

Transforming towards a sustainable society – challenges and solutions

Scientific Conference

Book of Abstracts

October 11th – 13th, 2023

Campus South | Karlsruhe

Building 20.30

AN EVENT OF

SSCIENCEWEEK

Transforming towards a sustainable society – challenges and solutions

Scientific Conference

Book of Abstracts

October 11th – 13th, 2023

Campus South | Karlsruhe

Kollegiengebäude Mathematik

Englerstraße 2

Building 20.30

76131 Karlsruhe



PROGRAM | Wednesday, October 11th, 2023

09:30 – 10:00	Registration			
10:00 – 13:00	Welcome & Opening Plenary “Transformation towards a sustainable society”			
13:00 – 14:30	Lunch & Poster Session (13:45 – 14:30h)			
14:30 – 16:00	Urban Trans- formation I	Future Mobility Solutions	Behavioural Change	
16:00	Coffee break			
16:30 – 18:00	Urban Trans- formation II	Health and Well-Being	Resilience and the Social Dimension	Energy I
18:00 – 19:00	Break			
19:00 – 22:30	Conference Dinner with Keynote Speech: The role of science on the roadmap towards sustainability (and peace) from a UNESCO perspective by Dr. Roman Luckscheiter, General Secretary, German UNESCO Commission			

Venue:

Karlsruhe Institute of Technology
Campus South
Kollegiengebäude Mathematik
Englerstraße 2
Building 20.30
76131 Karlsruhe

Conference Dinner:

Center of Art and Media (ZKM)
Lorenzstraße 19
76135 Karlsruhe

PROGRAM | Thursday, October 12th, 2023

09:00 – 10:30	Plenary “Innovative Energy Technologies”			
10:30	Coffee break			
11:00 – 12:30	Commu- nication and Narratives	Energy II	Circular Economy I	Water
12:00	Lunch & Poster Session (13:15 – 14:00h)			
14:00 – 15:30	Plenary “Nature Based Solutions”			
15:30	Coffee break			
16:00 – 17:30	Ecosystems and Biodiversity	Energy III	Circular Economy II	
17:30	Break			
19:00 – 21:00	Panel Discussion of the KIT Science Week			

Panel Discussion:

Kulturzentrum TOLLHAUS
Alter Schlachthof 35
76131 Karlsruhe

PROGRAM | Friday, October 13th, 2023

09:00 – 10:30

Plenary “Governance and Economy”

10:30

Coffee break

10:30 – 13:00

Plenary “Solutions/Resilience”
Summary

13:00

Lunch

Scientific Partner:



Welcome Addresses

Wednesday 11th | 10:00h – 10:30 h

Prof. Dr. Kora Kristof **Vice-President Digitalization and Sustainability,
Karlsruhe Institute of Technology (KIT)**

Mrs. Bettina Lisbach **Mayor of the City of Karlsruhe**

Mr. Tobias Kl ingenmayer **Green Culture Manager, ZKM, Karlsruhe**

Prof. Dr. Johannes Orphal **Head of Division IV,
Karlsruhe Institute of Technology (KIT)**

Wednesday, October 11th, 2023

Plenary Session

SESSION A

Transformation towards a sustainable society: Scientific Dimension

Wednesday 11th | 10:30h – 11:00h

Daniela Jacob

Climate Service Center, HGF Hereon

Plenary Session

SESSION A

Transformation towards a sustainable society: Scientific Dimension

Wednesday 11th | 11:00h – 11:30h

Anke Weidlich

Universität Freiburg

Plenary Session

SESSION A

Transformation towards a sustainable society: Economic Dimension

Wednesday 11th | 11:30h – 12:00h

Gunther Rothermel

SAP

Reinvent the “R” in ERP with SAP Sustainability

Companies are facing new and evolving Environmental, Social, and Governance (ESG) rules, regulations, and market pressure to deliver sustainable business practices. Sustainable business is no longer a question of if or why, but how. Gunther Rothermel presents both perspectives. SAP as an exemplar which means, as a company with its own sustainability targets and guidelines. On the other side, SAP as an enabler helping companies manage sustainability data with a suite of cloud-based solutions to create holistic sustainability transparency while steering sustainability investments for long-term value creation.

Plenary Session

SESSION A

Sustainable society - perspective and contribution from a medium size manufacturing business

Wednesday 11th | 12:00h – 12:30h

Ulrich Hahne

Herrenknecht AG

Plenary Session

SESSION A

**Consistent sustainability strategy as driver and game changer
in a global corporation**

Wednesday 11th | 12:30h – 13:00h

Cordelia Thielitz

Schneider Electric GmbH

Parallel Session

SESSION 1A

Urban Transformation I

Wednesday 11th | 14:30h – 15:00h

Mira Kopp

University of Jena

Municipal Circular Economy Indicators:

Do They Measure the Cities' Environmental Ambitions?

Circular economy is gaining traction in cities as an approach to mitigate their local and global environmental impacts, but the mitigation potential of circular economy strategies is increasingly questioned. To ensure the implementation of sustainable strategies that align with the cities' goals, relevant environmental monitoring tools are necessary. This study reviews 30 municipal circular economy policies to assess the relevance of their indicator sets with regards to their major environmental concerns. The review reveals a broad spectrum of circular city policies from waste management to climate action strategies with diverse environmental concerns. While greenhouse gas emissions of territorial scope are frequently monitored, the indicator sets mostly ignore that climate mitigation is targeted at a footprint scope and lack indicators for other environmental pressures and impacts. To adequately monitor the environmental impacts of urban circular economy strategies, transdisciplinary collaboration is required to further advance the applicability of urban footprint models to municipalities.

Parallel Session

SESSION 1A

Urban Transformation I

Wednesday 11th | 15:30h – 16:00h

Magdalena Vallon

Karlsruhe Institute of Technology (KIT)

Efficient climate protection at a local level

Mitigating and adapting to climate change is an urgent and complex issue and particularly challenging for those who have to make the actual decisions. Especially in the public sector, regulations are made at the European or national level, but implementation is the responsibility of local authorities such as cities, villages and municipal companies, which adds a complex task to their scarce financial and human resources. Therefore, a team of scientists from different institutes (KIT-IIP, KIT-ITAS, KIT-IfV, KIT-IMK) is developing a graph database, to evaluate various climate protection measures according to scientific standards and municipal decision making factors. These factors and the most important key issues (energy, mobility, water) were previously identified in a series of workshops with the Association of Municipal Companies (VKU Ba-Wü) and several municipalities and municipal enterprises in Baden-Württemberg. We will present these results of the according feasibility study „Kommunaler Klimaschutz“, with which the South German Climate Office (KIT) aims to provide support for local authorities.

Parallel Session

SESSION 1B

Future Mobility Solutions

Wednesday 11th | 14:30h – 15:00h

Lukas Barthelmes

Karlsruhe Institute of Technology (KIT)

Agent-based modeling framework for the investigation of transport related effects of urban rail-based parcel shipments

Recently, innovative city logistic concepts for courier, express, and parcel (CEP) shipments have raised particular interest in contributing to a more sustainable transportation system. One solution can be the utilization of existing urban rail infrastructure, where goods are transported together with passengers in a so-called ‚cargo tram‘. Although conceptual studies exist, detailed analyses of the effects on the overall transportation system still need to be carried out. Hence, in this study, we develop a methodology that integrates urban rail-based parcel transport into an existing agent-based modeling framework. The model is applied to the city of Karlsruhe, Germany, as part of the project LogIKTram. The overall effects of the cargo tram are simulated and evaluated. Moreover, the technical requirements for an efficient un-/loading of goods are presented. The results show that the realization of a rail-based parcel transport can reduce the overall mileage and number of trips caused by CEP shipments. However, the potential is driven by several factors, such as the number and location of city hubs and the overall evaluation of the cargo tram.

Parallel Session

SESSION 1B

Future Mobility Solutions

Wednesday 11th | 15:00h – 15:30h

Daniel Weiss

German Aero Space Center (DLR) – Institute of Transport Research

Unveiling the Landscape of the Multi-Level Perspective through Text Mining: Examining the Transportation Transition

The Multi-Level Perspective (MLP) is a prominent framework used to conceptualize (sustainability) transitions. While niche-regime interactions have been thoroughly explored, macro-level factors, referred to as the landscape within the MLP, lack dedicated analyses and methodologies for effectively identifying and systematizing relevant factors on a broader scale (Geels, 2011; Whitmarsh, 2012).

Our research aims to address this gap by introducing a novel methodology that combines the MLP framework with advanced Natural Language Processing (NLP) and signal mapping techniques. We demonstrate this approach using the transportation transition as an example (Müller 2022). The method involves the examination of a large corpus of publications from the Web of Science, dating from 2012 onwards. We automatically identify and cluster pertinent landscape factors using NLP, followed by a qualitative interpretation of their influence within the transportation transition.

Our novel approach contributes to the literature by offering a more comprehensive and systematic exploration of landscape factors associated with a specific transformation process.

Parallel Session

SESSION 1B

Future Mobility Solutions

Wednesday 11th | 15:30h – 16:00h

Goertz Jelle

inno2grid GmbH

Fleets as key enabler transforming tomorrow's mobility

Fleets as enablers of sustainable corporate mobility and attractive business models as a holistic approach supported by research projects such as uniTe2 - keyword: autogrid and fleet power plant

Parallel Session

SESSION 1C

Behavioural Change

Wednesday 11th | 14:30h – 15:00h

Conor Simpson

Karlsruhe Institute of Technology (KIT) – Campus Alpin

Right plant, right place. Exploring the potential of orphan crops and appropriate farm management in the context of sustainable food security

250,000 plant species have been identified as edible for humans yet historically we have consumed just 7,000. Today we consume around 150 plant species, of which just three provide 50% of our total calories. This story is the result of immense breeding success combined with fertilizer innovation that has enabled cosmopolitan species with high yielding elite cultivars. However, there are major trade-offs, including the loss of local cultivars and food species along with the production of greenhouse gases, increased eutrophication, nitrate leaching and biodiversity loss.

Using the leafy vegetable Shona cabbage (*Gynandropsis gynandra*) as a case study, I aim to highlight how untapped genetic diversity can reveal agricultural applications for an orphan crop. Additionally, I will present early results from an experiment aiming to mitigate the detrimental effects of nitrogen fertilization by comparing farm management systems. Through combining both the potential of untapped food resources, and optimising existing fertilization practices, I hope to demonstrate the importance of studying both genetics and the environment to achieve sustainable food security.

Parallel Session

SESSION 1C

Behavioural Change

Wednesday 11th | 15:00h – 15:30h

Ana Cordeiro Pires

Karlsruhe Institute of Technologie (KIT), Süddeutsches Klimabüro

Climate decadal predictions in forest management: from 10-year planning to climate adaptation

Forest management traditionally relies on 10-year plans to guide decisions about seeding, planting, and logging. However, this long-term planning is no longer adequate in a changing climate. The South German Climate Office is a partner on project EDE4.0, which aims at developing a digital decision support system for forest managers by combining regional climate model data, artificial intelligence, and tree-growth information. Our role is to assess different climate datasets to feed into this system, with particular focus on decadal predictions, which have an appropriate time scale to meet the forest management objectives. The current case study evaluates the ability of MiKlip decadal dataset to represent two forest-relevant indices for Baden-Württemberg: Last Late Frost (LLF) and Growing Season Start (GSS). We analyze probabilistic daily temperature distributions and anomalies over five decades. Results show an earlier GSS, caused by an increase in winter average temperature, and a later LLF, systematically occurring after the GSS, caused by a high variability of spring minimum temperature.

Parallel Session

SESSION 1C

Behavioural Change

Wednesday 11th | 15:30h – 16:00h

Helena Trenks

Karlsruhe Institute of Technologie (KIT)

Facilitating empowering role change in the energy transition through experiments: experiences from a real-world lab

The energy transition is not just a technical or political challenge; it furthermore requires changes at all levels of society. One central element to support this transition process is that citizens take up new, more active roles. Yet, models that allow direct involvement and prosumer practices of individuals are still not widely implemented. Real-world labs can provide a supportive infrastructure, in which actors can try out new (more sustainable) practices and develop new concepts of their own roles. To better understand if and how real-world labs support individual actors to take up new, more active roles in the transition process, we will take a look at the real-world experiment „Your Balcony Network“. This experiment aims at empowering citizens in the energy transition by using photovoltaic balcony modules, that offer a low-threshold possibility for own energy production and consumption. Empirical findings of our analysis will be presented; especially we will show how taking part in the experiment influenced the actor's actions and role understanding and what key mechanisms of change accompanied and supported this change.

Parallel Session

SESSION 2A

Urban Transformation II

Wednesday 11th | 16:30h – 17:00h

George Tsegas

Aristotle University of Thessaloniki

Assessing the Potential Environmental and Socio-economic Benefit of a TiO₂ Nanoparticle-based Photocatalytic Paint by Integrating LCA and CBA Methodologies

In the context of the LIFE VISIONS project, an innovative TiO₂ nanoparticle-based photocatalytic paint for indoor spaces was demonstrated, efficiently reducing NO_x and VOCs air pollution in the presence of UV and visible light. The paint also promises energy savings in the buildings applied, by lowering mechanical ventilation needs for air purification. For assessing the depollution rate of the paint, in-situ measurements and numerical Computational Fluid Dynamics (CFD) modelling were deployed, in controlled and real-scale applications. An integrated assessment of the potential environmental and socioeconomic benefit was conducted via Life Cycle Assessment (LCA) and Cost Benefit Analysis (CBA). More specifically, LCA examined the environmental profile of the paint throughout its life cycle, emphasizing on its production and application phases. CBA calculated potential health and economic benefits, while it was based on a Driver-Pressure-State-Impact-Response methodology. Finally, all health indicators were translated into monetary terms to assess the economic savings resulting from reduced air pollution related morbidity and mortality.

