product, but we appreciate the service it provides us". So why don't we reflect this in the relationship between consumer and producer? That is the approach used by chemical leasing, a business model based on the value of the service a chemical provides us. This service-based business model follows the main goal of integrating renewability and substitution in chemistry policy for resource efficiency and has also been reflected in the recently adopted EU Chemicals Strategy for Sustainability. Dr. Jakl identified accurate monitoring and clear exchange of information as key success factors, which at the same time are prerequisites for compliance.

The second speaker of the session, Gabriela Eigenmann, Senior Industrial Development Officer at UNIDO, introduced us to the organisation's contributions towards resource efficiency by working with small and medium enterprises. She identified innovative technology solutions, innovative business models and green chemistry as the three main elements for achieving a sustainable chemicals management. In projects conducted with partners in a number of countries from different regions, innovative practices were identified and applied with the aim of increasing material and energy efficiency across sectors. After all, sustainable chemistry management can not only contribute to resource efficiency, but also ensure occupational safety and circularity in products and plays an essential role in transitioning to a circular economy.

The difficult challenge of people changing their way of life, considering the importance of sufficiency and the use of sustainable products, has been at the centre of the discussion. Producers, on the other hand, need to be able to continuously exchange innovative examples and learn with each other.

Summarised by ERF Student Reporter: Rebecca Harms, University of Erfurt, Germany.

Parallel session 4: Renewable energies and end of life - the example of wind turbines

In this session we welcomed a stellar panel: Mr. Ferdinand Zotz, Head of Resource Management and Circular Economy, Ramboll Group from Munich, Germany; Mr. Martin Westbomke, Chairman of the Board, RDRWind, Germany; Mr. Jinfeng Zhang from the Blade Certification Division of the National Energy Key Laboratory for Wind and Solar Simulation, Testing and Certification, China; and Ms. Marylise Schmid, Analyst – Environment & Planning, Wind Europe, Belgium. The session dealt with what happens to wind turbines at the end of their life and how they can be sustainably decommissioned, dismantled and recycled.

Mr. Westbomke's presentation presented the project that was carried - together with the DIN, the German Normalisation Institute - to create an industry standard for such a sustainable process of decommissioning, dismantling and recycling of turbines (the DIN SPEC 4866). He also stressed the most vital steps to be taken next for this process to be fully implemented and integrated in a sustainable wind energy system: establishing networks with different stakeholders, supporting innovation and new technologies wherever possible and extending the scope of such a process to offshore wind turbines, which is currently non-existent.

A central topic of the debate was the significant growth of wind turbines installations since it is considered to be one of the renewable energy techniques that has the best environmental performance with the lowest green gas emission and a standard life cycle of turbines of around 20 to 25 years. Nevertheless, as Ms. Schmid pointed out, some might reach up to 35 years and around 85 to 90% can be recycled, and it has been proved that most of the components had established cycling practices.

The wind turbines' blades are considered the most challenging for recycling, because of the composite materials leading in their production. Ms. Schmid related this to a key point of the session: collaboration between different sectors and actors is needed to move forward, in this case towards a sustainable way to recycle composite materials. Apart from this, energy producers are responsible for the lifetime extension of turbines, via the inspection of the damage and the evaluation of continuous maintenance, and searching for innovative techniques for the blades' recycling. As a last point to consider, it is important to find out the appropriate locations in which to put the blade waste recycling facilities (only a few countries have made landfill ban for composite materials i.e. Austria, Germany Netherlands, and Finland).

Mr. Zhang´ presentation presented the current common practices in blade recycling in China, including various types such as physical, chemical or thermal recycling. He explained the current technologies used in physical recycling, and how the materials can be processed and given a new life in several ways (e.g. it is possible to obtain PVC for sealing, or to use the crushed retired turbines for cement or power plants).

A point that was stressed several times was the need for further research and funding's in order to be able to diversify technologies for recycling waste materials into new products, or otherwise, creating new materials that can be easily recycled.

Summarised by ERF Student Reporter: Hana Ben Mahrez (Eötvös Loránd University, Budapest, Hungary) & David Amado-Blanco González (Lund University, Sweden).

