Co-funded by the European Union

Karlsruhe Institute of Technology

Efficient ecomanagement of Karlsruhe district

Dr. Mariana Kozlowska

20.03.2025, International Jean Monnet School „Effective Ecomanagement for the European Future of Ukraine“

Figures and Facts about KIT (2021)

37 Spinoffs and Startups

5 Campuses – **200** ha area

367 Trainess

385 Professors and executive scientists

22,225 Students

300 Buildings with a usable area of **492,000 m²**

3,100 Doctoral students

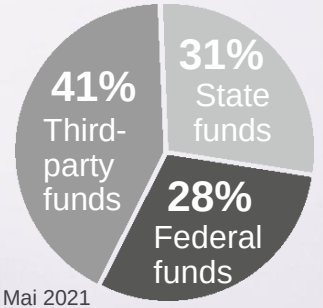
51 Patent applications

9,783 Employees

1,405 international scientists

KIT budget 2021

EUR 1090,7 million



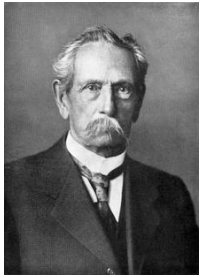
Status: Mai 2021

Famous Profs

Heinrich Hertz
(1857–1894)
discovered electromagnetic waves (1887), which are the basis for radio transmission

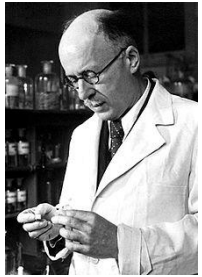
Fritz Haber
(1868–1934)
high-pressure synthesis of ammonia (1909), Nobel Prize in Chemistry (1918)

Famous Alumni



Karl Benz
(1844–1929)
the inventor of the automobile

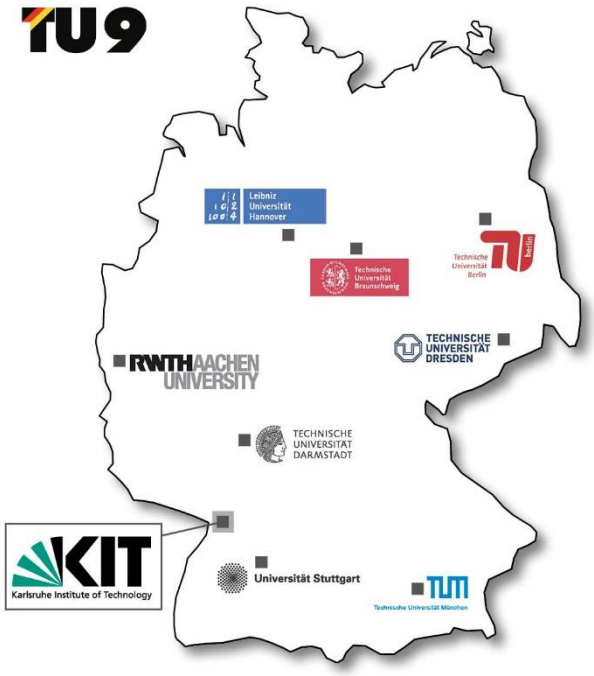
Emil von Škoda
(1839–1900)
the founder of the Škoda Works



Leopold Ružička
(1887–1976)
organic chemistry, terpenes, Nobel Prize in Chemistry (1939)