Parallel Session

SESSION 2A

Urban Transformation II

Wednesday 11th | 17:00h – 17:30h

Eva-Maria Knoch

Karlsruhe Institute of Technology (KIT)

Sustainable Mobility between Rural and Urban Areas

Connecting town and country is a challenge for public transport (PT). While most PT systems allow fast and inexpensive transport in dense urban areas, there is often no alternative to private cars in rural areas. As a result, many people commute to the city by private car and consume much traffic space. One solution could be customizable autonomous call taxis which are individually disposed and operated all over rural areas but use platooning when moving in the city. After a maximum of one change in a mobility hub, they bring users to their destination or offer a transition to other means of transport. The concept should not replace classic public transport or last mile solutions. It combines the advantages of private cars and public transport through maximum flexibility in terms of departure time or route selection. Individual cabins that can be opened or closed as required, providing privacy similar to a car. Compared to a private car, it improves ecological and economic efficiency. Discrimination- and barrier-free, it allows social participation for all and increases the ecological, economic, and social sustainability of mobility between rural and urban areas.

Parallel Session

SESSION 2A

Urban Transformation II

Wednesday 11th | 17:30h – 18:00h

Somidh Saha

Karlsruhe Institute of Technology (KIT)

Inter and transdisciplinary approaches to increase social-ecological resilience of urban and peri-urban forests: lessons learned from the GrüneLunge project (ID: 537)

Trees in urban and peri-urban forests/UPF are declining alarmingly. In the GrüneLunge project, we aimed to develop strategies for increasing the social-ecological resilience of urban and peri-urban forests/UPF to climate change impacts and urbanization by applying inter- and transdisciplinary research approaches. We have shown that reducing trade-offs between supporting (e.g., biodiversity values) and regulating (e.g., heat stress mitigation, pollution removal) ecosystem services is critical for maximizing the benefits of UPF. We have identified vital tree species that can help increase resilience to climate change impacts in urban areas. We found that drought in spring can be detrimental to city trees, which augmented an irrigation reform in Karlsruhe for city trees. Our results showed increased tree canopy cover and species diversity lowered temperature during the heat waves. Visits to the UPF increased after the pandemic. Increasing tree species diversity, involving citizens and municipal administration in urban green space planning, ensuring urban green space equity, and increasing city green cover foster social-ecological resilience.

Parallel Session

SESSION 2B

Energy I

Wednesday 11th | 16:30h – 17:00h

Hans Henning Stutz

Karlsruhe Institute of Technology (KIT), IBF

Geotechnical Gravitational Energy Storage (GGES): Energy storage using a mass of soil

The Gravitational Geotechnical Energy Storage (GGES) method is introduced, aiming to store excess electrical energy as potential energy in an elevated soil mass. This is achieved practically through a cavity that can be charged and discharged with water using pumps or turbines. Two different systems can be distinguished: a deep system and a shallow system. A large-scale field test and numerical simulations are used to demonstrate the shallow system and its feasibility. To overcome some shortcomings of the shallow system and to further optimize the energy storage system, the so-called deep system was invented on a different technology. Numerical simulations on this system confirm the long-term stability of the system for a lifetime of more than 50 years. This contribution will present and summarises research results achieved so far on the GGES and outlines the further development path toward the application of this system.

Parallel Session

SESSION 2B

Energy I

Wednesday 11th | 17:00h – 17:30h

Elham Fakharizadehshirazi

Karlsruhe Institute of Technology (KIT) – ITAS

Scenario-based analysis of ground-mounted photovoltaics potentials in Germany at different scales

Ground-mounted PV (GPV) projects are booming in Germany due to the political goals of climate neutrality by 2045 and their eligibility in the German Renewable Energy Sources Act (EEG). To support regional planning and enhance social acceptance of GPV, we developed an innovative, spatially differentiated GIS model with a multi-criteria approach. The model considers technical, economic, environmental, and social aspects.

Our GIS model has two components: a constraint and a suitability component. We devised different restriction scenarios and applied GIS-based multi-criteria decision analysis (MCDA) to evaluate suitability classes. We estimated land use demand and potential electricity generation under different scenarios, considering constraints and suitability factors. Results show even with strong restrictions, enough suitable areas exist to reach political targets. EEG regulations notably impact identifying suitable GPV sites, favoring locations near highways, railroads, and rewetted peatlands. The GPV model is applicable for local-scale transdisciplinary decision-making, demonstrated in a stakeholder-integrated municipality.

Parallel Session

SESSION 2B

Energy I

Wednesday 11th | 17:30h – 18:00h

Georgia Ioannidou

Aristotle University of Thessaloniki

A sustainable catalytic process for the production of butadiene from waste biomass intermediates

The demand for 1,3-butadiene, a valuable olefin for the production of synthetic rubbers has increased. As the majority of it is produced from fossil-based processes, which result in high CO₂ emissions, new sustainable ways are required. Erythritol, an industrial fermentation product, is considered an alternative feedstock to manufacture 1,3-butadiene. This study aims at the development of a suitable catalytic material for the effective erythritol conversion to 1,3-butadiene via hydrodeoxygenation. A series of Re, Mo and mixed Re-M (where M:Ag and Mo) supported on black carbon (BC), cerium and cerium zirconium oxide were synthesized and tested in liquid phase under batch conditions as they exhibit a notable performance. The catalyst screening was performed under reductive and non reductive atmosphere at specified reaction conditions comparing activity and product distribution. A Mo-Re/BC (5-10wt% loading) catalyst exhibited the best performance and reached 91% 1,3-butadiene selectivity for 51% conversion at 140 °C and 60 bar H₂ pressure. It was found that increasing temperature, hydrogen pressure and catalyst weight favor 1,3-butadiene production.

Parallel Session

SESSION 2C

Resilience and the Social Dimension

Wednesday 11th | 16:30h – 17:00h

Maitreyee Sevekari

Karlsruhe Institute of Technologie (KIT)

For the greater good? Assessing feasibility of climate change mitigation

Assessments of feasibility of climate change mitigation strategies so far have evaluated the implementation of modelled pathways that are developed by Integrated Assessment Models (IAMs). These involve assessing the practicality of implementation of strategies through the assessment of enabling factors or constraints present in the real world. The goal of this evaluation is centred around the narrow metric of emission reductions even though the implications of climate mitigation are deeper and more complex. This way of operationalising feasibility enables perpetuation of the status quo and demands an implicit trade-off, forgoing social justice for practicality and ease of implementation. This paper tries to contradict the necessity of this tradeoff. The paper advocates for the incorporation of the dimension of desirability within these assessments, which corresponds not to evaluation of needs which could provide a better understanding of the real world and make the process of implementation of policies feasible and just in the longer run.

Parallel Session

SESSION 2C

Resilience and the Social Dimension

Wednesday 11th | 17:00h – 17:30h

Bernhard Koch

Universität für Bodenkultur Wien

FOEBE and FOEBEPlus - ERASMUS+ Projects paving the path for the transformation into Bioeconomy

The bioeconomy sector draws on a system-oriented approach that extends to different sectors of the economy and is rooted in the principles of circularity and sustainable development. Ultimately, it requires a paradigm shift both in educational programs and in teaching practices, if young professionals are to be equipped with the entrepreneurial skill sets they need.

There is a clear mismatch between today's academic offerings in the field of business and the needs of the industry, hampering its potential for development. In addition, no harmonized European approach exists in this arena. The European Bioeconomy University (EBU) alliance joins forces to provide students with the best possible educational offering by implementing the change needed for educational programs in the field of bioeconomy. This partnership draws on their expertise, resources, and knowledge, as well as that of their industrial partners, to offer modules that enable students—as future entrepreneurs—to acquire a comprehensive and multifaceted understanding of every aspect of the bioeconomy.

Parallel Session

SESSION 2C

Resilience and the Social Dimension

Wednesday 11th | 17:30h – 18:00h

Markus Szaguhn

Karlsruhe Institute of Technology (KIT)

Transforming Work Cultures: Strengthening Competencies for Sustainable Development of Employees by Conducting Real-World Experiments in Corporate Contexts

Climate crisis requires a profound socio-ecological transformation, comprising corporate contexts. To maintain competitive, companies need to anchor sustainability deeply in processes, services and products. But how to shape an impact-oriented work culture, that involves employees in this transformation? And how to impart the competencies required? This contribution presents the results of an accompanying mixed-methods evaluation of a lecture format, firstly held in 2023 in an extra-occupational mechatronics master at the Eastern Switzerland University of Applied Sciences in St. Gallen. The format is rooted in transdisciplinary and real-world lab research, since it involves students in two interlinked experiments: a) analyzing and reducing their individual carbon footprints for raising awareness in everyday life and b) revealing their opportunities for transformative engagement, to identify and to support the implementation of relevant measures at their workplaces. The presentation underlines the value of experiments in corporate contexts for strengthening the employee's competencies and also, the overall resilience of companies.

Parallel Session

SESSION 2D

Health and Well-Being

Wednesday 11th | 16:30h – 17:00h

Elizabeth Noemi Diaz General

Karlsruhe Institute of Technology (KIT)

Land-based quality-of-life as a metric for transformative change: preliminary approach for the BIONEXT project

Transformative change within the biodiversity nexus is the ultimate goal of the EU-funded BIONEXT project that aims to mainstream biodiversity into sustainability policies in the food, water, health, energy and transport sectors, in the context of climate change. BIONEXT recognises that transformation requires a shift in how humans interact with nature and this will be reflected in ecological, technological and socio-economic systems. In this work, we analyse indicators of human, social, manufactured, financial and natural capitals used in the most recent version of an agent-based model known as CRAFTY-EU to discuss how a land-system-based framework for estimating the potential provision of Quality of Life (LANDS-QoL) can provide a metric for assessing transformative change, taking the case of BIONEXT. LANDS-QoL defines QoL in terms of material, health, social relations, security, freedom, and justice and equity, and incorporates the value of rural-natural lands to QoL assessments. With a connection to land system models, LANDS-QoL can explore different future climate and socio-economic scenarios in which sustainable transformative change occurs.

Parallel Session

SESSION 2D

Health and Well-Being

Wednesday 11th | 17:00h – 17:30h

Panagiotis Gkirmpas

Sustainability Engineering Laboratory / Aristotle University of Thessaloniki

Source term estimation in a complex geometry domain using computational fluid dynamics simulations and Bayesian inference

Releases of highly toxic gases and substances can be responsible for serious issues correlated to people's health, especially in the highly densely urban environment. In many cases, the source's characteristics, such as the location and the release rate, are unknown, preventing the authorities from reacting immediately in applying measures for population protection. Source term estimation techniques are used to identify the unknown sources' location and to quantify the release rate. The present work aims to estimate the location and the emission rate of an unknown air pollution source within an urban domain by combining computational fluid dynamics numerical simulations of the wind field and pollutant dispersion with a probabilistic algorithm that follows the Bayesian Inference method. The algorithm's capability to provide accurate predictions is evaluated against a wind tunnel experimental dataset. The present method is planned to be used as part of a source parameter estimation system capable of supporting decision-makers and local authorities with important information in the case of such emergencies.

Parallel Session

SESSION 2D

Health and Well-Being

Wednesday 11th | 17:30h – 18:00h

Ulrike van der Schaaf

Karlsruhe Institute of Technology (KIT)

Sustainable Hydrocolloid Emulsifiers from Food Waste Streams:

The Case of Sugar Beet Pectin

Consumer demands are changing towards more sustainable food ingredients. Hydrocolloid emulsifiers such as sugar beet pectins (SBP) are a promising alternative to many food ingredients: As edible, vegan polysaccharides with low allergenicity they are often sourced from waste streams of the agro-food industry. Applications of SBP bear several challenges that result from their natural variation but also from processing and formulation of the particular food product they are used in. To overcome these challenges, molecular structure-function relationships are required to allow for a mechanistic understanding of the emulsion stabilizing properties.

The complexity of the use of SBP in food emulsions will be highlighted. The colloidal conformation of SBP changes depending on the pH and ionic strength of the solution. This impacts the interfacial and emulsion stabilizing properties of SBP. Consequently, the SBP concentration must be chosen depending on the conformation to ensure stable formulations.

The underlying mechanisms and formulation concepts can be transferred to hydrocolloid emulsifiers in adjoining fields of research and industry.

Thursday, October 12th, 2023

Special Session

Thursday 12th | 09:00h – 09:20h

Anda Iosip

Full-time activist in Scientist Rebellion

Scientist Rebellion: From Publication to Public Action

Can activism and academia go well together? Scientists have been studying climate and the effects of climate change for decades. It is now clear that our current economic system based on the ruthless exploitation of nature and humans has brought the natural life-sustaining systems to the brink of collapse. Conventional methods such as promoting science and climate facts, writing papers, books, summaries and reports, signing letters or petitions, participating in demonstrations and even contacting lawmakers or government officials to advocate specific climate policies proved to be unsuccessful in overcoming the political systems from prioritizing corporate gains. Therefore, the current situation calls for a radical change in the way scientists engage with society about the biospheric emergency. We invite scientists to use their privilege, reputation, knowledge, and understanding, to act according to the gravity of the situation. Many scientists are now outlining a path forward that entails embracing non-violent civil disobedience - a powerful tool for driving social change on short timescales. It is our emergency brake. In this talk, you will find out how climate activism can be integrated into scholarly responsibilities without compromising professional integrity.

