



Umwelt-Campus
Birkenfeld

H O C H
S C H U L E
T R I E R

IfaS

Institut für angewandtes
Stoffstrommanagement

Potenziale erkennen - Prozesse optimieren - Mehrwert schaffen

www.stoffstrom.org

Rhineland-Palatinate – at a glance

- Population: 4.2 Mio in 2022
- Size: ca. 20,000 km²
- Gross domestic product : € 171.7 billion (2022)
- Export ratio: 53 %
- Unemployment rate: RLP 4.6% (2022)
Germany 5.3% (2022)
- 21 Mio. Tourists in 2022



Sources: Statista, 2023 & Statistisches Landesamt, Rheinland-Pfalz

TRIER – BIRKENFELD – IDAR-OBERSTEIN



TRIER

5,372 Students



BIRKENFELD

2,452 Students



IDAR-OBERSTEIN

50 Students

HOCHSCHULE TRIER

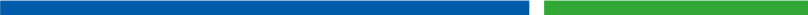
8,000 Students

70 different nations

160 Professors



Introduction to the International Circular Economy Week (ICEW)



Prof. Dr. Peter Heck, CEO IfaS
09.10.2023

- Presentation of the Environmental Campus and the Institute for Applied Material Flow Management
- Introduction to Material Flow Management and Circular Economy
- Presentation of the aims and agenda of activities of the ICEW
- Presentation of the innovative technical facilities
 - Municipal waste treatment
 - Municipal wastewater treatment
 - Renewable energy generation
- Presentation of the IfaS Staff



Take as much as
you want! There is
enough for
everybody!

Circular Economy = Green Business Development

- To secure resources and sinks
- To create development and welfare
- To enhance science and technology
- To reduce carbon and ecological footprint
- **Investing in ecosystems instead of spending on pollution control**

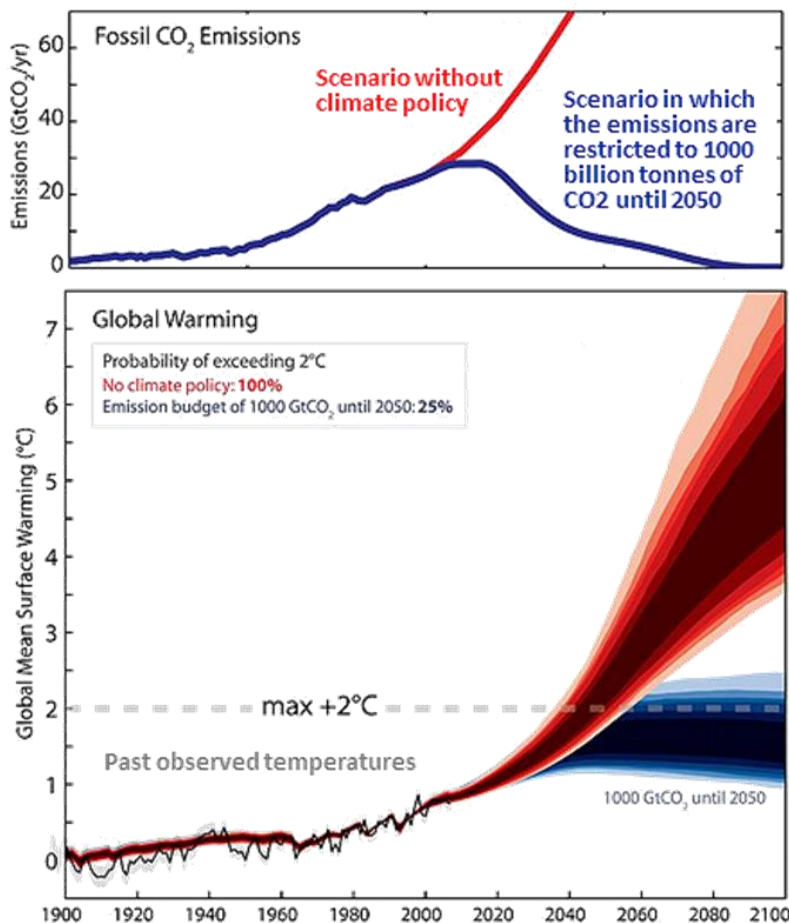
CLIMATE
CHANGE

IT'S SETTLED...
WE AGREE TO SIGN
A PLEDGE TO HOLD
ANOTHER MEETING
TO CONSIDER CHANGING
COURSE AT A DATE
YET TO BE DETERMINED.