Martin Brudermüller
(1961)
CEO of BASF

KIT in the TU9 Association



1825 1865 2009

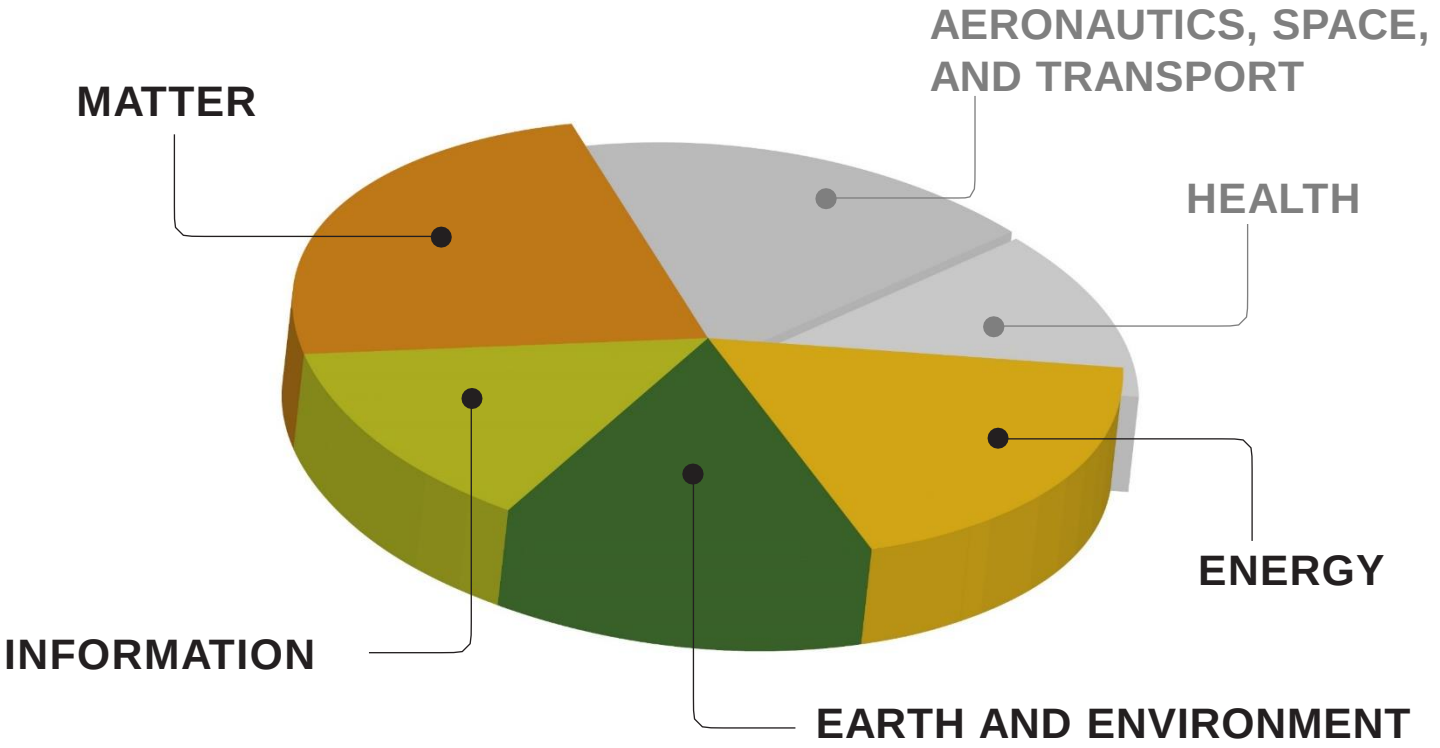
- Network and representation of the interests of leading institutes of technology in Germany
- Characterized by: Strength in research and tradition
- Partnerships with renowned universities worldwide
- Centers of technology and innovation
- Joint support of research, higher education and engineering in natural sciences