Plenary session II: The European green deal - New impulses for a resource efficient Europe in a circular economy

In this panel discussion, moderated by **Dr. Harry Lehmann** (General Director, Division of Environmental Planning and Sustainability Strategies of the German Environment Agency), we had the pleasure to count with several speakers related to the European Union and discussed the frameworks, paths and relevance of a circular economy in the context of European Green Deal, and how such a deal and recovery from the COVID-19 pandemic are two sides of the same coin. The speakers included:

- **Dr. Janez Potočnik**, Co-chair of the UNEP International Resource Panel and former European Commissioner for R&D and Environment, Slovenia.
- **Ms. Delara Burkhardt**, Member of European Parliament, Group of the Progressive Alliance of Socialists and Democrats, Germany.
- **Ms. Sirpa Pietikäinen,** Member of European Parliament, Group of the European People's Party, Finland.
- **Mr. Michael Bloss**, Member of the European Parliament, Group of the Greens/European Free Alliance, Germany.

The session started with a sense of urgency but hope, as Ms. Burkhardt laid out the many reasons why it is necessary to adopt a circular economy that helps reduce our material resource extraction patterns (e.g. around 80% of biodiversity loss is related to resource extraction!) and how the current pandemic represents a unique reminder of the need for a systemic -and not just cosmetic- change. Such a mix of feelings was reflected also in Mr. Bloss' intervention, as he stressed the need for us to reduce the EU's material footprint -14 tonnes per capita per year - and reminded us of the hope that the younger generations bring in creating a radical change through popular pressure, with movements such as Fridays For Future.

Next we had a presentation by Dr. Potočnik introducing the framework outlined in the report *A System Change Compass for delivering the European Green Deal in a time of recovery*, co-written by the Club of Rome and SYSTEMIQ. This report shows how a systemic approach can help in a quick and effective rollout of an ambitious European Green Deal and a circular economy. The framework is based on a Compass with 10 guiding principles to redefine key concepts in our socioeconomic systems to a central *natural resources optics*, that considers the dependence of our economies on the planet. See below for a graph with said principles:

These, applied together with a mapping of human needs through different economic ecosystems, leads to 30 guidelines at the system level for policymakers to incorporate in their decision-making, and to 50+ subsystems (industrial champions and leaders within such ecosystems) that should be invested in and powered for a greener Europe after COVID-19.
The idea of an EGD guided in this way being necessary for a successful recovery after the pandemic was again pointed out by Dr. Potočnik and reinforced by all speakers, and Ms. Pietikäinen joined in the call for a paradigm shift in which industries don't consider resources as infinite, and take an "astronaut approach" where we can see clearly how small our planet is and how much we are consuming of it.
Next followed a discussion about how Europe can use our advantage in setting standards for a change, such as with more complete eco-design regulations, and how the size of the European markets would surely create a ripple effect in the rest of the world. Of course, this cannot be attained only through political parties, but needs a very strong popular support that translates into political drive. The tools for such a European Green Deal are there, but rallying public pressure for less short-sighted policy approaches are necessary for such a change to happen.
In short, we already know what to do and how to approach the problem, but as Hegel said (quoted by Dr. Potočnik): KNOWING IS NOT ENOUGH; WE MUST APPLY. WILLING IS NOT ENOUGH, WE MUST DO.

Summarised by ERF Student Reporter: David Amado-Blanco González, Lund University, Sweden.

Parallel session 5: Sustainability, climate protection and resource efficiency in the health system

The starting point of this project was the UBA Resource Report for Germany 2016, informs Christopher Manstein from the German Environment Agency, the Chair of this session. The health sector has a significant share of carbon emission and footprint- in Germany alone, 107 million tonnes, which translates to 1.3 tonnes per capita, is being contributed as a total raw resource consumption (5%) by this sector. The four main areas significantly contributing to this share are- chemical products by 31.5%, food and beverage by 28.6%, energy and tools by 12.2%, followed by construction work by 10.2%. Globally, Japan and Sweden have higher shares in this sector than Germany.