Plenary Session

SESSION B

Innovative Energy Technologies

Thursday 12th | 09:20h – 09:40h

Dimitri Balis

Aristotle University of Thessaloniki, Greece

Wildfires in Greece and their impact on air quality:

Is this the new normality?

During the summer of 2023, a large number of megafires occurred on Greece, triggered by an extremely long-lasting heatwave and strong winds, meteorological conditions which have become more frequent during the last decade. Such a megafire lasted for almost 15 days in NE Greece resulting to a burned wild forest area of more than 1000000 acres. The plume of the fire moved West-to-South West reaching the Ionian Sea and even the coast of Africa. At Thessaloniki we operate a suite of advanced remote sensing instruments, including lidar, FTIR, MAXDOAS and sun photometers, which made the capture the evolution of the fire plume possible. Unprecedented high values of AOD and CO were observed over the urban agglomeration, which eventually demonstrate what we should expect in the future in terms of air quality burden. These high values set a range of variability that should be considered by the future satellite remote sensing missions.

Plenary Session

SESSION B

Innovative Energy Technologies

Thursday 12th | 10:00h – 10:20h

Kathrin Menberg

Karlsruhe Institute of Technology (KIT)

Chances and risks of aquifer thermal energy storage (ATES) systems

Decarbonising the heating and cooling sector is crucial for decreasing our global CO₂ emissions. One favourable option for environmentally friendly energy supply in buildings is the use of shallow geothermal energy, such as ground source heat pump and tunnel geothermal systems. Furthermore, underground thermal energy storage systems offer possibilities for peak time shaving and balancing seasonal variations in thermal energy demand and availability. In particular, aquifer thermal energy storage systems are characterised by high storage capacities and low storage costs. Hence, this talk will provide an overview of the present status and future potential of ATES systems including the chances and risks associated with such systems. Economic and environmental benefits compared to conventional, fossil-based energy sources emphasise the potential of ATES as a key technology for the transition of the heating and cooling sector to zero carbon. As cooling plays an important role for economic feasibility, a specific focus is set on identifying current cooling needs and potential synergy effects for ATES systems on district-scale.

Special Session

Thursday 12th | 11:00h – 12:30h

Prof. Dr. Sarah Burch, Dr. Jose DiBella and Taginder Clair; University of Waterloo, Canada

Prof. Dr. Barry Ness; Lund University, Sweden

Prof. Dr. Megan Farelly; Monash University, Australia

Prof. Dr. Daniel J. Lang and Dr. Annika Weiser; KIT, Germany

Dr. David Sipple, Arizona State University and University of Freiburg

Fostering sustainability transformation through transformative business practices and models of SMEs’ – Insights from the TRANSFORM project

SMEs play a critical role in shaping our communities locally and can have impacts on national and international level. Accordingly, they also have tremendous potential to drive sustainability transformation beyond their company by experimenting with and implementing transformative business practices and models. In this special session, we would like to share some insights into the TRANSFORM project, which is being conducted by an international network of researchers working to build the capacity of SMEs to accelerate the transformation to sustainable and resilient communities. As a foundation, the project has developed a database of case studies of small businesses from around the world that identify, structure, and embed the sustainability practices and models used by these businesses. Building on these case studies, the transdisciplinary and transformative research conducted as part of TRANSFORM focuses on developing and evaluating transformative experiments with small businesses as well as actors in their entrepreneurial ecosystem; building the capacity of small businesses to improve their sustainability practices, including developing resources and tools to support them; and synthesizing the findings to develop policy recommendations and strategic materials to support decision makers in creating an enabling environment.

After a presentation of the approaches and initial findings of the TRANSFORM project, including the database as well as concrete examples of transformative SME experiments, capacity building activities, and entrepreneurial ecosystem analyses, we invite conference participants - both academics and practitioners - to discuss our findings and potentials as well as the challenges of transformative SME business practices and models in general. In addition, we would like to explore opportunities for participants to get involved in the TRANSFORM network locally in Karlsruhe and Freiburg as well as internationally.

Parallel Session

SESSION 3A

Communication and Narratives

Thursday 12th | 11:00h – 11:30h

Sami Mustikkamaa

University of Turku

Does anyone deserve to be on the losing side? Deservingness perceptions and compensating for regressive effects of environmental policies

People commonly perceive environmental taxes to be unfair and particularly costly towards people with low incomes. Yet prior studies have found that compensating for vulnerable groups is not always a popular way of spending new tax revenues. In this paper, we hypothesize that this could happen due to perceptions of deservingness. Support for compensatory actions might be reduced if policies benefit specific groups that elicit negative perceptions of deservingness, such as the unemployed – who are often seen as undeserving of help. Using novel survey experiments from European Social Survey CRONOS-2, an online panel covering 12 European countries, we assess how support for compensation policies changes whether they compensate deserving or undeserving groups. Our results show that attitudes towards compensatory actions bear resemblance to traditional welfare policymaking, where perceptions of deservingness clearly matter, and suggest avenues for effective climate policy communication.

Parallel Session

SESSION 3A

Communication and Narratives

Thursday 12th | 11:30h – 12:00h

Sara Akemi Ponce Otuki

Federal University of Viçosa

PERCEPTION OF SCIENTIFIC FEEDBACK BY RESIDENTS OF COMMUNITIES AFFECTED BY THE SAMARCO/BHP BILLITON/VALE DISASTER, BRAZIL

Scientific feedback is the return of research results to the community participating in the investigation. This research aims to analyze how scientific feedback occurs and to understand the interactions between researchers and residents of an area of socio-environmental conflicts. A qualitative research was carried out, with in-depth interviews and content analysis. In November/2021, semi-structured interviews were conducted with about 60 individuals from the communities directly affected by the Fundão dam collapse tragedy in Brazil. The results indicate the desire for scientific feedback, especially on the theme of contamination, but these results are never or rarely returned to the community. The vast majority of researchers do not return their results, causing a feeling of frustration and helplessness among the research subjects, perpetuating academic extractivism. The results show that the return of research results to the communities affected by socio-environmental disasters is a priority point on the agenda of researchers in the region, mainly related to the themes of environment and health.

Parallel Session

SESSION 3A

Communication and Narratives

Thursday 12th | 12:00h – 12:30h

Susanne Ober, Andreas Seebacher

Institut für Technikfolgenabschätzung und Systemanalysen

Transforming with the ‘MobiLab’ – a mobile participatory laboratory for trans-disciplinary and transformative research in real world labs

Sustainability transformation needs physical spaces for exchange between various stakeholders to negotiate sustainability solutions. Inspired by the science shop Zukunftsraum – the heart of the real-world laboratory in Karlsruhe – the MobiLab enables transformative research processes and widens their outreach capacity. The flying structure reflects sustainable design requirements.

Research on the MobiLab tested the four method families for transformational sustainability science formulated by Wiek and Lang (2016, Transformational Sustainability research). First results point to the unfolding of five impacts: functionality and equipment, creating physical and symbolic spaces, interaction, and impact on the team. Especially the creative-intuitive and experimental method families seem to invite people to participate enabling exchange between science and society. The talk will also address shortcomings of the MobiLab concept.

Parallel Session

SESSION 3B

Energy II

Thursday 12th | 11:00h – 11:30h

Leandra Scharnhorst

Karlsruhe Institute of Technology (KIT)

Consumer Preferences and Acceptance of Compensation Schemes for Controlled Power Shutdowns in Germany: Results from a Choice Experiment

In the near future, local grid congestion is expected to increase due to the rising deployment of renewable energy and electrification on the demand side. Despite the introduction of demand response schemes, grid operators may need to resort to controlled power shutdowns for individual consumers to manage local grid congestion. These measures necessitate consumer acceptance to ensure grid stability. This study assesses the willingness-to-accept (WTA) of compensating households for participating in such controlled power shutdowns. To do so, we first conducted a choice experiment involving 682 German consumers. We use a mixed logit model to examine their preferences regarding the design of compensation schemes, considering duration, frequency, and pre-warning time for the acceptance of controlled power shutdowns. Furthermore, the overall acceptance of the tariff-design as well as the sociodemographic and household characteristics are analyzed to uncover potential preference drivers. First results show that duration and frequency have a negative influence, whereas pre-warning time and compensation have a positive influence on the utility.

Parallel Session

SESSION 3B

Energy II

Thursday 12th | 11:30h – 12:00h

Rafal Andrzejczyk

Karlsruhe Institute of Technology (KIT)

Innovative techniques for analyzing latent thermal energy storage integration with renewable energy source systems

This study presents a holistic overview of work to move towards a better, more advanced transformation to find sustainable solutions in thermal energy storage systems (TESS). The main aim is to optimize latent TESS by finding optimal solutions based on geometrical configurations or storage materials i.e. biodegradable phase change materials (BPCM). Furthermore, it proposes advanced methodologies such as machine learning techniques for the analysis of experimental results to make a simple analytical model of the phase change process. Moreover, new experimental techniques such as image data analysis are proposed. It is planned to use analytical modeling results to be implemented into the Dymola environment to analyze the possibility of TES cooperation with different kinds of installations popularly used in building applications. Special attention is paid to TES cooperation with RES (renewable energy sources) like PV (photovoltaic panels), HP (heat pump) SP (solar panels). The analysis will be prepared for different kinds of objects localized in different parts of the EU and with different energetic classes.

Parallel Session

SESSION 3B

Energy II

Thursday 12th | 12:00h – 12:30h

Holger Ihssen

Karlsruhe Institute of Technology (KIT) / STS

Seasonal energy storage for the circular economy of the future with high energy density

The European long-term energy storage demand can be assessed in about 1200-1300 TWh per year at the European level to allow full decarbonization as required in 2050. Such storage demand requires very high storage volumes making volumetric energy density of storage media the critical parameter. In this context, reactive metals are gaining increasing attention as sustainable, circular, safe energy carriers due to their very high volumetric energy density. Aluminum is very well suited for long-term storage applications. Hydrogen and heat are generated by using steam for the oxidation process of aluminum. This avoids the use of catalysts. The alumina is recycled back into aluminum using established industrial processes powered by renewable electricity. This is already implemented in multi-MW plants for metal production. The evaluated round-trip efficiencies are competitive with H₂-based storage cycles or even better, while the volumetric energy density of the storage is significantly higher. In addition, the principles of circular economy and recyclability under the Critical Raw Materials Act and the Net Zero Industry Act are fully considered.

Parallel Session

SESSION 3C

Circular Economy I

Thursday 12th | 11:00h – 11:30h

Kai Hecke

Schneider Electric GmbH

Circular economy in the service sector using refurbished products

Circular economy as an instrument for building up the value of spare parts and mal-function reserves. Concrete approaches via reselling and reusing, refurbishment and recycling.

PRESENTATION WILL BE HELD IN GERMAN

Parallel Session

SESSION 3C

Circular Economy I

Thursday 12th | 11:30h – 12:00h

Salar Tavakkol

Karlsruhe Institute of Technology (KIT)

Circular Plastics for Closing the Carbon Cycle

Chemical recycling of plastic waste through pyrolysis is essential for closing the carbon cycle and contributing to a circular economy. Complementary to the existing collection and mechanical sorting systems, pyrolysis can achieve higher product quality and avoid the downgrading effects of stand-alone mechanical recycling technologies. Under atmospheric pressure and an inert atmosphere, pyrolysis is a thermochemical process in which plastic waste is converted to three product fractions: gases, condensate and solids. Depending on the polymer types, their composition in the starting material, and pre- and post-treatment, the products can be used in petrochemical processes to produce new plastics. The present talk provides an overview of the experimental research platform regarding the chemical recycling of plastics with the pyrolysis technology at the Institute of Technical Chemistry (ITC), with an exemplary objective to chemically recycle the organic fraction of shredded refrigerators in the framework of a scientific collaboration with Helmholtz Institute Freiberg for Resource Technology (HIF).

Parallel Session

SESSION 3C

Circular Economy I

Thursday 12th | 12:00h – 12:30h

Sabine Fleck

Karlsruhe Institute of Technology (KIT)

High pressure entrained flow gasification - a key process in circular economy

High pressure entrained flow gasification (HP-EFG) producing a high quality syngas is a key enabling technology to close the anthropogenic carbon cycle. Research on gasification and burner design is performed at test rigs from lab to pilot scale, focusing on maximizing the fuel specific process efficiency and syngas quality at varying operating conditions. For transfer to industrial scale, investigations are carried out at the 5 MW HP-EFG as part of the Carbon Cycle Lab. Extensive measurement equipment allows to study the processes during operation, validate research results and thus enables optimization of the process. Data on heat release and slagging – not accessible in the lab and bench scale facilities - deliver information for reactor design and scale-up. Process data derived from operation with model and technical fuels varying the stoichiometry in a wide range were used to calculate heat transfer and carbon conversion, which were applied for scale up to 50 and 100 MW. Experiments under atmospheric conditions showed the influence of burner geometry on fuel conversion and underline the importance of burner design for an efficient gasification process.