WORLD LEADERS

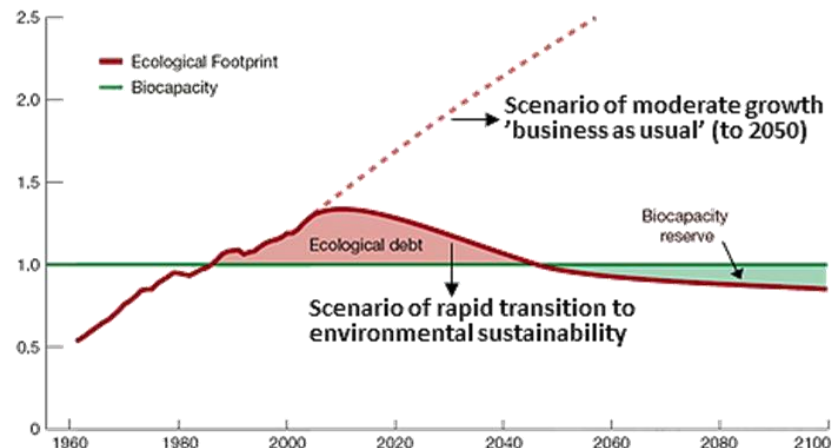
Global Warming and Carbon Emissions

By scenarios of emissions, in gigatons of CO₂ and temperatures



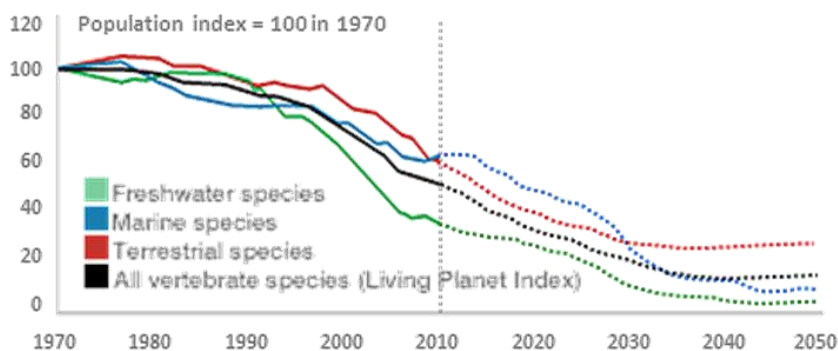
Global Biocapacity and Ecological Footprint