Dr. Tanja Bratan, the first speaker for the session, tells us of three key parameters of the qualitative assessment conducted, namely, higher resource consumption, higher health care cost and stakeholder analysis and screening along with literature analysis. The first two factors of higher resource consumption and higher health care cost shows the synergies to be realised. The results of the project were good policy recommendations such as modular construction of medical aids and equipment, good practice examples and need for further research for expanding the knowledge base. Priority areas with regards to the four aforementioned significant contributors to emissions in the health sector being recognised, can now be worked upon for resource conservation. Staff shortages, decline in care quality, stressed systems and hygiene regulations also need to be looked at. Food is another system that needs to be synergised for a better individualistic as well as planetary health. She is positive of the motivation held by pro-active stakeholders and also, says that a large group of the stakeholders are open to sensitisation on the topic and that only mobilising them is needed.

Dr. Ulli Weisz, who apart from being a professor, has had 10 years of nursing experience, points out the twin challenges of- (a) increasing health impact due to climate change and an increasingly stressed health system as a result and vice-versa, and (b) health care's contribution to climate change and its challenges in reducing emissions. She highlights the opportunities that the sector has- health sector being a neglected aspect for a long time in climate research and climate mitigation studies, and health and climate are conjoined and that both have a symbiotic relationship. Reduction in carbon emissions is possible without undermining health care provision- it can be achieved by reducing direct energy use, decreasing unnecessary consumption and wastage, low carbon products and most importantly, health promotion and prevention.

Dr. Nicole de Paula opens her talk by saying that now is the best time to be alive in human history simply because human population is healthier in general as is evidenced in increased life expectancy, reduced poverty and reduced child mortality. However, she also says that now is also the worst time to be alive because of the planetary expense that we have come to achieve the aforementioned developmental successes. This is now seen in the increase of infectious diseases, exacerbated non-communicable diseases, mental health crises due to reduction of green areas as a factor, food and nutrition insecurity and rise in displacement and conflict. Women, being the majority in the front line of primary health care as well as being doubly burdened by care, are disproportionately affected, which has only become more evident in the pandemic crisis. Gender equality targets are also highly unmet and to build a sustainable world, all aspects must be taken care of and go hand-in-hand. The recommendations laid out in the IASS policy brief can be summarised as- (a) strategic

engagement of health professionals with climate planning processes, (b) climate finance usage to bring out health and planetary co-benefits, and (c) gender equality solutions for implementing and achieving SDGs and Paris Agreement goals.

Summarised by ERF Student Reporter: Shelly Debbarma, The Energy and Resources Institute, India.

Parallel session 6: Fostering the resource efficient and circular economy - How to manage the interface between chemical, product and waste legislation?

Dr. Bettina Rechenberg General Director, Division Sustainable Production and Products, Waste Management, German Environment Agency concludes and Chair of this session opens the session by saying that this topic is very up to date because on the 14th October 2020, the European Commission has revealed the chemical strategy for sustainability towards a toxic-free environment, as part of the "European Zero Pollution Ambition".

Enrique Garcia John, Policy Officer, Waste Management & Secondary Materials, Directorate-General for Environment, European Commission speaks about the Green Deal and the EU actions on Challenges arising from the CPW interface and summarises, that the Commission will support the development of solutions for high-quality sorting and removing contaminants from waste, including those resulting from incidental contamination. Furthermore, he says, that this means better sorting, and better decontamination technologies. Mr John concludes, that there is still a lot to do but the Commission will try to promote this via a number of different financing instruments.

Bo Balduyck claims, that the knowledge gap on hazardous substances in products and waste needs to be closed and a true circular economy needs non-toxic material streams.
Maria Thestrup Jensen Ministry of Environment and Food, Environmental Protection Agency, Denmark, presents instead the Generation and Application of secondary chemical Resources (GEAR) project, which overall purpose is, that Danish enterprises are develop innovative solutions on the world´s most pressing environmental problems.
Also, the International communication via online-Platform about chemicals in waste, is a point, where improvement is also required, in the opinion of Mr John.

Dr. Rechenberg adds, that the German Environment Agency also started a project, which purpose is the better exchange of information's within the Value-Chain and improving the interface between chemical and waste-law.
So, the (international) exchange of information's, the improvement of production and also new laws and financial instruments are getting more and more important for an efficient management between chemical, product and waste legislation.

Summarised by: Raphael Kroll, SBS systems for business solutions.