Parallel Session

SESSION 3D

Water

Thursday 12th | 11:00h – 11:30h

Daniel Valero

Karlsruhe Institute of Technology (KIT), IWG

Tackling plastic pollution transport in rivers – one aspect at a time

Plastics are found everywhere, from the air we breathe to remote locations. However, our understanding of how they travel from their sources (human activities) into rivers and oceans is still limited. In this talk, we will discuss recent laboratory experiments designed to mimic river flow conditions that affect the transport of plastics. By examining one variable at a time, we aim to identify the key forces responsible for the movement of plastics. This research helps to quantify these mechanics and assess their impact on both the transport and monitoring of plastics in natural environments. We will also discuss how existing theories about fluid turbulence can be applied, but also raise some limitations. Additionally, we will uncover some physical traits of plastics that can make a difference in determining their fate.

Parallel Session

SESSION 3D

Water

Thursday 12th | 11:30h – 12:00h

Karina Kaminski

Schneider Electric GmbH

Sustainability and Resilience in Water

Within the journey to Net Zero or even Net Negative GHG (Greenhouse Gas) emission targets of our society, energy efficiency is the low-hanging fruit within the short-term range of actions to take. The impact of energy on the bottom line of water and wastewater utilities is highly relevant. More than one third of the overall costs in this segment are energy costs already today.

For minimizing energy consumption throughout the whole water cycle, digitalization is the enabler – likewise to the energy and mobility transition. In this presentation Schneider Electric will highlight potentials of digital solutions in the water industry for sustainability and resilience.

Parallel Session

SESSION 3D

Water

Thursday 12th | 12:00h – 12:30h

Jonas Ullmann

DVGW-EBI

PeePower™: Scale-up and field test of a novel bioelectrochemical system in efforts towards a sustainable bioeconomy

Within the project PeePower™, hydrogen production from urine in a novel bioelectrochemical system (BES) was investigated on the Federal Garden Show in Mannheim (BUGA23). With a separating toilet, it is possible to obtain undiluted urine from all visitors. Using the obtained urine as feed, microbial catalyzed hydrogen production in a pilot-scale reactor is investigated. The 100 L reactor contains rotating graphite discs (anode) on which microorganisms can grow as a biofilm. The cultivated exoelectrogenic bacteria are able to oxidize organic substrates from urine and transfer the generated electrons to the anode surface. On the cathode, electrons and protons are recombined to form hydrogen. The project aims to provide insights into a possible scale-up scenario of lab-scale BES, reveal shortcomings of the reactor design for future improvements, as it could serve as a platform system for multiple waste-to-product processes in efforts towards a sustainable bioeconomy.

Plenary Talks

SESSION C

Nature Based Solutions

Thursday 12th | 14:00h – 14:40h

Karl M. Wantzen

Université de Strasbourg, France

Water and Sustainability – transformation and/or disruption?

The irrefutable evidence of global Climate Change challenges the global society with shrinking maneuvering space to mitigate negative effects and/or to adapt to inevitable changes. While the resilience of ecosystems, and thereby, their potentials to function, to evolve and to support life forms of all kind, is degrading, the efforts and costs for mitigation/adaptation measures are skyrocketing. Business-as-usual behavior is increasing this dilemma, while the growing urgency to employ radical measures augments the risk of destabilizing democratic systems. Physical (e.g., « bassines » in France) and armed (e.g., Cashmere region) water conflicts among humans occur worldwide, without speaking of the ecocide on non-human beings (e.g., large boreal river fish populations are down to 5%). For the sustainable management of continental hydrosystems (and lastly, for peace-keeping and the maintenance of biological and cultural diversities) it is therefore necessary to develop adequate, fast, and efficient solutions. The River Culture Concept (see book on <https://unesdoc.unesco.org/ark:/48223/pf0000382775>) makes an attempt to harmonize human and nature's needs by (re-) integrating traditional ecological knowledge, biological strategies and innovative technologies, and by revaluing hydrosystems and their terri- (better: hydro-)tories. On the juridical/political/administrative levels, basin-wide, holistic approaches should not only be praised but rather be effectively implemented. The use of water-consuming products, practices and technologies needs to be critically revised, and abandonment/disruption of some of those will be inevitable (e.g., agricultural products like « blood avocados ») and replaced by nature-based solutions to improve the hydrological sponge effect of landscapes (e.g., « water sowing »). New, interdisciplinary training programs, such as the new EUCOR Master in Continental Water Sustainability (CWS) may help to overcome path-dependencies in basin management. More global solidarity, transboundary cooperation and acknowledgement of functioning hydrosystems as essential life-support-systems for humans and beyond-human beings is needed.

Plenary Talks

SESSION C

Nature Based Solutions

Thursday 12th | 14:40h – 15:20h

Aude Zingraff-Hamed

ENGEEES - École nationale du génie de l'eau et de l'environnement de Strasbourg

Blue NBS performances – can we believe it?

Surface freshwater and especially rivers are of paramount importance for mankind. Rivers are an important source of biological diversity. Furthermore, rivers are drivers of human development due to the ecosystem services they provide. Humans do not passively benefit from underlying ecosystem functions but interact with the river system. River management was historically focused on the intensive exploitation of riverine ecosystem services and society protection with the help of hard civil engineering measures. Consequently, socio-hydro-systems lost their capacities to function as a dynamic ecosystem and is collapsing. Furthermore, in the context of climate change the grey solutions show major limitations and new solutions are needed to efficiently protect the people and critical infrastructures in a changing environment.

In Europe, river planning and management took a decisive turn in the late 19th and early 20th centuries with the ratification of the EU's Water Framework Directive (WFD). The WFD orchestrates restoration efforts and demands that all water bodies achieve a good ecological status (or potential). Along with implementation of the WFD, the concept of nature-based solutions (NBS) to mitigate hydro-meteorological risk has also grown in popularity, especially in the context of change of climate patterns observed in relation with global climate changes. While NBS, such as river restoration, have been recognized as essential for the reestablishment of socio-ecological functions of rivers and are presented as "the solution" to all our problems, their implementation is facing many limitations. Especially at the level of the decision-making process is the missing trust in the solutions a major bottleneck to their implementation. Also, engineers are not confident in designing the all-in-one solution.

In this plenary talk, the facts and the believes around the NBS so as the role of the scientist in removing the non-rationale barriers to NBS implementation will be intensively discussed.

Parallel Session

SESSION 4A

Ecosystems and Biodiversity

Thursday 12th | 16:00h – 16:30h

Fabien Koch

Karlsruhe Institute of Technology (KIT)

Groundwater biomonitoring as a tool for identifying environmental trends

Groundwater is an important source for fresh-, drinking- and service water and the largest terrestrial freshwater biome of the world. Climate change and human activities cause changes in groundwater with unknown consequences for groundwater ecosystems. Thus, a thorough understanding of how this ecosystem responds to stressors is critical for sustainable groundwater management. To assess the ecological status of groundwater ecosystems, this study monitored the spatial and temporal variability of groundwater fauna and physico-chemical parameters in an urban aquifer in Karlsruhe, as well as in the wider area of the state of Baden-Württemberg, Germany. A major influence of local parameters, such as land-use and content of dissolved oxygen, on groundwater ecology in terms of colonisation and biodiversity was found. Overall, groundwater biomonitoring was shown to work well and fast with regard to revealing changes in important parameters and environmental trends. Thus, biomonitoring of groundwater could be the basis for developing potential measures for the protection of groundwater ecosystems and a sustainable use of groundwater.

Parallel Session

SESSION 4A

Ecosystems and Biodiversity

Thursday 12th | 16:30h – 17:00h

André Paz

Karlsruhe Institute of Technology (KIT) / Federal University of Viçosa

Soil seed bank six years after the Fundão Dam disaster in Brazil: impacts on seedling emergency and growth

In 2015, tons of iron ore tailings were dumped on Doce River basin, reaching large areas of riparian vegetation. Some areas were restored by different techniques and six years passed. Our objective was to investigate if plant emergency and establishment are impaired in areas affected by tailings. We collected soil samples from affected (A) and unaffected areas (N) and counted the richness and abundance of emerged plants. The two most abundant species of the study were used in an experiment and the soil was analyzed. The accumulated species richness was lower in A than N. However, mean species richness and abundance per sample did not differ between areas. The species in the growth experiment thrived, with different responses: sp.1 had lower increment in height and diameter in A and sp.2 produced proportionally more roots than aerial parts in A. This soil had lower fertility and organic matter content. Despite the higher overall abundance of seedlings in A, there is a reduction in total richness and impacts in plant growth. It shows how strong can be the effects of a large-scale mining disaster on ecological restoration and consequently on ecosystem functions and services.

Parallel Session

SESSION 4A

Ecosystems and Biodiversity

Thursday 12th | 17:00h – 17:30h

Janina Koentges

Schneider Electric GmbH

The precarious state of biodiversity and Schneider Electric's pioneering role in conserving biodiversity

"Biodiversity is facing a critical threat, underscored by indices such as the Biodiversity Planetary Boundaries and the Living Planet Index, which highlight substantial declines in species diversity. This has garnered recognition as a significant Material Issue, emphasizing the necessity for adaptability in light of multifaceted environmental, social, and economic challenges. The interconnectedness of climate change and biodiversity presents a complex dilemma, shaped by human activities that subsequently reciprocate impacts on humanity. Schneider Electric is committed to taking a leadership role in biodiversity conservation, employing the Global Biodiversity Score (GBS) to comprehensively evaluate their ecological footprint. Their primary influences on biodiversity encompass greenhouse gas emissions and land use practices, both of which can be effectively managed within the supply chain. Biodiversity holds profound significance not only for Schneider Electric's workforce and clientele but also in the broader context of ecological equilibrium and sustainability.

Parallel Session

SESSION 4B

Energy III

Thursday 12th | 16:00h – 16:30h

Hendrik Hölscher

Karlsruhe Institute of Technology (KIT)

Replacement of TiO₂ with Bio-inspired Porous Polymers Fabricated via Supercritical-CO₂ Foaming for Reversible White Coloration

Titanium dioxide (TiO₂) is the pigment of choice for a bright white color impression in many consumer products. However, replacements are needed due to sustainability and health concerns about TiO₂ leading to a continuous controversial debate over its usage and the EU recently introduced its first bans on TiO₂ as a food additive. In nature, a bright white color impression frequently originates from transparent biomaterials like chitin, cellulose, or keratin equipped with sophisticated nanostructures such as porous networks, ellipsoidal beads, or air voids. The latter can be mimicked by foaming polymers with non-toxic, inert, supercritical CO₂ resulting in air voids in the nanometre range that perfectly scatter light, thus leading to a bright white color impression. As this effect is caused by the porous structure alone, the white color is achieved without additional pigments. The respective foamed polymer remains a mono-fraction, which simplifies recycling as the polymer becomes transparent again by heating. The supercritical CO₂ foaming process is also suitable for biopolymers and can be adapted for foaming foils, thin films, and particles.

Parallel Session

SESSION 4B

Energy III

Thursday 12th | 16:30h – 17:00h

Fabian Nitschke

Karlsruhe Institute of Technology (KIT)

Geothermal Lithium – Potentials and Challenges of a Domestic Production

Due to the increasing electrification of transportation Germany is anticipated to be confronted with a substantial short-term deficit in lithium supply. One potential solution lies in harnessing the lithium found in geothermal brines within the Upper Rhine Graben (URG) and the North German Basin (NGB) through a process known as direct lithium extraction (DLE). This approach offers geostrategic advantages, is considered to be environmentally friendly, and holds the potential to support the geothermal technology roll-out. This study assesses Germany's lithium deposits based on existing geothermal capacities and extrapolates the required expansions to supply the future demands. To assess the long-term performance of a reservoir under production, a generic model, based on the URG geothermal setting, was developed, and simulations were conducted over a 30-year operational period. Despite significant depletion of the fluid's Li content, an average annual production of 231 tonnes can be achieved with a state-of-the-art doublet-type geothermal power plant. DLE has the potential to significantly help reducing Germany's dependence on Lithium imports.

Parallel Session

SESSION 4B

Energy III

Thursday 12th | 17:00h – 17:30h

Hans H. Stutz

Karlsruhe Institute of Technologie, IBF

Geotechnical Gravitational Energy Storage (GGES): Energy storage using a mass of soil

The Gravitational Geotechnical Energy Storage (GGES) method is introduced, aiming to store excess electrical energy as potential energy in an elevated soil mass. This is achieved practically through a cavity that can be charged and discharged with water using pumps or turbines. Two different systems can be distinguished: a deep system and a shallow system. A large-scale field test and numerical simulations are used to demonstrate the shallow system and its feasibility. To overcome some shortcomings of the shallow system and to further optimize the energy storage system, the so-called deep system was invented on a different technology. Numerical simulations on this system confirm the long-term stability of the system for a lifetime of more than 50 years. This contribution will present and summarises research results achieved so far on the GGES and outlines the further development path toward the application of this system.

Parallel Session

SESSION 4C

Circular Economy II

Thursday 12th | 16:00h – 16:30h

Alireza Javadian

Karlsruhe Institute of Technology (KIT)

NEWood - a 100% bio-based, 100% recyclable and 100% circular alternative to wood-based materials

In 2020, global raw material consumption surpassed 90 billion tonnes, with material production contributing 23% of GHG emissions. The European construction sector is a major player, accounting for 42% of energy usage, 35% of GHG emissions, 50% of material extraction, and 30% of water consumption. Our research at the Institute of Design and Building Technology, in collaboration with Fiber Engineering GmbH, focuses on resource efficiency, circular economy practices, and renewable materials to mitigate these impacts. We introduce 'NEWood,' a 100% bio-based, resource-efficient, and carbon-negative material produced from wood and agricultural waste, bound by fungal mycelium. NEWood is a sustainable substitute for wood-based materials, adhering to circular economy principles with zero waste. Utilizing advanced manufacturing methods, NEWood matches the properties of MDF and particleboard, offering a sustainable alternative. Our research paves the way for NEWood's commercialization in construction and furniture applications, driving a more sustainable future.