KIT – The Research University in the Helmholtz Association

HELMHOLTZ

RESEARCH FOR GRAND CHALLENGES

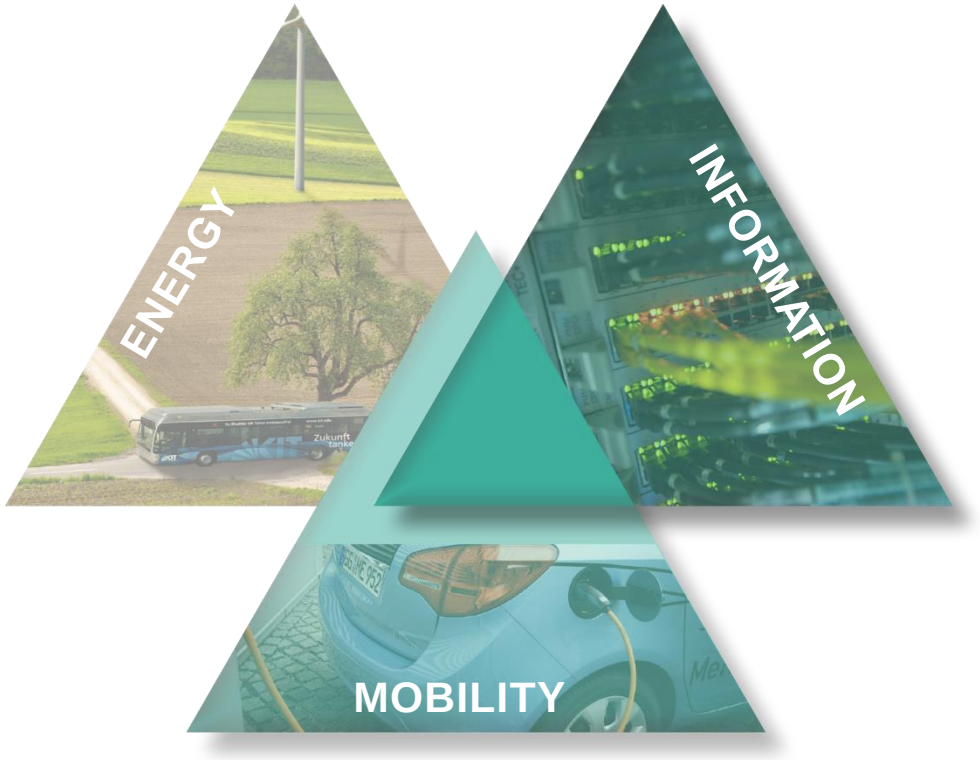
Research Fields of the Helmholtz Association: Participation of KIT



The UN Sustainable Development Goals

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future

Topics Sharpening the Profile of KIT



Karlsruhe Transformation Center for Sustainability and Cultural Change (2012)

science and research + business, municipal and civil society

- To achieve our climate protection goals quickly and **jointly**
- To **share** and **increase** knowledge on sustainability issues
- **Real-world laboratories** create interfaces between science, business, politics, and society

URBAN.KIT
Urban Transformation - Connecting Urban Sustainability Labs

REALLABORE DER NACHHALTIGKEIT

- ✓ Nutrition
- ✓ Mobility
- ✓ Consumption
- ✓ Energy

Biomass to Liquid (bioliq®)

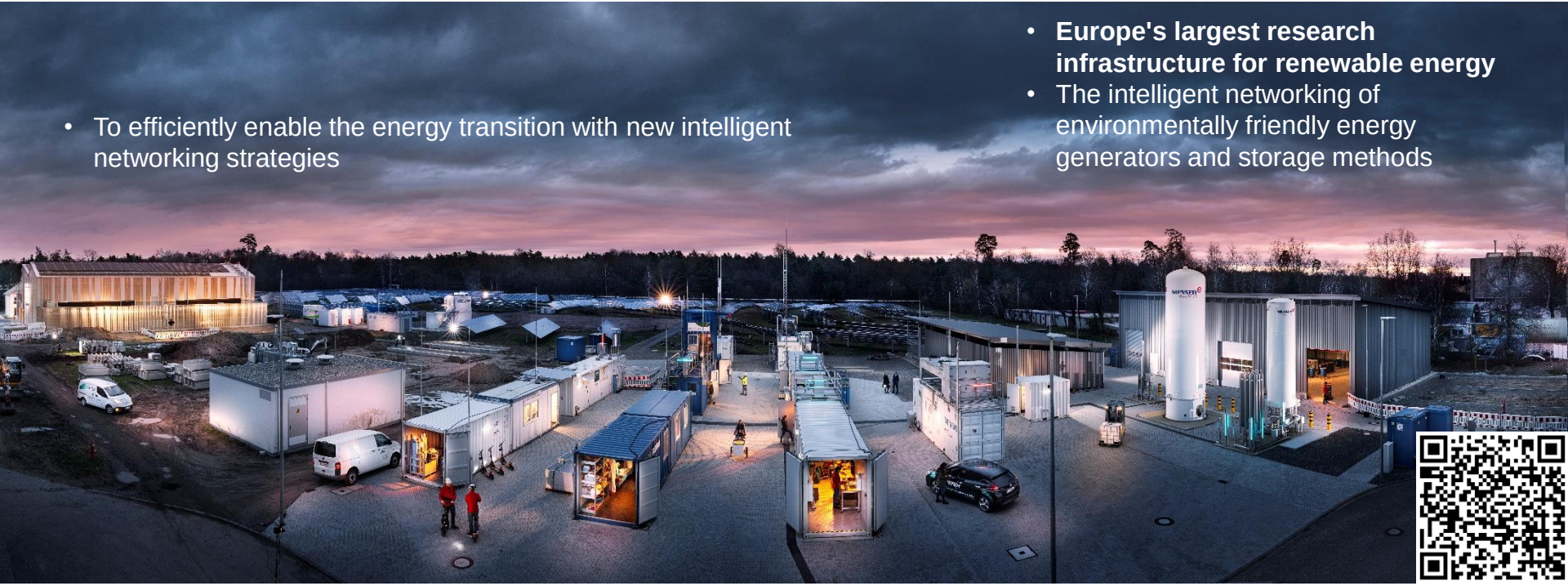
- **2005** – pilot project funded by the Federal Ministry of Food and Agriculture
- First combined operation of all four stages in **2014** for **the production of gasoline from wheat straw**
- Complete utilization of the biomass material and energy
- Exclusive use of residual biomass that does not compete with agriculture and food production for cultivation areas