Parallel session 7: Resource efficiency and circular economy indicators and targets

The session started with Barbara Bacigalupi, Policy Officer, Directorate General for Environment, European Commission. The general idea was about monitoring progress on circular economy in the EU.

Moving from linear to circular economy requires a systematic change across the economy. Hence there is no one circularity indicator. 10 individual indicators were identified covering 4 main groups:

- Production consumption
- Waste management
- Secondary raw material
- Competitiveness innovation

By doing so, the entire loop of circular economy has been covered, capturing the main circular economy elements. Some suggestions on how to improve the EU monitoring frame work by 2021 were also mentioned.

Prof. Dr. Hans Mommaas Director, Netherlands Environmental Assessment Agency gave some insights on how in the Netherlands they are trying to handle the complexity of monitoring and evaluating the circular economy. He also mentioned the critical elements target setting; the indicator sets and stakeholder networks. To conclude he mentioned the faced challenges like availability of data of private sector for instance, and creating comparable data across countries.

Dr. Melanie Haupt Institute of Environmental Engineering, ETH Zürich, Switzerland talked about the waste disposal indicators and their applications as well as the national target settings for waste management.

Dr. Philip Nuss from Section Fundamental Aspects, Sustainability Strategies and Scenarios, Sustainable Resource Use, German Environment Agency, highlighted the development of science-based target. The general idea was that it is necessary to provide industry and governments with targets for orientation on sustainable resource use. The footprint-based indicators and targets can be integrated into management. Besides, Proxy targets allow learning starting with today s knowledge informed by science considering context.

Summarised by ERF Student Reporter: Naoures Hmissi, ELTE university, Budapest Hungary.

Parallel session 8: Global implications of a country's water footprint - the case of industrialised countries

Most of the consumed goods that are daily consumed come with a water footprint (flowers, milk, meat), 6000L/d are consumed by a person every day. This consumed/polluted water, supply chains of products, organization, or nations:

- Blue water: Ground and surface water (« loss » from river basin by evapotranspiration, product integration, or discharge in other basins or the sea).
- Green water: rainwater (« loss » is due to evapotranspiration of rainwater by plants).
- Grey water: polluted blue water (measured by the required volume of water to dilute wastewater).

In order to explain the water footprint of Germany and its impact on the world, Mr. Jonas Bunsen mentioned the importance of combing the global hydrogeological data with input-output (EE-MRIO) analysis in helping us to approximate and to investigate the water footprint of Germany in the world.

Dr. Masaharu Motoshita from his side showed that 60% of Japan depends on other countries for 60% of the total demand of freshwater, while all of the overconsumption occurs in other countries, especially the developing ones, that irrigation water demand is critical in overconsumption, but other industrial activities also matter and that small amounts of overconsumption in some watersheds cannot be disregarded in the context of local sustainability of freshwater.

Summarised by ERF Student Reporter: Hana Ben Mahrez, Eötvös Loránd University, Budapest.

Parallel session 9: Sustainable lifestyles for the resource efficient and circular economy

Achieving carbon footprint reduction requires a change in energy sources, increasing building and appliance efficiency, and changing lifestyles. According to Detlef van Vuuren, Professor in Integrated Assessment of Global Environmental Change, Utrecht University, individuals and households adopting a sustainable lifestyle is the least considered option applied to climate prediction models.

However, studies show lifestyle changes, such as decreasing meat consumption, not only reduce emissions, but are also responsible for predicted reductions in water, energy and land use requirements, subsequently allowing for biodiversity restoration. Lifestyle changes are therefore integral to meeting ambitious climate targets and limiting global warming to below 2°C by 2030.

Dr Lewis Akenji, Executive Director of SEED, highlighted the need for personal carbon footprints to reduce to 3 tonnes by 2030. Industrialised countries such as Finland, currently at 10.4 tonnes per person per year, will need to reduce by more than 70% to achieve the

goal, whilst China, at 4.2 tonnes per person per year, will only have reduce carbon emissions by 30% per person.