Parallel Session

SESSION 4C

Circular Economy II

Thursday 12th | 16:30h – 17:00h

Pallavi Reddy Yarka Reddy

Karlsruhe Institute of Technology (KIT)

Sustainability in the cement industry: Thermodynamic Modelling of Belite Cement Clinker

Cement is one of the most manufactured products on the globe, where its manufacturing process contributes to a significant amount of greenhouse gas emissions. The cement industry is responsible for about 8% of global greenhouse gas emissions, i.e. from process fuels and raw materials. On the other hand, approximately 230 million tons of construction and demolition waste was generated in Germany in 2020. Continued attempts are being made to explore new technologies to increase the sustainability of the cement industry by recycling cementitious materials as a replacement of fresh limestone and by also reducing GHG emissions. We, at the Institute for Technical Chemistry, are working on the chemical recycling of cementitious wastes which are transformed into new hydraulic binders by a new process. The synthesis is based on the formation of clinker mineral belite Ca_2SiO_4 (in contrast to alite Ca_3SiO_5 ; the main phase in Ordinary Portland Cement (OPC) clinker) at temperatures below those of OPC clinker generation (1000°C instead of 1450°C). In particular, the production of belite cement clinker reduces energy demand as well as the CO_2 emission of the production process.

Parallel Session

SESSION 4C

Circular Economy II

Thursday 12th | 17:00h – 17:30h

Ayla Alkan

University of Freiburg

Reducing Greenhouse Gas Emissions and Raw Material Extraction with Passenger Vehicle Material Efficiency Strategies for Turkey

Material consumption is mainly caused by services that meet human needs and products produced accordingly and is the main cause of human-induced emissions. Mobility, food and shelter are among the three most important human needs, and mobility emits the most emissions among them. In this study, nine material efficiency (ME) strategies for passenger vehicles are analyzed for Turkey by employing the ODYM-RECC model. Material efficiency strategies were conducted under Shared Socioeconomic Pathway 1 (SSP1), SSP2 and Low Energy Demand (LED) socioeconomic scenarios and two separate climate policy scenarios, one with no mitigation policy after 2020 and the other with low-carbon energy supply and widespread electrification. Based on policy assumptions, these nine material efficiency strategies could reduce annual emissions from passenger vehicles by 29% in 2050. Lightweighting by desing/downsizing and ride-sharing show the highest mitigation potential. Both primary and secondary production in steel production decreases, secondary aluminium production increases as a substitute, and plastic production shifts to secondary production.

Friday, October 13th, 2023

Plenary Session

SESSION D

Governance and Economy

Friday 13th | 09:00h – 09:40h

Alistair Hudson

Chairman of the ZKM, Karlsruhe, Germany

The political economy of art

Plenary Session

SESSION D

Governance and Economy

Friday 13th | 09:40h – 10:00h

Christian Büscher

Karlsruhe Institute of Technology (KIT)

Risk Governance in CO₂ – sequestration services as global means of mitigating climate change effects

The permanent and irreversible entropic degradation of matter and energy is accelerated by the structures, social mechanisms and codings of differentiated social systems. With the emergence of symbolically generalized communication media, like money, power, true knowledge, law, or else a “technicalization” in the handling of social events has become established. For example, preferences in economics are clearly marked without intermediate values: Payment or non-payment represent an idealization of the situation that cannot be overridden by other values (Schumpeter). In this sense, this contribution discusses (in sociological terms) how innovative concepts of “Risk Cost of Carbon” by Chen et al. is the attempt of rewarding per tonne of additional CO₂ e mitigation service. The authors propose to grant a price(signal) for “climate mitigation services that can reduce systemic risk to a normatively agreed level.” With this idea, the authors utilize the social mechanism of a symbolically generalized exchange media to create a global governance of climate change mitigation efforts, and also opens the door for interdisciplinary research.

Plenary Session

SESSION D

Governance and Economy

Friday 13th | 10:00h – 10:20h

Nikas Scheidt

Karlsruhe Institute of Technology (KIT)

Institutional and Technological Drivers of Renewable Energy Deployment

International institutions and technological innovations are considered key drivers of renewable energy (RE) deployment, which is at the core of the global energy transition necessary to combat climate change. However, whether and how these factors contribute to RE deployment has yet to be examined in greater detail. This paper uses a global panel dataset covering 152 countries over the period from 1992 to 2017 and fixed-effects panel regression techniques to address this gap. The results indicate that both membership in international environmental agreements and filed RE technology patents are positively related to the share of RE in electricity generation. Moreover, there is a positive interaction effect between the two factors, which suggests that strengthening both institutional and technological channels may be a particularly effective way to further energy transitions. These results hold when controlling for many other factors such as economic development, energy prices, trade openness, natural resource dependency, and democratic institutions, and they withstand a battery of additional robustness checks.

Plenary Talks

SESSION E

Solutions/Resilience

Friday 13th | 11:00h – 11:40h

Frank Krysiak

Universität Basel, Switzerland

Research for sustainable development:

How economics influenced the Swiss energy transition

Among many other disciplines, economics strives to provide research that supports transitions towards a sustainable society. Thereby, the focus is often placed on designing policies to achieve desirable aggregate outcomes, such as, reducing overall CO₂-emissions via carbon pricing. In this talk, I will use the example of the Swiss energy transition to showcase what economic research has achieved, what we (as researchers) could have done better, and where and why the interaction with other disciplines has been key to succeeding. In addition, I will use the example of the Swiss Competence Centers for Energy Research to discuss how ideas for solutions differ between disciplines and how interaction between researchers with vastly different backgrounds has provided more useful solutions.

Plenary Session

SESSION E

Solutions/Resilience

Friday 13th | 11:40h – 12:00h

Nicolas Moussiopoulos

Aristotle University Thessaloniki

Atmospheric forcing modelling on critical road infrastructures within the frame of the EU PANOPTIS project

The aim of the EU PANOPTIS project (<http://www.panoptis.eu/>) is to leverage multiscale modelling tools in combination with environmental monitoring sensors and EU services to address multi-hazard risk, smart prevention and preparedness for the operational optimisation and protection of critical Road Infrastructures (RI). An integrated solution was developed providing a unified user interface to support Road Operators in the decision-making process, management of incidents and response to crisis situations. Climate and atmospheric impacts on RI are quantified, mapped and visualized through an operational modelling system (OMS) by means of a dynamical downscaling methodology and the application of numerical atmospheric flow models. The system provides operators with near-real time atmospheric fields, including wind, temperature, humidity, radiation, precipitation and fog occurrence both in a “nowcasting” and a 24-forecast mode. Employing data assimilation, OMS can incorporate data streams from sensors and meteorological stations in the field trial areas in order to improve the accuracy of real-time forecasts.

Plenary Session

SESSION E

Solutions/Resilience

Friday 13th | 12:00h – 12:20h

Richard Fuchs

Karlsruhe Institute of Technology (KIT) – Campus Alpin

Agriculture 4.0 – Decoupling food production from the land

New food technologies such as Indoor Farming (e.g. vertical farms) in combination with others, such as gene editing (e.g. CRISPR/Cas9), photo voltaic (PV) or light emitting diodes (LEDs) have the potential to provide a step change in how food is produced worldwide, as they can boost agricultural productivity whilst saving land area and reducing chemical inputs. However, the lack of profitability and scalability, together with high energy consumption and struggle with societal acceptability hinder a fast take-off. In fact, little is known about the full potential of these technologies when combined applied over large geographic areas. This research gap has serious implications for global sustainability assessments and policy guidance and arises from the use of unsuitable metrics (e.g. forecasting technological transformation) to represent risks and opportunities of innovative food technologies. A step change is needed in how pathways to sustainable food futures are envisioned and how innovative food technologies are integrated in the environmental sciences.

Here we review indoor farming in combination with gene-editing, PV and LEDs in terms of their current efficiencies and explore their future global upscale potential. We show how these technologies may be used collectively by combining their productivity and efficiency gains to unfold a disruptive upscale potential, transforming current pathways of conventional agricultural production. Under such a scenario, food production would essentially be decoupled from the land, freeing-up land currently used for agriculture and improving the resilience of agricultural production systems. A transformative change in the agricultural production system, which we label Agriculture 4.0 (following the term Industry 4.0), could mark the start of a 4th Agricultural Revolution, turning the way we produce food upside down with widespread societal and environmental implications, both positive and negative.

Plenary Session

SESSION E

Solutions/Resilience

Friday 13th | 12:20h – 12:40h

Denise Heike Böhnke

Karlsruhe Institute of Technology (KIT)

Platform for Urban Research at KIT

Cities are seen as key areas for the necessary transformation in both the climate and the sustainability debate. Cities are highly vulnerable to the impacts of climate change due to the concentration of people, infrastructure and business processes. At the same time, cities are a highly complex system due to the wide range of topics and the close linkage of key actors (science, administration and politics, citizens, economy). Due to the high complexity of the system, as well as the theoretical - predictive nature of the challenges posed by climate change and sustainability aspects - science has an outstanding importance for the transformation of cities. The Karlsruhe Institute of Technology has been contributing to urban research in a particularly diverse way for years due to the wide range of urban research topics, including planning and architecture, mobility, civil and water engineering, urban ecosystem related topics, energy, resources, smart city, human geography and real laboratories. Through the development of a "Platform for Urban Research", these competences are to be enhanced, interlinked and become publicly visible. The development of an overarching strategy for urban research combines and links the topics in a unique way. A special objective is the promotion of inter- and transdisciplinary research projects, which take up and extend the previous, valuable activities from basic research to practice. This presentation offers the opportunity to learn more about this exciting mission of developing a platform for urban research.

WKSW - Energy, Raw Materials, Storage

Benjamin Busch, Karlsruhe Institute of Technology (KIT)

Diagenetic reservoir quality prediction modelling for CCS, underground gas storage, and geothermal applications

As large storage volumes for renewable energy, gases, or fluids can only be provided in the deep geological subsurface, understanding reservoir quality differences becomes increasingly important. Reservoir quality combines the assessment of the potential storage volume and the transmissivity to fluids in porous lithologies.

As porous rocks are affected by fluid-rock interactions and the mechanical stresses acting on them in the subsurface, understanding the physico-chemical processes is the basis to assess rock property changes.

Including the variable mineralogical composition of different storage lithologies will result in a multitude of possible geochemical alterations. If the controlling factors are well understood and linked to physico-chemical conditions, the reservoir quality can be assessed ahead of drilling operations and aid in the assessment of suitable reservoir lithologies in addition to assessing fractures and faults, enhancing or compartmentalizing the fluid migration.

WKSW - Behavioural Change

Joanna Louise Raymond, Karlsruhe Institute of Technology (KIT)

Exploring the co-benefits and trade-offs of changes to EU agri-subsidy allocation

To meet the Paris Agreement of limiting the increase in global average temperature to "well below 2°C" above preindustrial levels requires a transition to more sustainable, low-carbon food production. Despite the known contribution of livestock production to greenhouse gas emissions, the EU Common Agricultural Policy has for decades funded widespread promotion of animal products and provided large subsidies favouring meat and feed production. In this research, we seek to understand how repurposing subsidies from animal production to food crops for direct human consumption impacts food security, land use and the environment. Specifically, we use the CRAFTY agent-based modelling framework to simulate land use change across Europe. By modifying the production function, the demands for food services and agent responses for uptake of subsidies within the model, we explore how agent allocation and cultural service provision evolve spatio-temporally in response to these changes. We discuss the role of subsidy reallocation in the meeting the broader EU Green Deal targets.

WKSW - Behavioural Change

Annika Fricke, Karlsruhe Institute of Technology (KIT)/Karlsruher Transformationszentrum

Generating self-experiments: An interactive format for behavioural change

Experiments are used as a proven method in real-world labs (RWL), f.e. in the form of real, thought or change experiments. Since 2013, self-experiments (SE) have been used as a teaching and educational format in the RWL Quartier Zukunft of the Karlsruhe Transformation Center (KAT). We define a SE as an experiment carried out on one's own way of life over a pre-determined period of time (for research, educational and transformational purposes). The focus is on trying out an individual sustainable lifestyle, leaving entrenched routines on a trial basis and adopting new perspectives to enable long-term behavioral change. In 2022, the Self-Experiment Generator (https://www.re-allabor-netzwerk.de/blog_selbstexperimentegenerator.php) was developed at KAT as an interactive format to initiate and research further SE and bring it to the wider community. The poster shows the transdisciplinary development process and the functioning of the format with selected examples of SE, as well as goals and application examples to anchor the format in the Education for sustainable development and science landscape. If desired, the SE generator can also be set up on site.

WKSW - Circular Economy

Nikolaus Nestle, BASF SE

PREcycling - Plastics Recycling from and for home appliances, toys and textile

Plastics can contribute to many dimensions of sustainability during their use, but the waste at end of life is becoming a focus: the sheer quantities that are landfilled or incinerated, as well as the use of resources and CO₂ emissions during production wasted. Both issues are addressed with sensible recycling strategies.