EnergyLab 2.0

By 2045, climate neutrality is to be achieved. Meanwhile – by 2030 – greenhouse gas emissions are to be reduced by at least 65% compared with 1990

- To efficiently enable the energy transition with new intelligent networking strategies

- **Europe's largest research infrastructure for renewable energy**
- The intelligent networking of environmentally friendly energy generators and storage methods

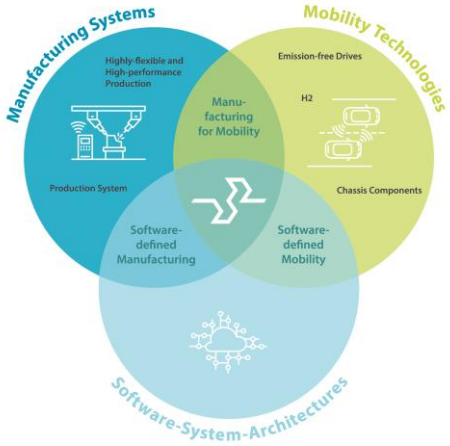


Hydrogen mobility@KIT

- The building and operation of a hydrogen refueling station at KIT Campus Nord (since 2013)
- Supplies 2 fuel cell buses (based on the Evobus Hybrid fuel cell Citaro model) operated for the KIT shuttle bus line
- This plant works daily providing gaseous hydrogen at 450 bar as fuel, and has a storage capacity of 420 kg, making it one of the biggest operative plants in southern Germany

Future mobility technologies

- Climate-neutral future production technologies and manufacturing systems
- New mobility concepts to **electric vehicles** and completely **new components** and **designs** to methods and **processes** for product development
- Development of embedded electronic systems and toolchains, e.g. XANDAR
- InnovationCampus Future Mobility is a joint technology platform between KIT and Uni Stuttgart



Lighter, more efficient, more powerful, more sustainable: new types of electric motors and their local, efficient production

"eVee" experimental vehicle: a lightweight chassis or new types of drive components are being tested

Electric and driverless prototypes for individual and public transportation

More examples: https://www.kit.edu/kit/english/pi_2023_014_hannover-messe-2023-sustainable-solutions-for-mobility-energy-and-industry.php

Other ways of mobility beyond KIT initiatives

For the needs to transport larger items around the city

https://www.transformationszentrum.org/downloads/Lastenr%c3%a4der/kat_lastenradflyer_2025.pdf