By scenarios of ecological footprints, in number of Earths needed



Global Biodiversity and Species Loss

By groups of species, in percentage change in species population

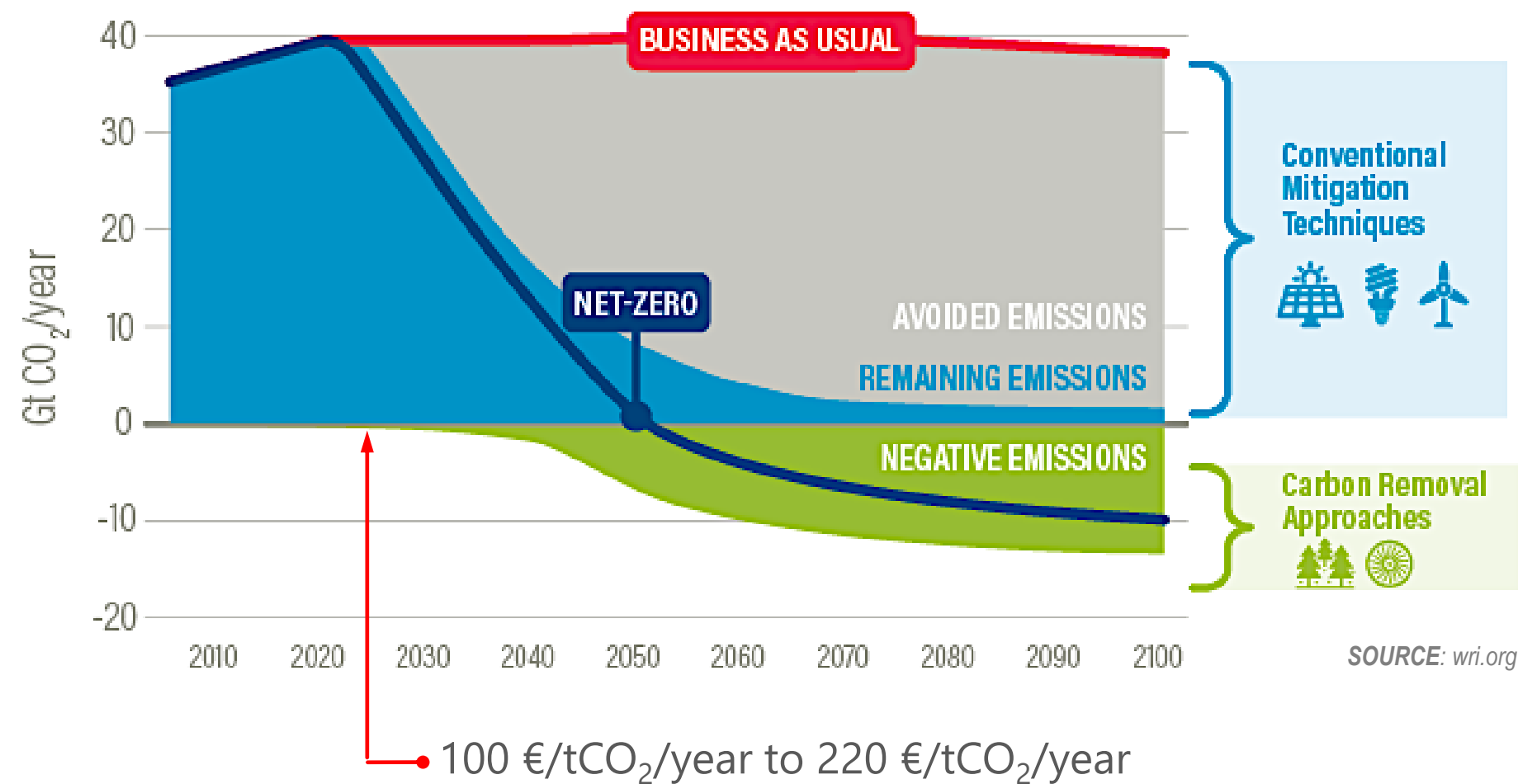


Global Poverty and Migration Crisis



Sources: Institute for Atmospheric and Climate Science (IACETH), World Wide Fund for Nature (WWF), Zoological Society of London (ZSL), United Nations Environment Programme's World Conservation Monitoring Centre (UNEP-WCMC), Global Footprint Network (GFN).