However, challenges to achieving sustainable lifestyles exist in the 'layers of influence' surrounding personal needs. Uncontrollable factors relating to personal situation and socio-technical conditions predetermine how lifestyle needs are met, and so act as barriers to changing them. Akenji further held brand owners, the power players in production systems, responsible for influencing consumption. Targeting brand owner habits and increasing understanding of where power hotspots lie in industry, alongside institutional change, will allow progression towards lifestyle change.

Speaking last in the highly engaging lecture, Malin Pettersson-Beckeman, Head of Sustainability, Communications & Engagement at the Inter IKEA Group, demonstrated how IKEA are answering calls for brand owner responsibility. The brand has taken considerable steps to achieving a goal of becoming climate positive and inspiring and enabling 1 billion people to live healthy and sustainable lives by 2030. They aim to do this by becoming circular, and making sustainable products and services both affordable and attractive to as many people as possible. IKEA are starting to design every product from the very beginning to be repurposed, repaired, resold and eventually recycled, sourcing 97% of their wood from FSC certified sources and working to develop bio-based glue.

The overriding message is that individuals and companies must work together to integrate sustainable living into daily life, that is accessible to all, and contributes to a circular economy. However, government policies must also be put into action to strengthen sustainable approaches and optimise the adoption of future measures to considerably improve carbon footprints.

Summarised by ERF Student Reporter: Rachel Fishman, University of Bristol, UK.

Parallel session 10: Resource efficient buildings, infrastructures and building solutions

Construction industry are resource intensive. 50% of resources used in various activities during construction are extracted from Earth. The industry cumulatively releases 40% of greenhouse gases and 50% of waste generated. Therefore, it becomes important to tackle the vices in the industry for a green future.

The session was chaired by Alexa Lutzenberger. The first speaker Cédric de Meeûs, Vice-President, Group Public Affairs & Government Relations, spoke about reinventing the construction industry. The goal set by him was a net zero carbon industry. Shelter is an essential necessity yet 1.6 billion people in the world lack adequate housing. When looking at the solutions, resources that are flexible and efficient are the need of the hour. Policies framed that are needed for resource efficient construction should look into: material neutrality, life cycle performance and demand-pull measures.

The second speaker was Hubert Rhomberg, Managing Director of Rhomberg Holding introduced the work of digital twin. The digital twin of the building is an AI based optimisation process considering several scenarios and parameters and also allows to extract exact

amount of material and costs. It can be utilised by the people working on a new project saving their time drastically. A new funding model proposed in which a building is considered as a material bank and while dismantling all the material can be reused.

The third speaker Klaus Dosch, Director of Factor X talked comprehensively about three turnarounds in construction as energy, climate and raw materials. Each project needs to look into design, list of resources and dismantle manual. Each new building should have a Resource-Score, consisting of three components- climate-score, material-score and energy-score. The session concluded with a Q&A answered by all the speakers.

Summarised by ERF Student Reporter: Akshaya Paul, TERI University, India.

Parallel session 11: The international dimension of resource efficiency - Policies and best practise examples from all over the world

Dr. Detlef Schreiber of GIZ GmbH, Germany, the Chair of this session, introduced the audience to the project MoniRess, a collaborative project partnership between UBA (which is the German Environment Agency), ifeu and GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) which surveys countries on a global scale and monitors international development policies and raw resource policies amongst other things. This session was all about looking beyond Europe, particularly towards the East, the necessity of international cooperation and systemic learning from each other. A poll was posted in the beginning in which it was asked of the audience to choose how much percentage of the world's countries they think have resource efficiency policies in place. 57% of the audience voted for 25% of the world's countries to have such a policy into place but surprisingly, Dr, Schreiber informed us that about 75% of the countries have such a policy into effect to varying degrees in the form of waste management, circular economy and policy of manufacturing segments. The Indian speaker, Dr. Khosla, said that to better foster international policies, the European Resources Forum could have a convention to which the panel could report back to, as is the case with the UNDP and UNFCCC.

We start off with Russia with Prof. Dr. Olga Sergienko from ITMO University, who talked about indicative characteristics such as adoption of UNEP SDGs, strategy characteristics such as waste management and climate change and about institutional support, and the need for documentation of best available techniques, and circular economy reforms. Russian example of waste management policies and practices was highlighted where the territorial waste management as well as ban on waste disposal containing useful components were key aspects and food waste reduction within the food supply chain was stressed upon. Dr. Sergienko stressed upon scientific research, awareness of consumers and increasing interest in business circular models as areas to focus on going forward.