Carpooling benches

For free

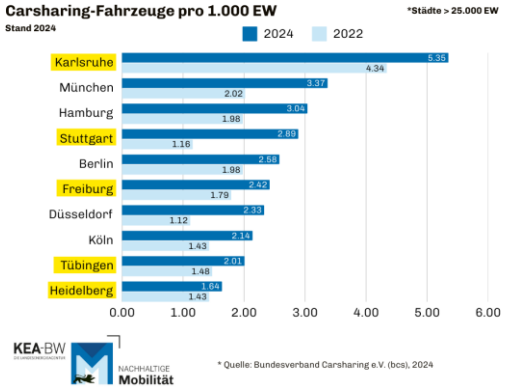
Deutschlandticket

Electric vertical takeoff and landing aircraft

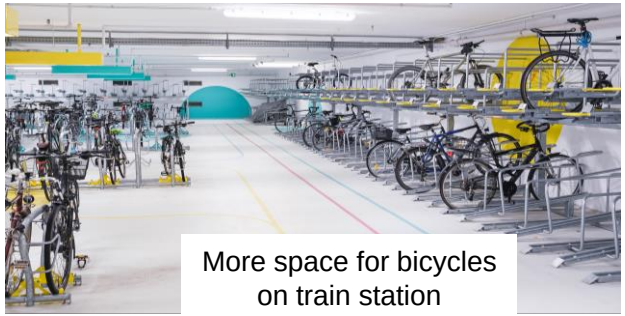
VOLOCOPTER

Other ways of mobility

Car sharing



Bike sharing



More space for bicycles on train station

E-scooter sharing

Relevant initiatives in Karlsruhe

- Karlsruhe's Environmental Management (since 2010)

EMAS
GEPRÜFTES UMWELTMANAGEMENT
DE-138-00081

kek
Karlsruher Energie- und Klimaschutzagentur

✓ Projects in the city to achieve maximum environmental and climate benefits (e.g. green energy, energy-efficient renovations)
✓ environmental management system compliant with the European EMAS regulation (Eco Management and Audit Scheme)

Karlsruhe Climate Adaptation Strategy 2021

- Urban Climate Planning (mitigate heat accumulation in densely built areas)
- Infrastructure Adaptations (solutions for heavy rainfall and potential flooding)
- Research and Collaboration

Biowaste is scanned (obligatory in 2025)

- Biowaste: 49-54 kg/person per year
- 5-10% is wrongly sorted – higher recycling costs

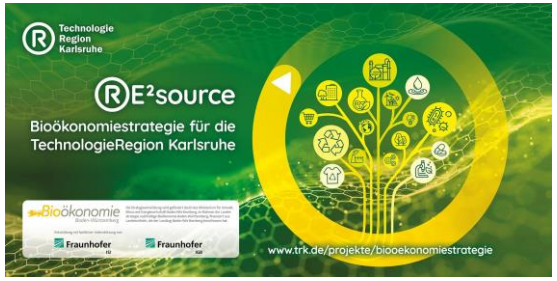
„Deepscan Scanner“ (60000 Euro)

https://www.baden-tv.com/mediathek/video/fuer-ein-sauberes-karlsruhe-der-bioabfall-stoerstoffdetektor-im-test/

The same is planned with plastic and paper

Bioeconomy Initiatives in the Karlsruhe TechnologyRegion

- Sustainable bioeconomy by promoting innovative businesses with **bio-based products** and processes
- To utilize **plant-based** fibers in regional value chains, particularly in construction, packaging, and food industries
- Promotion of start-ups, marketing the location in new target markets
- Design of regional bioeconomy strategies
- Diversity and sustainability, technology transfer
- Cooperation platforms with companies