The international relevance of Carbon removal



Financial Aspects | Assumptions

Carbon certificate price

■ 100 €/t

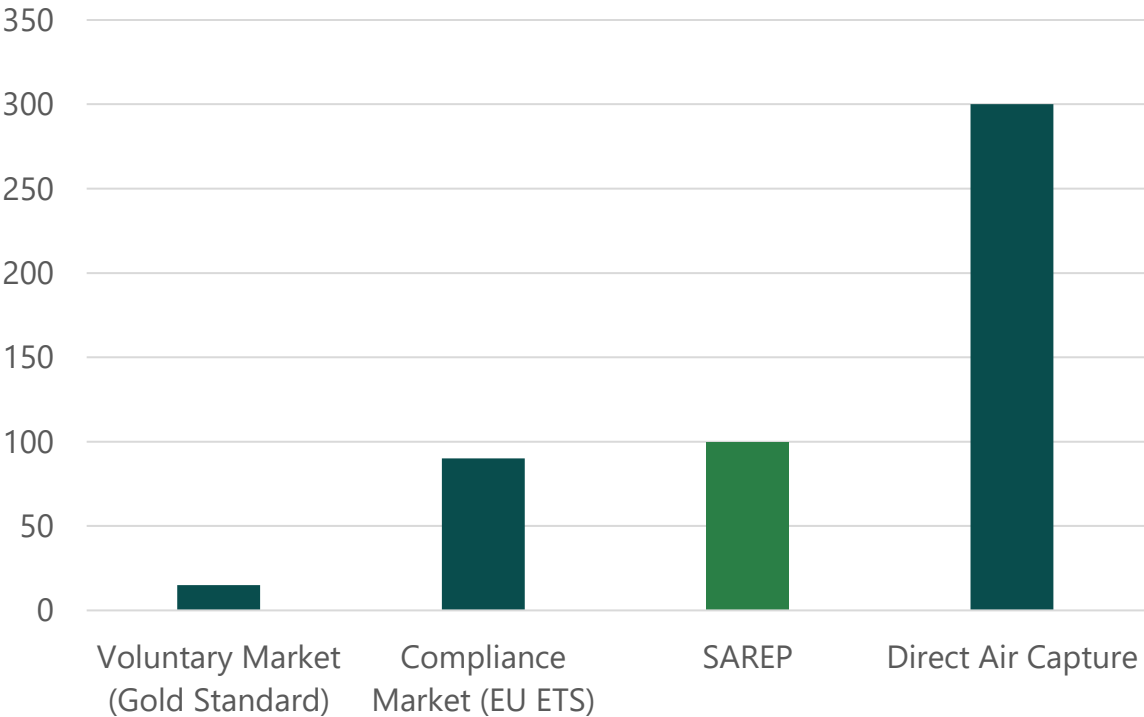
WACC

■ 2%

Accrediting period

■ 30 years

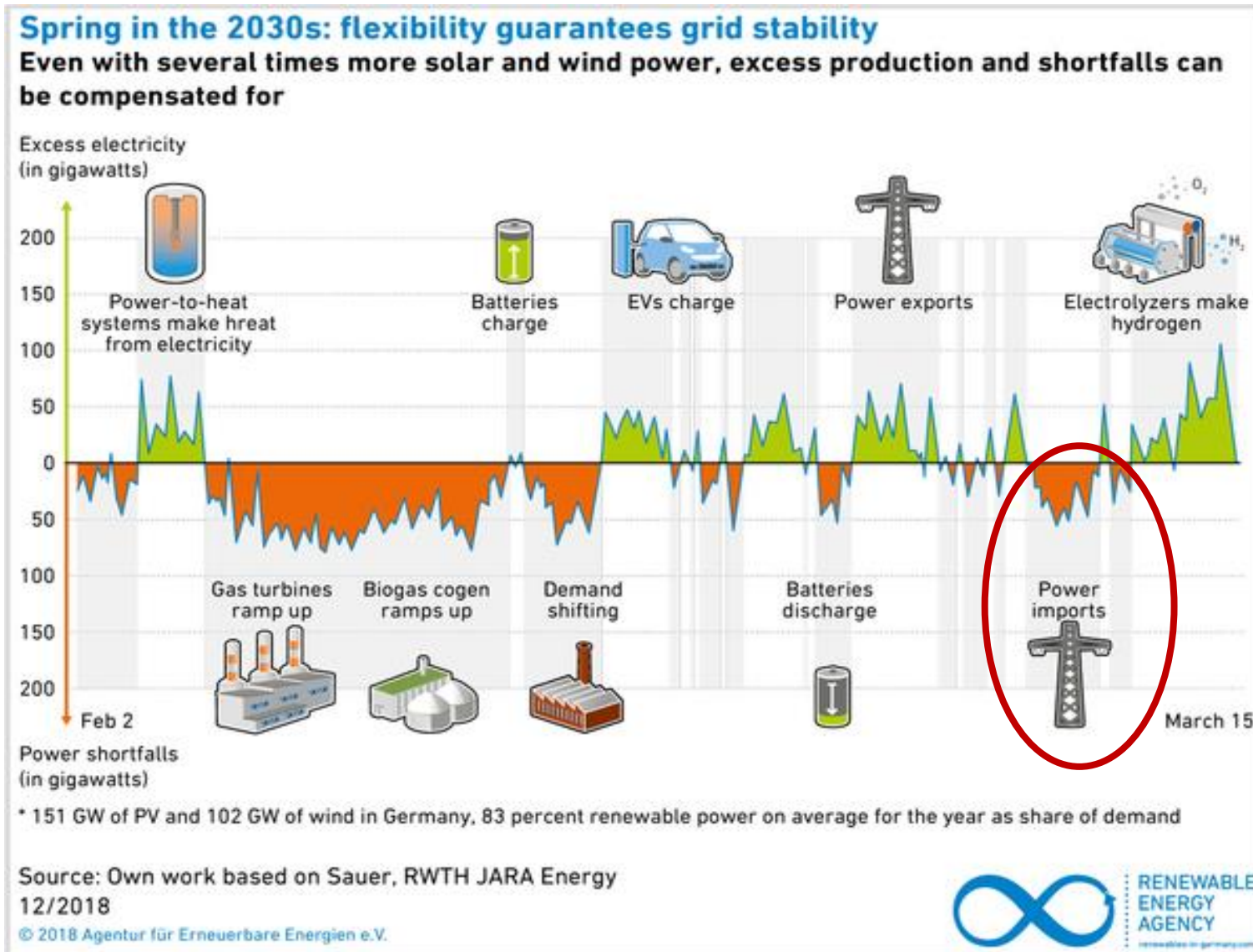
Carbon Offset Price (€/t CO₂) 2023





Sustainability is the
better economy

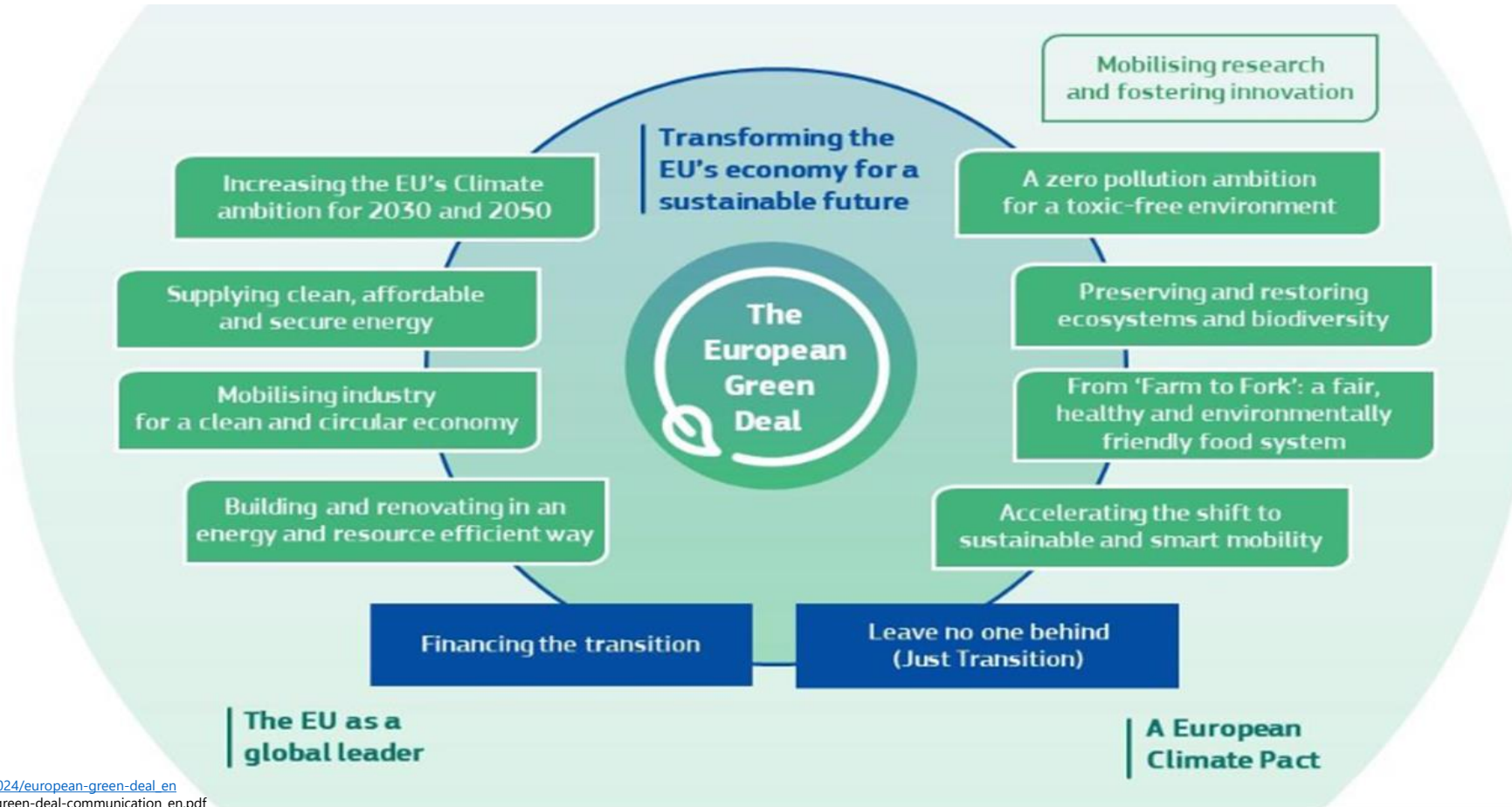
65% Renewables and grid stability



- Ukraine war forces quick alternatives!
- 100% Renewable and sectoral cross combination?
- Scientist believe on 100% energy independence already in 2030

The European Green Deal: opportunity for CE

The European Green Deal is a roadmap strategy created to make **the EU the first climate neutral continent by 2050** economy turning climate and environmental challenges into opportunities across all policy areas