In the Indian context, we are illuminated on the resource efficiency/circular economy policies and approaches by Dr. Ashok Khosla, a member of the UNEP International resource Panel, who says that India's resource productivity, despite being a developing country, is increasing and not bad in comparison to China and Germany. He expounds on the fact that the country being people rich and resource poor, it had already had to effect into place laws and

regulations for resource efficiency as early as 1958. One of the key players of bringing about a change in the resource efficiency and circular economy system has been the non-governmental organisations (NGOs) who have contributed, and continue to contribute, significantly to land and water management, energy provision for cooking and lighting, recycling, construction material innovations. Development Alternatives, founded by Dr. Khosla in 1983, is a good practice example of the construction material innovation use in that the building of his organisation has been built using 50% of recycled materials and used foundry slag, fly ash, etc. as materials as well. In collaboration with the Swiss Government, they have come up with a first new cement in 200 years, LC3 which is a very good low carbon building material. Dr. Khosla closed his session by saying that "Efficiency is meaningful only if it is built on sufficiency" and "Resource productivity is meaningful only if it raises human productivity and well-being as well".

From India, we moved on to China which is the third economy to include circular economy laws after Germany and Japan, Prof. Dr. Bing Zhu, Director and Professor of the Institute for Circular Economy, stated. The Chinese policy has three main components of industrial recycling system, urban recycling system and resource recycling industry. It also has an 'evaluation indicator system of circular economy' in which the good practice example of Industrial Parks (IPs) in China were taken. Within the circular economy, such industrial parks would be key to resource efficiency implementation and sustainable development by the three parameters of circular transformation, establishment of eco-industrial parks and pilot projects of national low-carbon industrial parks, in-short, a circularity of circular economy, green economy and low-carbon economy. The circular economy policy is also reported by Dr. Zhu of supporting China's goal of achieving carbon neutrality by 2060. He was most enthusiastic about plastic policy collaboration between China and Europe.

Lastly, Ms. Chika Aoki-Suzuki of the Institute for Global Environmental Strategies, presented to us the case of Japan's circular economy policies. 'Policy for sound material cycle society' which has been in effect since 2001 has the fundamental approach of 3Rs i.e. reduce, reuse, recycle coupled with renewables, along with various indicators, investment guidelines, labelling to help effectively implement the policies laid out. One of the fundamental measures introduced into this policy was the measures for marine plastic. Material flow in Japan has seen an increase in circular usage rate and reduced waste productivity and in turn, increased resource productivity. Public-Private Partnership (PPP) is also an important incorporation for the effectiveness of a circular economy policy and it brings under its belt initiatives such as Plastic Smart and CLOMA (Japan's Clean Ocean Material Alliance). Two best practices examples that she has highlighted are those of UNIQLO's measures of recycling their own products and Kao and Lion, a toiletry goods company, that is to be commended for its efforts at recycling material and packaging redesign.

Summarised by ERF Student Reporter: Shelly Debbarma, The Energy and resources Institute, India.

Parallel session 12: Learning about resource efficiency - The role of the higher education system

Prof. Holger Rohn Technische Hochschule Mittelhessen, University of Applied Sciences, BilRess-Network, Germany opens the session with his presentation about Education for resource efficiency and resource conservation in Higher Education, focussing on the situation in Germany. He concludes the resource conservation and resource efficiency are not yet systematically and comprehensively anchored in German universities and study programs. He continues, that existing approaches to resource formation must be significantly expanded and extended to develop resource competence, but the large number of universities, study programs, training through the Bologna Process and densely packed curricula make implementation difficult.

Prof. Dr. Torsten Masseck Universitat Politècnica de Catalunya, Spain illuminates the education-situation from a south-European perspective. He says that training future professionals for a world of uncertainties through experience-based education is essential. He adds, that challenge-driven education attending societal challenges together with public and private stakeholders should be extended and focusses on the University as an important social actor for life-long learning, value discussion, prototype initiatives and the link between research, application and societal outreach.
One of the problems in his opinion is the generational change of teaching staff. He recommends a mix of top-down and bottom-up approaches with the ultimate goal: creating new generations of "game changers".