H_2iPort KA Mod

Karlsruhe Mobility Lab
powered by Technologie Region Karlsruhe

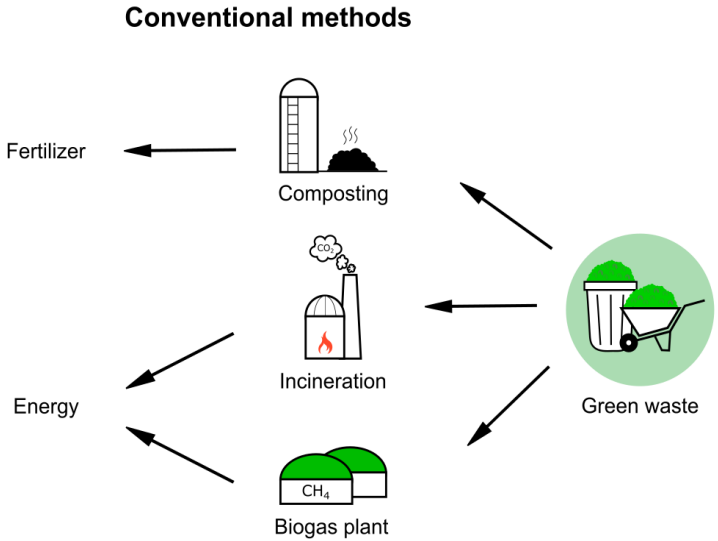
Grass clippings

Large quantities available
- e.g. Berlin 120,000 t a^{-1}

Current use
- Composting and subsequent use as fertilizer
- Biogas production

Overall, the use of grass clippings still costs significantly more than it generates

→ New conversion routes required

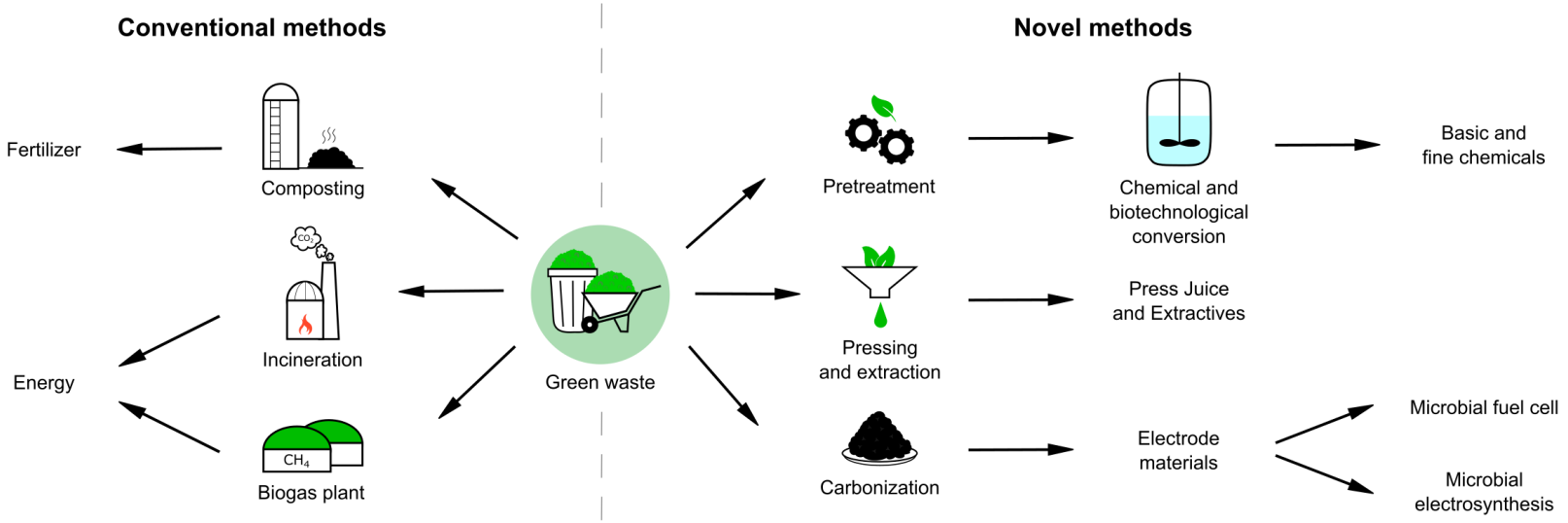


Slide adapted from Prof. Dirk Holtmann (KIT)

Grass biorefinery – an example

Slide adapted from Prof. Dirk Holtmann (KIT)

Successful development of new conversion routes



Routes can be integrated!