PREcycling aims to demonstrate high-quality recyclates produced from plastic waste based on three exemplary waste streams, that pose very different challenges: household appliances, toys, and textiles. Covering the whole chain, waste materials will be collected, recycled with advanced methods and the resulting recyclates used to produce demonstrators. Quality control criteria will be defined, and sampling and analysis methods will be developed to ensure safety and consistency of recyclates. To leverage these for increased circularity, traceability solutions and digital information management will be employed. Methods and strategies developed within the project can then be transferred to other plastic waste streams e.g. from the automobile industry.

www.precycling-project.eu, funded under Horizon Europe (No 101058670)

WKSW - Circular Economy

Ottavia Aleo, BMW Group

Operational principles and challenges of Circular Economy: paradigm shift in the manufacturing industry.

Circular Economy (CE) has emerged as a potential solution to resource scarcity and waste generation, induced from a linear economy paradigm dominant in the 19th century. However, CE literature lacks a comprehensive study into its implementation in manufacturing. Current CE trends focus on eco-efficiency, emphasizing recycling and waste reduction. To unlock CE's full potential, a shift to eco-effectiveness is needed, optimizing positive impacts and considering holistic lifecycles of product and processes. Shift to CE will be gradual and will involve mainly stakeholders' collaboration and data transparency. This research aims to combine existing CE themes, with emerging trends and potential challenges to its implementation in the manufacturing industry, emphasizing the need for a paradigm shift toward sustainable production and collaboration between stakeholders. With a top-down approach, the study serves as foundation to explore how CE can improve company performance through sustainable practices and revenue generation. Understanding and supporting systematically these aspects is vital for a successful circular transition in manufacturing.

WKSW - Ecosystems and Biodiversity

Flavia Digiacomo, Tino Degenhardt, Karlsruhe Institute of Technology (KIT)

A multidisciplinary approach to develop innovative water management solutions for biodiversity and ecosystem conservation.

The protection of groundwater is primarily ensured by intact ecosystems. To provide both, it is necessary to develop sustainable environmental management systems that integrate environmental protection and water management.

In the BioWaWi project, the water protection areas (WPA) of the city of Bühl are studied as an example for WPAs throughout Germany. Methods are being developed on how waterworks can investigate and ensure the biodiversity and ecosystem services of their WPAs. For this purpose, the study area has been equipped with automatic and data-transmitting soil moisture sensors and climate measuring stations, which provide comprehensive information on the current water balance at any time. Detailed soil, biotope and species mapping allows assessing the local water availability. In addition, a comprehensive water balance model is created that includes groundwater, the water-saturated soil zone, and vegetation.

This information will be used to derive recommendations for action and practical measures that will help waterworks to ensure high quality drinking water while preventing the loss of biodiversity and ecosystem services.

WKSW - Ecosystems and Biodiversity

Katharina Mayer, Karlsruhe Institute of Technology (KIT) – Campus Alpin

Development of a spatially explicit global Human Pressure Index to map anthropogenic pressure on biodiversity from 1990-2020

The loss of biodiversity due to human activities is moving at a rate much faster than known background extinction rates. Efforts to protect biodiversity have been made, but with limited success. The Aichi targets 2020 were almost all missed, with worsening trends for 12 out of the 20 targets. One reason for this failure is the ineffective application of measures that are not tailored to the underlying causes of biodiversity loss. Knowledge on the spatial and temporal distribution of anthropogenic drivers would therefore enable more targeted interventions that address location-specific stressors. Five major anthropogenic drivers of biodiversity change have been summarised by IPBES: land use change, resource extraction, environmental pollution, alien invasive species and climate change. We want to show the cumulative effect of these drivers over a longer period of time (1990-2020) with a newly developed Human Pressure Index by quantifying and mapping multiple drivers into a single annual index with a spatial resolution of 10 km at global scale. I will present results from this index, focusing on spatial and temporal trends in pressures on biodiversity globally.

WKSW - Energy Economy, Future Business Cases

Matthias Hertel, Karlsruhe Institute of Technology (KIT)

Artificial Intelligence Use Cases for the Energy Transition

Artificial intelligence (AI) can be used to monitor, control and plan the future energy system. We give an overview on AI use cases for the energy transition from our work and beyond. This includes forecasting energy supply and demand, smart electric vehicle charging, optimal power flow approximation, flexibility detection, building control, predictive maintenance and automated distribution grid planning.

However, AI methods consume energy and resources themselves, and rebound effects can lead to an increased energy demand. We give recommendations on how to use AI sustainably, and highlight open questions regarding the potentials of AI applications for the energy transition.

WKSW - Energy, Raw Materials, Storage

Katharina Schätzler, Karlsruhe Institute of Technology (KIT)

GeoLaB – Geothermal laboratory in the crystalline basement

Against the background of climate change and the geopolitical situation, the worldwide pressure mounts to reduce the dependence on fossil fuels. Geothermal technologies have a key role to play in supplying and storing heat. The greatest, yet untapped geothermal potential lies in the crystalline basement with important hotspots in tectonically stressed areas. New targeted, science-based strategies are the key to harness this energy under safe, sustainable, predictable, and efficient conditions. The planned GeoLaB (Geothermal Laboratory in the Crystalline Basement) will address the challenges of reservoir technology and wellbore safety for deep geothermal projects. Experiments will contribute significantly to understanding the coupled, nonlinear processes associated with high flow rates in crystalline reservoir rocks. The application and development of cutting-edge monitoring, online analysis and visualization tools will provide fundamental knowledge for the operation of geothermal energy. As an interdisciplinary and international research platform, GeoLaB will collaborate with universities and industry partners to foster synergies.

WKSW - Energy, Raw Materials, Storage

Julian Dutzi, Karlsruhe Institute of Technology (KIT)

Hydrogen and methane production from ten biomasses in the process of supercritical water gasification.

Supercritical water gasification (SCWG) is a promising technology that can process a wide range of organic feedstock to form hydrogen- and/or methane-rich gases. Mainly wet feedstock like sewage sludge or animal manure is considered for this process since water is necessary as a reactant. To investigate the capability of SCWG to process dry biomasses, ten different biomasses were gasified. Processing dry biomasses within the SCWG is not typical. In the framework of the H2020-project CERESis this method was chosen, since heavy-metal contaminants in the biomass can be removed simultaneously to gasifying the biomass. Thus, for this framework it is important to know the limitations of the process in terms of processing different dry biomasses.

The results indicate that biomasses with similar elemental compositions, are equally gasifiable and produce similar product gases. Thus, subsequent gas upgrading steps do not need to be adjusted when the feed is changed as long as the elemental composition stays in similar ranges. Feed pretreatment, especially the size reduction of the biomass particles, has proven to be important to avoid plugging of the tubing.

WKSW - Energy, Raw Materials, Storage

Jasemin Ayse Ölmez, Karlsruhe Institute of Technology (KIT)

Metallic raw materials for Germany - Unexploited mining potentials of African developing countries based on the examples Botswana, Morocco, and Zimbabwe

Germany is almost 100% dependent on imports of primary metallic raw materials and thus on global trade with worldwide suppliers. Technological developments, digitalization, and the German energy and mobility revolution, such as e-mobility and the switch to a low-carbon energy supply, will require an increase in the demand for metals in the future. Recycling by itself will not be sufficient to meet the rising demand for metallic raw materials. Africa is a continent rich in raw materials. African countries export e.g., platinum, manganese and cobalt worldwide. Direct investors in national mining projects from the German side are almost non-existent and are conducted by large mining companies based e.g., in Australia and China. The economies and populations of several African countries are reliant on the mining and commodities sector. The globally increasing demand for metallic raw materials could therefore become a prospective potential for the African population through the development of the mining sector. Therefore, the mining potential of Botswana, Morocco, and Zimbabwe with different socio-economic characteristics are presented.

WKSW - Energy, Raw Materials, Storage

Fatemeh Bahmei, Karlsruhe Institute of Technology (KIT) – Helmholtz Institute Ulm, HIU

Sodium-Ion Capacitors: A Pathway towards Environmentally Sustainable Energy Storage Technologies

Renewable energy sources like wind, solar, and water power are gaining attention due to global energy demand, fossil fuel depletion, and environmental concerns. Efficient energy storage is crucial for renewable technologies. Researchers are developing high-energy and high-power density devices like rechargeable batteries and supercapacitors. Supercapacitors have fast charge/discharge, high-power density, and long lifespan. A hybrid system called lithium-ion capacitors (LICs) combines supercapacitors and lithium-ion batteries for higher energy density. However, limited lithium resources have led to exploration of sodium-ion-based hybrid ion capacitors (SICs). SICs use abundant sodium resources, have reduced ecological impact, and lower emissions. Life cycle assessments are needed to evaluate SICs, and ongoing research focuses on minimizing negative effects and optimizing materials, recycling, and electrolyte selection. Sodium-ion capacitors offer an environmentally friendly energy storage solution for a sustainable energy ecosystem.

WKSW - Energy, Raw Materials, Storage

Athanasios Vadarlis, Karlsruhe Institute of Technology (KIT)

Subsequent steam reforming of the product gas from ethanol gasification with supercritical water

The shift from fossil fuels to sustainable energy sources relies on hydrogen technologies. Meeting the growing hydrogen demand for achieving net-zero emissions by 2050 necessitates diverse and efficient production approaches. One possible approach is hydrogen generation from ethanol gasification using supercritical water. Further upgrading of the product gas is necessary to maximize the hydrogen yield. This involved a downstream fixed bed steam methane reforming (SMR) reactor after the gasifier. Increasing SMR temperature and decreasing space velocity increased hydrogen yield and methane conversion. The pressure effect was more pronounced at lower pressures (1-20 bar) than high (25-40 bar), due to SMR reaction kinetics. Placing the reformer after gasification notably increased total hydrogen yield. Excessive steam inhibited carbon formation but promoted active metal sintering. A prolonged 49-hour on-stream stability test revealed a slight methane conversion drop from 84% to 78%.

WKSW - Energy, Raw Materials, Storage

Jasemin Ayse Ölmez, Karlsruhe Institute of Technology (KIT)

The German industrial and economic market is adapting - Impact of the Russia-Ukraine conflict on the supply of metallic raw materials for Germany

The EU and Germany import critical and strategic raw materials. Together with China and South Africa, Russia is one of the countries with the greatest global abundance of raw materials. The Ukraine is an important exporter of noble gases. The ongoing conflict led to EU-sanctions against Russia. The war led to the absence of raw materials on the world market such as the noble gas neon from Ukraine. The effects of the conflict on the German market are investigated on the basis of the raw materials aluminum, potash salt, nickel, titanium and the noble gas neon. Diverting market concentrations, diversifying importing countries and stockpiling of critical and strategic raw materials can secure the EU and also Germany from supply shortages. Initial steps include obtaining certain raw materials from alternative countries. Increased costs for various metals are associated with the past Covid-19 pandemic, fears of supply shortages, and panic buying by various countries to restock their own inventories. Substitution approaches or recycling of raw materials being imported from Russia are not sufficient to ensure the current or future demand of raw materials in Germany.

WKSW - Energy, Raw Materials, Storage

Michal Rogowski, Muhammad Saqib, Rafa Andrzejczyk, Gdansk University of Technology, Poland

Thermal Energy Storage Study Augmentation Based on Image Processing Techniques

The presented study broadens the concept of employing image processing in phase change process analysis for thermal energy storage (TES) purposes. In preliminary studies two various geometries immersed in two phase change materials during different phase change processes are examined. The first case is a solidification process in shell and tube thermal energy storage systems of RT18HC, while the second case focuses shell and coil geometry during melting process of coconut oil. Heating surface geometries are selected based on their frequent utilization in the industry. Both studies focused on solid/liquid fraction as well as solidification/melting front thickness estimation respectively for each phase change process. This research aims for the development of advanced and optimized models integrated with machine learning and image processing, suited for complex geometries, as well as non-invasive, semi-automated solid or liquid fraction estimation within the thermal energy storage storage tank volume.

WKSW - Energy, Raw Materials, Storage

Benjamin Busch, Karlsruhe Institute of Technology (KIT)

Using the subsurface for green energy transition and net-zero emissions: potential and risks

The subsurface plays an important role in the green energy transition and net-zero emissions since it offers significant potential for renewable energy storage and carbon dioxide sequestration (CCS). For instance, green hydrogen can be stored in e.g., depleted gas fields and aquifers. Such spaces can also be used for the sequestration of CO₂ captured from the atmosphere.

Hydrogen has different physical and chemical characteristics than natural gas and can also enter into many biological processes, limiting the direct use of current knowledge obtained from underground natural gas storage. In our laboratory, we conduct batch experiments with reservoir rocks to investigate potential geochemical reactions, and cutting-edge real-rock microfluidic experiments to study microbial activity in real-rock pores during underground hydrogen storage (UHS). Our laboratory is dedicated to gaining a comprehensive understanding of UHS, CCS, and the feasibility of geo-bio-methanation at the micro-meso scales. By doing so, we aim to minimize potential risks associated with large-scale applications and contribute to the advancement of geo-storage technologies.

WKSW - Governance and Economy

Veronica Di Battista, BASF SE

Safe and Sustainable by Design (SSbD) strategies for Advanced manufactured materials'

In the EU funded project HARMLESS, we develop Safe and Sustainable by Design (SSbD) strategies with focus on advanced manufactured materials; we aim to guide companies in making decisions at the design phase of an advanced material, when options are many and budget is low. To do so, we are developing a user-friendly intelligent SSbD Decision Support System (DSS), meant to compare structurally different materials with similar functionality. Previous experience and stakeholder analysis is used to integrate existing and newly generated data & models into a user-friendly tool. The DSS builds upon the HARMLESS framework. In the framework, we use predictive tools and non-animal testing (i.e., Novel Approach Methodologies(NAMs)) for assessing safety and sustainability aspects at each innovation stage from ideation to business case, lab and pilot phases. The DSS supports decision making to balance performance, safety and sustainability. We report on a case study with perovskite materials, component in automotive three-way catalysts during the lab phase of innovation.