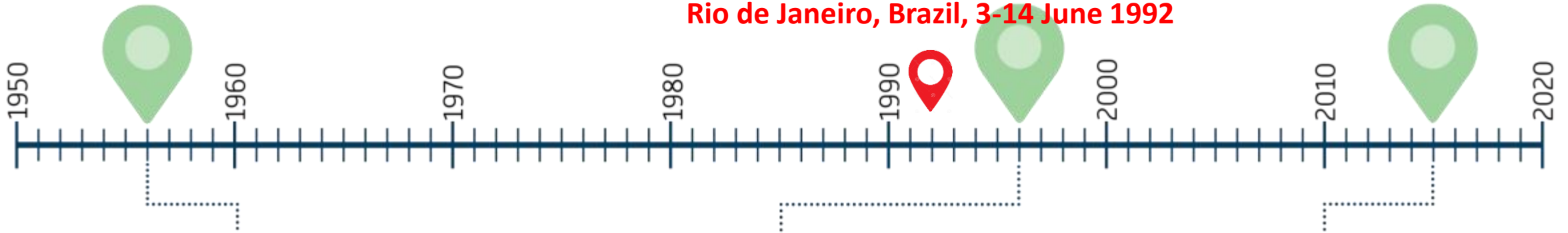
https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en
https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

- **Trier University of Applied Sciences**
 - More than 7.500 students (Founded in 1810)
 - More than 150 professors
 - More than 150 international university cooperations
- **Environmental Campus Birkenfeld (ECB)**
 - Inaugurated in 1996
 - More than 2.700 students (2010)
 - More than 60 professors
 - Students from more than 30 nationalities
- **Educational focus on environmental studies**
 - Faculty of Environmental Economics and Law
 - Faculty of Environmental Engineering
- **State conversion project**



ECB – the unique green campus idea

United Nations Conference on Environment and Development,
Rio de Janeiro, Brazil, 3-14 June 1992



Up to 1994:
US Military Hospital



1996: Starting the
endeavour



Germany's Greenest
University Campus

Sustainability Awards of the Environmental Campus in Birkenfeld

- **Fairtrade University 2021**
- **Green Metric Ranking 2022 → ECB – NO 1 in Germany**
 - Nr. 6 Globally and Nr. 1 in Germany (among 1050 universities)
 - Nr. 1 in category „Energy and Climate Protection“
- **International Sustainability Campus Network**
 - World's largest sustainability forum for universities
 - Nr. 1 award in the category „Campus Planning and Management Systems“
- **Nomination German Sustainability Award 2024**
 - UCB was selected from 423 higher education institutions (Federal Statistical Office) in Germany as one of the 10 pioneers of transformation in the category "Schools and Higher Education Institutions".