Slide adapted from Prof. Dirk Holtmann (KIT)

Challenges

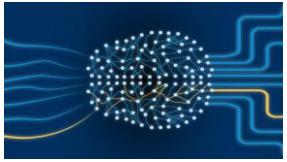
- Scale-up of processes
- Development of logistics concepts/ decentralized bio-economy concepts
  Co-operation with Andreas Rudi, Institute for Industrial Production (IIP)
- Broadening the feedstock base





…

- Paradigm shift by robust processes
  - one substrate → products to many substrates → products

Slide adapted from Prof. Dirk Holtmann (KIT)

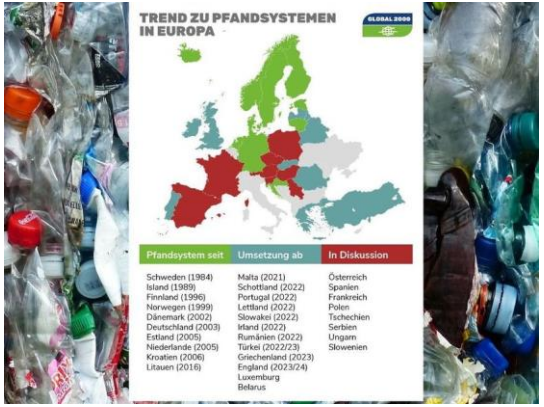
Foodsharing

reducing food waste by redistributing surplus food to those who can use it

- Online platforms
- Fairteiler (Public Distribution Points)
- Foodsaver Volunteers

Less plastic by tap **water refill**

Standard ways to reduce waste



PLAFCO – a sustainable plastic substitute made from paper

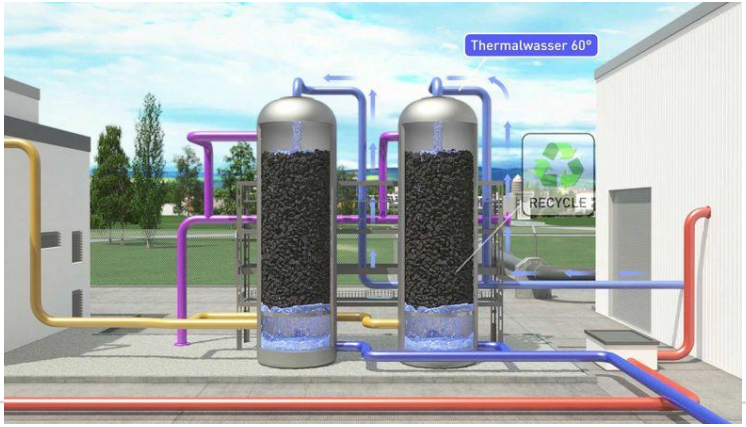
- Products such as drinking straws and disposable tableware made from fossil raw materials **are banned from sale from mid-2021**
- PLAFCO - *plasticised fibre composite*
- This method transforms paper into a cellulosic composite that is more compressed than paper
- It replace many plastic and hybrid products
- Fully biodegradable and compostable as well as protecting the environment and not polluting water

Modern ecomanagement: efeuCampus Bruchsal

- **efeuCampus Bruchsal GmbH** was founded in 2018 as a 100% subsidiary of the city of Bruchsal
- The aim is to develop innovative eco-friendly solutions for **urban goods logistics** that are ecologically sensible and economically viable
- Initial project: delivering packages and collecting recyclables

Bruchsal: thermal water for electricity and beyond

- Experts estimate: ca. 1.6 Mio tons of lithium will be needed annually by 2028 for batteries
- Lithium production through the evaporation of sea and brine water needs high water consumption and the simultaneous water shortage in some producing countries
- Alternative mining regions and sustainable methods of lithium extraction are sought after
- In Bruchsal, EnBW is testing the **climate-neutral, industrial extraction of lithium from deep geothermal energy**
- Prediction: Production of around 20,000 batteries for electric cars



Take-home messages

- Renewable energy
- Emission-free
- New technologies, new materials and optimized processing for high sustainability
- Recycling
- Digitalization, control, optimization
- Education and active inspiration

Thank you for your attention!

KIT – Exzellent Research, Outstanding Higher Education, and Driver of Innovation

Participation of all scientists in teaching and research

Excellent research infrastructure

DEVELOPING SCIENTIFIC CAREER PATHS

Cultural diversity

The Research University in the Helmholtz Association

TRANSPARENT SERVICES FOR RESEARCH, TEACHING, AND INNOVATION

KIT thinks and acts as ONE institution

Energy

Mobility

Information

Research-based teaching and learning

INNOVATION AS A STATUTORY MISSION

TOWARDS A LEADING POSITION IN EUROPE