WKSW - Health and Well-Being

Tobias Moeller, Karlsruhe Institute of Technology (KIT), Institute of Sports and Sports Science

Exoskeletons for human motor performance assessment in older adults – Critical reflection on challenges and solutions

To date, exoskeletons are mainly used to provide (mobility) support to workers or persons with physical impairments. However, integrated sensors may also make exoskeletons suitable for assessing human motor performance, e.g., abilities and skills related to the lower limbs that decline during normal aging such as gait, posture, muscle strength, and proprioception. To this end, we postulate three different approaches: 1) Adapting/adjusting traditional (e.g., clinical or lab-based) testing protocols for exoskeleton-based assessments; 2) developing new testing protocols specifically tailored to the characteristics of exoskeletons; and 3) continuous monitoring of exoskeleton-recorded data to determine motor performance parameter variations over time. We hypothesize that human motor performance assessment using exoskeletons is possible and could have important implications for future mobility solutions as well as health and well-being in old age.

WKSW - Health and Well-Being

Anthi Chatzopoulou, Aristotle University of Thessaloniki, Greece

The effect of future climate on surface UV radiation

One of the major challenges of the 21st century is the adaptation to the new environmental conditions. For a better assessment of climate change and impacts, different scenarios (SSPs) have been proposed in the framework of the IPCC. This study investigates the variability of UV radiation at the Earth's surface in the course of the 21st century, due to changes in factors affecting the transfer of UV radiation through the atmosphere. In order to get an overview of the surface UV changes, simulations of irradiance are performed globally with the aid of the RTM libRadtran. Monthly mean data of ozone, AOD at 550 nm and surface albedo extracted from CMIP6 models under different SSPs are used as inputs to the RTM simulations. The reduction of the surface reflectivity over polar regions, will lead to reductions in the reflected radiation. Reductions are expected also due to the recovery of the ozone layer after the middle of the 21st century. The ozone layer prevents harmless radiation of penetrating into the troposphere, thus its modifications will have direct effects on biological systems. In this study we present results on related changes for the CIE-erythema.

WKSW - Health and Well-Being

Stefan Schläfle, Karlsruhe Institute of Technology (KIT)

Tire-Road Particulate Matter Emissions

The German Environment Agency holds particulate matter responsible for approximately 28,000 premature deaths in Germany each year. The smaller the particles, the deeper they penetrate into the human body, reaching the pulmonary alveoli or even the blood. While electrification is leading to a decrease in particulate emissions from internal combustion engines, those from tire-road and brake abrasion are increasing both in percentage and absolute terms. Particularly in the case of electrically driven vehicles, higher mass and torques have an amplifying effect on particulate matter emissions. Due to more recuperating vehicles, emission from brakes is expected to decrease in the near future, making tire-road contact the final source of particulate matter on the vehicle. In order to analyze this particulate matter emission, realistic test bench experiments are being carried out at FAST, which should provide information on the exact emission behavior while driving. Tests on nanoparticles and microparticles show that emissions can be significantly reduced with an anticipatory and consistent driving style.

WKSW - Resilience and the Social Dimension

Jaewon Son, Karlsruhe Institute of Technology (KIT),
Institute for Technology Assessment and Systems Analysis (ITAS)

Citizens' perceptions of cultural ecosystem services of urban green spaces in Germany and the Republic of Korea

Cultural ecosystem services are intangible benefits from nature that directly influence human well-being. Their measurement is complex and subjective, which needs further research and comparative study across countries. This research examines public perceptions of cultural ecosystem services in urban green spaces with the case study in Karlsruhe, Germany, and Suwon, Republic of Korea. A map-based questionnaire was conducted for three months for assessments of cultural ecosystem services with spatial data to involve residents in urban green spaces assessment. Results showed that the perceptions of cultural ecosystem services vary based on social, behavioral, and economic backgrounds not only between the countries but also within each city. Through participatory mapping, both cities' spatial distribution of cultural ecosystem services was visualized for a better understanding of the social and cultural values of urban green space. The study aims to support decision-making by incorporating public perception of cultural ecosystem services in both countries.

WKSW - Solutions/Resilience

Spencer Roberts, Karlsruher Institut für Technologie (KIT), IMK-IFU

The upscaling potential of emerging food production technologies and their land use consequences for the global food system

While future population projections may vary, the ability to feed any future populations within a world of growing constraints from climate change, on land and resource availability, dietary changes (i.e., increasing demands for livestock meat), and production capacities remain a pressing question. This project focuses on two major aspects of the global food system: indoor farming and protein production. An exploratory geospatial modeling approach is used to assess the capacity of technologies within those segments to change current land-use and food production relationships. The geospatial analyses examine improvements and shifts in food production technology, the associated energy demands and production capacities, and compare them to conventional agriculture and the current global food system. Multiple pathways and their trade-offs for the global upscaling and development of indoor farming and alternative protein production systems are explored from 2020 to 2050.

WKSW - Water

Teba Gil-Díaz, Karlsruhe Institute of Technology (KIT) – AGW

Colloidal transport and seasonal variations of REEs in aquatic systems: preliminary results for the state of Baden-Württemberg

Several Technology Critical Elements (TCEs) are widely understudied in aquatic systems. Many unknowns are particularly linked to the lack of mechanistic understanding regarding the reactivity and transport of TCEs in contrasting river systems. Among these elements, Rare Earth Elements and Yttrium (REY) are critical raw materials and show a sensitive chemistry that can provide insightful understanding on the mineralogy and physical-chemical processes that occur along aquatic systems. In this work, we aim at characterizing the colloidal vs truly dissolved concentrations of REY in three contrasting rivers in Germany (Rhine, Neckar and Danube) by comparing two filtering meshes. The seasonal component of such transport is also investigated based on monthly collections of water samples in 2023. This information can be used for developing scenarios for potential risk assessment of anthropogenic discharges from both stable and/or radioactive origin in surface aquatic systems in the state of Baden-Württemberg. Acknowledgements go to the Excellence Strategy of the German Federal and State Governments, as well as to LUBW and AUE for sample collection.

WKSW - Water

Ulrike Scherer, Karlsruhe Institute of Technology (KIT)

Drought and source water quality – an emerging challenge for drinking water supply

Since the beginning of the 21st century, Central Europe has been repeatedly hit by severe droughts, with serious consequences for agriculture, forestry and water supply. Dried-up wells and low levels in drinking water reservoirs in regions that have not previously suffered from water scarcity have already indicated, what might be ahead in the coming decades. So far, management strategies in the drinking water sector have mainly focused on compensating for water deficit, but there are equally severe impacts on water quality due to droughts. The latter are controlled by climatic, hydrological, biogeochemical and anthropogenic factors that operate at different temporal and spatial scales and exhibit great variability. The objective of this study is thus to i) identify key water quality parameters and feedback mechanisms which will change during drought and ii) develop concepts for adapting existing technologies for sustainable drinking water supply in temperate regions. The focus is on surface water and shallow groundwater, since these are the most vulnerable resources.

WKSW - Water

Rüdiger Grote, Karlsruhe Institute of Technology (KIT)

Mitigation stormwater runoff by increasing urban tree coverage – interactions with heatwave events

Along with climate change, increased frequency and intensity of extreme events are expected, such as heat waves, drought periods and flash floods caused by heavy precipitation. Cities are particularly vulnerable environments due to the prevalence of impervious surfaces. Green infrastructure, in contrast, reduces peak runoff by intercepting rainfall and allowing infiltration into the soil. Karlsruhe in Southern Germany is striving to decrease its vulnerability against expected climate extremes. Therefore, the GrüneLunge project (<https://www.projekt-gruenelunge.de/>) is investigating the impact of hypothetical tree plantings, targeting a generally advertised green coverage ratio of 30%. Therefore, a city-scale ecosystem model (i-Tree Hydro Plus) has been set up and run for different climate episodes considering an increased tree cover specifically for each city district. Results demonstrate the mitigation potential for stormwater runoff but also show that the efficiency of these measures depend on previous climate episodes and infrastructure boundary conditions.

Speaker / Presenter	Affiliation	Title	Session	Date, Time
Aleo, Ottavia	BMW Group	Operational principles and challenges of Circular Economy: paradigm shift in the manufacturing industry.	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Alkan, Ayla	University of Freiburg	Reducing Greenhouse Gas Emissions and Raw Material Extraction with Passenger Vehicle Material Efficiency Strategies for Turkey	Session 4c: Circular Economy II	Thursday, 12th, 17:00-17:30
Andrzejczyk, Rafal	Karlsruhe Institute of Technology (KIT)	Innovative techniques for analyzing latent thermal energy storage integration with renewable energy source systems	Session 3b: Energy II	Thursday, 12th, 11:30-12:00
Bahmei, Fatemeh	Karlsruhe Institute of Technology (KIT) - Helmholtz Institute Ulm, HIU	Sodium-Ion Capacitors: A Pathway towards Environmentally Sustainable Energy Storage Technologies	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Balis, Dimitri	Aristotle University of Thessaloniki, Greece	Wildfires in Greece and their impact on air quality: Is this the new normality?	Session B: Innovative Energy Technologies	Thursday, 12th, 09:20-10:00
Barthelmes, Lukas	Karlsruhe Institute of Technology (KIT)	Agent-based modeling framework for the investigation of transport related effects of urban rail-based parcel shipments	Session 1b: Future Mobility Solutions	Wednesday, 11th, 14:30-15:00
Böhnke, Denise Heike	Karlsruhe Institute of Technology (KIT)	Platform for Urban Research at KIT	Session E: Solutions/ Resilience	Friday, 13th, 12:20-12:40
Busch, Benjamin	Karlsruhe Institute of Technology (KIT)	Diagenetic reservoir quality prediction modelling for CCS, underground gas storage, and geothermal applications	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Busch, Benjamin	Karlsruhe Institute of Technology (KIT)	Using the subsurface for green energy transition and net-zero emissions: potential and risks	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Büscher, Christian	Karlsruhe Institute of Technology (KIT)	Risk Governance in CO2 – sequestration services as global means of mitigating climate change effects	Session D: Governance and Economy	Friday, 13th, 09:40-10:00
Chatzopoulou, Anthi	Aristotle University of Thessaloniki	The effect of future climate on surface UV radiation	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Cordeiro Pires, Ana	Süddeutsches Klimabüro, IMK-TRO, KIT	Climate decadal predictions in forest management: from 10-year planning to climate adaptation	Session 1c: Behavioural Change	Wednesday, 11th, 15:00-15:30

Degenhardt, Tino	Karlsruhe Institute of Technology (KIT)	A multidisciplinary approach to develop innovative water management solutions for biodiversity and ecosystem conservation.	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Di Battista, Veronica	BASF SE	Safe and Sustainable by Design (SSbD) strategies for Advanced manufactured materials'	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Diaz General, Elizabeth Noemi	Karlsruhe Institute of Technology (KIT)	Land-based quality-of-life as a metric for transformative change: preliminary approach for the BIONEXT project	Session 2d: Health and Well-Being	Wednesday, 11th, 16:30-17:00
Dutzi, Julian	Karlsruhe Institute of Technology (KIT)	Hydrogen and methane production from ten biomasses in the process of supercritical water gasification.	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Fakharizadehshirazi, Elham	Karlsruhe Institute of Technology (KIT) - ITAS	Scenario-based analysis of ground-mounted photovoltaics potentials in Germany at different scales	Session 2b: Energy I	Wednesday, 11th, 17:00-17:30
Fleck, Sabine	Karlsruhe Institute of Technology (KIT)	High pressure entrained flow gasification - a key process in circular economy	Session 3c: Circular Economy I	Thursday, 12th, 12:00-12:30
Fricke, Annika	Karlsruhe Institute of Technology (KIT) /Karlsruher Transformationszentrum	Generating self-experiments: An interactive format for behavioural change	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Fuchs, Richard	Karlsruhe Institute of Technology (KIT) – Campus Alpin	Agriculture 4.0 – Decoupling food production from the land	Session E: Solutions/ Resilience	Friday, 13th, 12:00-12:20
Gil-Díaz, Teba	Karlsruhe Institute of Technology (KIT) – AGW	Colloidal transport and seasonal variations of REEs in aquatic systems: preliminary results for the state of Baden-Württemberg	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Gkirmpas, Panagiotis	Sustainability Engineering Laboratory / Aristotle University of Thessaloniki	Source term estimation in a complex geometry domain using computational fluid dynamics simulations and Bayesian inference	Session 2d: Health and Well-Being	Wednesday, 11th, 17:00-17:30
Goertz, Jelle	inno2grid GmbH	Fleets as key enabler transforming tomorrow's mobility	Session 1b: Future Mobility Solutions	Wednesday, 11th, 15:30-16:00
Grote, Rüdiger	Karlsruhe Institute of Technology (KIT)	Mitigation stormwater runoff by increasing urban tree coverage - interactions with heatwave events	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00