Sakari Autio claims, that Universities can be an important driver promoting resource efficiency. Education has the task to create future oriented employees for working life and cooperation with companies and public organizations. He concludes that there is a big need for a Global cooperation to understand the Global Value Chains.

Also, the actual Corona-Crisis How impacts the education, but can also be a chance to gain new studies and ideas about this Life-Stiles and brings people out of the comfort-zone. Mr Autio says for example, that this crisis shows, that education can run also with smaller Buildings and less transportation. But the question will also be, how on a long term this virus impacts the situation.
The Speakers conclude, that the youngest generations of Students have an important role in developing new studies, the topics and also creating new ideas on improving the education-system and that a radical change in Lifestyle is inevitable.

Summarised by: Raphael Kroll, SBS systems for business solutions.

Parallel session 13: Top ten technologies towards a sustainable use of our resources

"Hartwig Michels" mentioned in this session that there is a growing pressure on the resources of our planet in order to cover the needs of citizens as well as on the industrial companies to offer long term sustainable growth and deliver quarterly results. How can we proceed to use materials smarter, less, and longer? Resorting to industry leaders (MNC's and start-ups) and key opinion leaders (Governments and NGO's, academia, experts, and media), a list of top 10 WMF technologies was elaborated in a way that their impact is huge and measurable on decoupling economic growth and the use of natural resources while creating value for industries:

1/ Recycling of plastics and carbon fibre composites.
2/ Recycling of EV batteries.
3/ Improving mobility performance of EV batteries.
4/ Improving storage performance of residential batteries.
5/ Low energy access to potable water.
6/ Spintronics for lower power consumption of data storage/usage.
7/No CO2 production of bulk materials
8/ Hydrogen based on renewable for fuel cells at reasonable cost.
9/ 3D manufacturing of plastics and carbon fibre composites.
10/ Al and Quantum or accelerated materials discovery.

All of these techniques have a huge impact on both short and long term. During the presentation, a focused investigation on 3 of the techniques was explained. The most important points are as follow:

-Chemical Recycling of plastics: « by Prof Stéphane Mangin » 100 Mt less monomers every year for the same volume of plastics products worldwide with positive applications (food protection, light weighting of cars insulation of buildings…)
-Spintronics: "by Cody Finke" 50% reduction in energy consumption compared to conventional electronics
-New process for cement: "By Prof. Victoir de Margerie" 50% reduction in CO2 emissions and H2 as a low-cost by-product.

And also:
-Lower pressure and better geographical autonomy on critical materials thanks to more efficient battery recycling.
-Faster and lower costs development of hydrogen economy based on renewable etc.

Their development requires priority setting and coordination between all stakeholders of the material supply chain which raises some questions: be regulatory (which frame(s) will be most efficient), legal (how do we assess competition of grant IP), and financial (how do we fund investments or value achievements).

Summarised by ERF Student Reporter: Hana Ben Mahrez, Eötvös Loránd University, Budapest.

Plenary session III: Outlook and next steps

The closing session was coined by the thought that civil society plays a very important role in achieving resource efficiency and that, of course, includes every single one of us.

When thinking about policy decisions and their impact on communities, we must not forget those communities in the global south who are directly involved in material flow processes. Our economy has to be modelled in a way that enables every community in the world to be resilient in the wake of crises and ensures social stability. Dr. Ashok Khosla, member of UNEP International Resource Panel, reminded us that there are two sides of the important term "sufficiency": What has been discussed a lot during today's conference is sufficiency as a maximum, meaning our ability to limit our consumption to what we actually need. Resource efficiency, however, also has to do with sufficiency as a minimum, ensuring that every human being has enough resources to lead a healthy life.

To this end, non-governmental and civil society organisations, social enterprises and think tanks need to be strengthened so they can successfully assume their vital role as powerful actors in policy making. At the same time, we need to rethink our economic system in a way that fulfils our basic needs and equally respects planetary boundaries.

The ideas of paving the way towards a green economy while not leaving anyone behind have also been reflected from the student reporters' contributions live on stage.

Summarised by: Rebecca Harms, University of Erfurt, Germany.