Hahne, Ulrich	Herrenknecht AG	Sustainable society - perspective and contribution from a medium size manufacturing business	Session A: Transformation towards a sustainable society	Wednesday, 11th, 12:00-12:30
Hertel, Matthias	Karlsruhe Institute of Technology (KIT)	Artificial Intelligence Use Cases for the Energy Transition	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Hölscher, Hendrik	Karlsruhe Institute of Technology (KIT)	Replacement of TiO ₂ with Bio-inspired Porous Polymers Fabricated via Supercritical-CO ₂ Foaming for Reversible White Coloration	Session 4b: Energy III	Thursday, 12th, 16:00-16:30
Hudson, Alistair	ZKM	The political economy of art	Session D: Governance and Economy	Friday, 13th, 09:00-09:40
Hssen, Holger	Karlsruhe Institute of Technology (KIT) – STS	Seasonal energy storage for the circular economy of the future with high energy density	Session 3b: Energy II	Thursday, 12th, 12:00-12:30
Ioannidou, Georgia	Aristotle University of Thessaloniki	A sustainable catalytic process for the production of butadiene from waste biomass intermediates	Session 2b: Energy I	Wednesday, 11th, 17:30-18:00
Iosip, Anda	Full-time activist Scientist Rebellion	Scientist Rebellion: From Publication to Public Action	Scientist Rebellion	Thursday, 12th, 09:00-09:20
Jacob, Daniela	Climate Service Center, HGF Hereon	Transformation towards a sustainable society: scientific dimension	Session A: Transformation towards a sustainable society	Wednesday, 11th, 10:30-11:00
Javadian, Alireza	Karlsruhe Institute of Technology (KIT)	NEWood - a 100% bio-based, 100% recyclable and 100% circular alternative to wood-based materials	Session 4c: Circular Economy II	Thursday, 12th, 16:00-16:30
Kai Hecke	Schneider Electric GmbH	Circular economy in the service sector using refurbished products	Session 3c: Circular Economy I	Thursday, 12th, 11:00-11:30
Kaminski, Karina	Schneider Electric GmbH	Sustainability and Resilience in Water	Session 3d: Water	Thursday, 12th, 11:30-12:00
Klingenmayer, Tobias	ZKM-Karlsruhe, Green Culture Manager	Welcome Addresses	Welcome Addresses	Wednesday, 11th, 10:00-10:30
Klingenmayer, Tobias	ZKM	Welcome at Conference Dinner	Conference Dinner	Wednesday, 11th, 19:00-21:00
Knoch, Eva-Maria	Karlsruhe Institute of Technology (KIT)	Sustainable Mobility between Rural and Urban Areas	Session 2a: Urban Transformation II	Wednesday, 11th, 17:00-17:30

Koch, Bernhard	Universität für Bodenkultur Wien	FOEBE and FOEBEPlus - ERASMUS+ Projects paving the path for the trans- formation into Bioeconomy	Session 2c: Resilience and the Social Dimension	Wednesday, 11th, 17:00-17:30
Koch, Fabien	Karlsruhe Institute of Technology (KIT)	Groundwater biomonitoring as a tool for identifying environmental trends	Session 4a: Ecosystems and Biodi- versity	Thursday, 12th, 16:00-16:30
Koentges, Janina	Schneider Electric GmbH	The precarious state of biodiversity and Schneider Electric's pioneering role in conserving biodiversity	Session 4a: Ecosystems and Biodi- versity	Thursday, 12th, 17:00-17:30
Kopp, Mira	University of Jena	Municipal Circular Economy Indicators: Do They Measure the Cities' Environ- mental Ambitions?	Session 1a: Urban Trans- formation I	Wednesday, 11th, 14:30-15:00
Kristof, Kora	Karlsruhe Institute of Technology (KIT), Vice-President Digitalization and Sustain- ability	Welcome Addresses	Welcome Addresses	Wednesday, 11th, 10:00-10:30
Krysiak, Frank	Universität Basel	Research for sustainable development: How economics influenced the Swiss energy transition	Session E: Solutions/ Resilience	Friday, 13th, 11:00-11:40
Lisbach, Bettina	Mayor of the City of Karlsruhe	Welcome Addresses	Welcome Addresses	Wednesday, 11th, 10:00-10:30
Luckscheiter, Roman	German UNESCO Commission, General Secretary	The role of science on the roadmap towards sustainability (and peace) from a UNESCO perspective	Conference Dinner	Wednesday, 11th, 19:00-21:00
Mayer, Katharina	Karlsruhe Institute of Technology (KIT) – Campus Alpin	Development of a spatially explicit global Human Pressure Index to map anthropogenic pressure on biodiversity from 1990-2020	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Menberg, Kathrin	Karlsruhe Institute of Technology (KIT)	Chances and risks of aquifer thermal energy storage (ATES) systems	Session B: Innovative Energy Tech- nologies	Thursday, 12th, 10:00-10:20
Moeller, Tobias	Karlsruhe Institute of Technology (KIT), Institute of Sports and Sports Science	Exoskeletons for human motor per- formance assessment in older adults - Critical reflection on challenges and solutions	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00

Moussiopoulos, Nicolas	Aristotle University Thessaloniki	Atmospheric forcing modelling on critical road infrastructures within the frame of the EU PANOPTIS project	Session E: Solutions/ Resilience	Friday, 13th, 11:40-12:00
Mustikkamaa, Sami	University of Turku	Does anyone deserve to be on the losing side? Deservingness perceptions and compensating for regressive effects of environmental policies	Session 3a: Communication and Narratives	Thursday, 12th, 11:00-11:30
Nestel Nikolaus	BASF SE	PRecycling - Plastics Recycling from and for home appliances, toys and textile	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Nitschke, Fabian	Karlsruhe Institute of Technology (KIT)	Geothermal Lithium – Potentials and Challenges of a Domestic Production	Session 4b: Energy III	Thursday, 12th, 16:30-17:00
Ölmez, Jasemin Ayse	Karlsruhe Institute of Technology (KIT)	Metallic raw materials for Germany - Unexploited mining potentials of African developing countries based on the examples Botswana, Morocco, and Zimbabwe	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Ölmez, Jasemin Ayse	Karlsruhe Institute of Technology (KIT)	The German industrial and economic market is adapting - Impact of the Russia-Ukraine conflict on the supply of metallic raw materials for Germany	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Orphal, Johannes	Karlsruhe Institute of Technology (KIT), Head of Division V and Chair of the Scientific Conference Committee	Welcome Addresses	Welcome Addresses	Wednesday, 11th, 10:00-10:30
Orphal, Johannes	Karlsruhe Institute of Technology (KIT)		Session E: Summary, Conclusions, Closing	Friday, 13th, 12:40-13:00
Paz, André	Karlsruhe Institute of Technology (KIT) / Federal University of Viçosa	Soil seed bank six years after the Fundão Dam disaster in Brazil: impacts on seedling emergency and growth	Session 4a: Ecosystems and Biodiversity	Thursday, 12th, 16:30-17:00
Ponce Otuki, Sara Akemi	Federal University of Viçosa	PERCEPTION OF SCIENTIFIC FEEDBACK BY RESIDENTS OF COMMUNITIES AFFECTED BY THE SAMARCO/BHP BILLITON/VALE DISASTER, BRAZIL	Session 3a: Communication and Narratives	Thursday, 12th, 11:30-12:00
Raymond, Joanna Louise	Karlsruhe Institute of Technology (KIT)	Using agent-based modelling to explore the co-benefits and trade-offs of changes to EU subsidy allocation	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00

Roberts, Spencer	Karlsruhe Institute of Technology (KIT) – IMK-IFU	The upscaling potential of emerging food production technologies and their land use consequences for the global food system	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Rothermel, Gunther	SAP	Transformation towards a sustainable society: Economic Dimension	Session A: Transformation towards a sustainable society	Wednesday, 11th, 11:30-12:00
Saha, Somidh	Karlsruhe Institute of Technology (KIT)	Inter and transdisciplinary approaches to increase social-ecological resilience of urban and peri-urban forests: lessons learned from the GrüneLunge project (ID: 537)	Session 2a: Urban Transformation II	Wednesday, 11th, 17:30-18:00
Saqib, Muhammad	Politechnika Gdanska, Poland	Thermal Energy Storage Study Augmentation Based on Image Processing Techniques.	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Scharnhorst, Leandra	Karlsruhe Institute of Technology (KIT)	Consumer Preferences and Acceptance of Compensation Schemes for Controlled Power Shutdowns in Germany: Results from a Choice Experiment	Session 3b: Energy II	Thursday, 12th, 11:00-11:30
Schätzler, Katharina	Karlsruhe Institute of Technology (KIT)	GeoLaB – Geothermal laboratory in the crystalline basement	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Scheidt, Nikas	Karlsruhe Institute of Technology (KIT)	Institutional and Technological Drivers of Renewable Energy Deployment	Session D: Governance and Economy	Friday, 13th, 10:00-10:20
Scherer, Ulrike	Karlsruhe Institute of Technology (KIT)	Drought and source water quality - an emerging challenge for drinking water supply	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Schläfle, Stefan	Karlsruhe Institute of Technology (KIT)	Tire-Road Particulate Matter Emissions	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Seebacher, Andreas	Karlsruhe Institute of Technology (KIT)	Transforming with the 'MobiLab' – a mobile participatory laboratory for transdisciplinary and transformative research in real world labs	Session 3a: Communication and Narratives	Thursday, 12th, 12:00-12:30
Sevekari, Maitreyee	Karlsruhe Institute of Technology (KIT)	For the greater good? Assessing feasibility of climate change mitigation	Session 2c: Resilience and the Social Dimension	Wednesday, 11th, 16:30-17:00

Simpson, Conor	Karlsruhe Institute of Technology (KIT) – Campus Alpin	Right plant, right place. Exploring the potential of orphan crops and appropriate farm management in the context of sustainable food security	Session 1c: Behavioural Change	Wednesday, 11th, 14:30-15:00
Son, Jaewon	Karlsruhe Institute of Technology (KIT) – ITAS	Citizens' perceptions of cultural ecosystem services of urban green spaces in Germany and the Republic of Korea	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Stutz, Hans Henning	Karlsruhe Institute of Technology (KIT) – IBF	Geotechnical Gravitational Energy Storage (GGES): Energy storage using a mass of soil	Session 2b: Energy I	Wednesday, 11th, 16:30-17:00
Szaguhn, Markus	Karlsruhe Institute of Technology (KIT)	Transforming Work Cultures: Strengthening Competencies for Sustainable Development of Employees by Conducting Real-World Experiments in Corporate Contexts	Session 2c: Resilience and the Social Dimension	Wednesday, 11th, 17:30-18:00
Tavakkol, Salar	Karlsruhe Institute of Technology (KIT)	Circular Plastics for Closing the Carbon Cycle	Session 3c: Circular Economy I	Thursday, 12th, 11:30-12:00
Thielitz, Cordelia	Schneider Electric GmbH	Consistent sustainability strategy as driver and game changer in a global corporation	Session A: Transformation towards a sustainable society	Wednesday, 11th, 12:30-13:00
Trenks, Helena	Karlsruhe Institute of Technology (KIT)	Facilitating empowering role change in the energy transition through experiments: experiences from a real-world lab	Session 1c: Behavioural Change	Wednesday, 11th, 15:30-16:00
Tsegas, George	Aristotle University of Thessaloniki	Assessing the Potential Environmental and Socio-economic Benefit of a TiO ₂ Nanoparticle-based Photocatalytic Paint by Integrating LCA and CBA Methodologies	Session 2a: Urban Transformation II	Wednesday, 11th, 16:30-17:00
Ullmann, Jonas	DVGW-EBI	PeePower™: Scale-up and field test of a novel bioelectrochemical system in efforts towards a sustainable bioeconomy	Session 3d: Water	Thursday, 12th, 12:00-12:30
Vadarlis, Athanasios	Karlsruhe Institute of Technology (KIT)	Subsequent steam reforming of the product gas from ethanol gasification with supercritical water	Poster Session	Wednesday, 11th 13:45-14:30 & Thursday, 12th 13:15-14:00
Valero, Daniel	Karlsruhe Institute of Technology (KIT) – IWG	Tackling plastic pollution transport in rivers – one aspect at a time	Session 3d: Water	Thursday, 12th, 11:00-11:30
Vallon, Magdalena	Karlsruhe Institute of Technology (KIT)	Efficient climate protection at a local level	Session 1a: Urban Transformation I	Wednesday, 11th, 15:00-15:30

van der Schaaf, Ulrike	Karlsruhe Institute of Technology (KIT)	Sustainable Hydrocolloid Emulsifiers from Food Waste Streams: The Case of Sugar Beet Pectin	Session 2d: Health and Well-Being	Wednesday, 11th, 17:30-18:00
Wantzen, Karl M.	Université de Strasbourg	Water and Sustainability - transformation and/or disruption?	Session C: Nature Based Solutions	Thursday, 12th, 14:00-14:40
Weidlich, Anke	Universität Freiburg	Transformation towards a sustainable society: Scientific Dimension	Session A: Transformation towards a sustainable society	Wednesday, 11th, 11:00-11:30
Weiss, Daniel	German Aero Space Center (DLR) – Institute of Transport Research	Unveiling the Landscape of the Multi-Level Perspective through Text Mining: Examining the Transportation Transition	Session 1b: Future Mobility Solutions	Wednesday, 11th, 15:00-15:30
Yarka Reddy, Pallavi Reddy	Karlsruhe Institute of Technology (KIT)	Sustainability in the cement industry: Thermodynamic Modelling of Belite Cement Clinker	Session 4c: Circular Economy II	Thursday, 12th, 16:30-17:00
Zingraff-Hamed, Aude	ENGEEES - École nationale du génie de l'eau et de l'environnement de Strasbourg		Session C: Nature Based Solutions	Thursday, 12th, 14:40-15:20

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