Sources: <https://www.umwelt-campus.de/campus/leben-am-campus/green-campus-konzept/auszeichnungen>
<https://greenmetric.ui.ac.id/rankings/overall-rankings-2022>

Germany's #1 - globally #6 in 2022

Overall Rankings 2022

Show

100

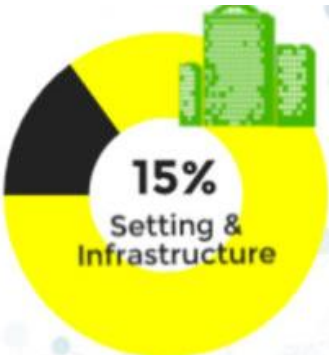
 entries

Search

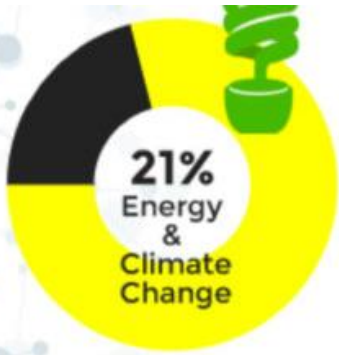
Rank 2022	University	Country	Total Score	Setting & Infrastructure	Energy & Climate Change	Waste	Water	Transportation	Education & Research
1	Wageningen University & Research	Netherlands	9300	1325	1825	1800	1000	1600	1750
2	Nottingham Trent University	United Kingdom	9175	1300	1975	1800	850	1500	1750
3	University of Nottingham	United Kingdom	9175	1375	1700	1800	1000	1650	1650
4	University of Groningen	Netherlands	9160	1325	1635	1800	1000	1750	1650
5	University of California, Davis	USA	9150	1375	1775	1800	1000	1450	1750
6	Umwelt-Campus Birkenfeld (Trier University of Applied Sciences)	Germany	9125	1175	1975	1575	950	1700	1750



Source: <https://greenmetric.ui.ac.id, 2>



The aim is to trigger the participating university to provide more space for greenery and in safeguarding environment, as well as the development of sustainable energy.



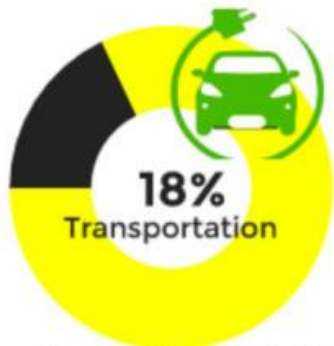
With this indicator, universities are expected to increase the effort in energy efficiency on their building and to care more about nature and energy resources.



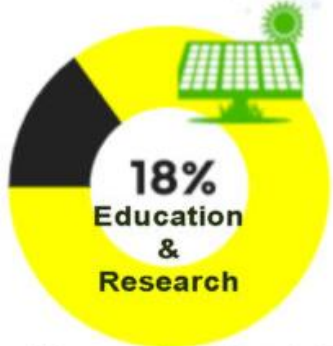
Some programs and waste treatments should be among the concern of the university, i.e. recycling program, toxic waste recycling, organic waste treatment, inorganic waste treatment, sewerage disposal, policy to reduce the use of paper and plastic in campus.



The aim is that universities can decrease water usage, increase conservation program, and protect the habitat.



Transportation policy to limit the number of motor vehicles in campus, the use of campus bus and bicycle will encourage a healthier environment.



This expansion of the criteria based on the thought that university has an important role in creating the new generation concern with sustainability.

Green Metric 2022: approx. 1000 participants from 75 countries



Source: <https://greenmetric.ui.ac.id>, 2023

Zero Emission Campus – Concept



- **100%** renewable heat supply based on waste wood, biogas (co-generation) and solar thermal
- **100%** renewable electricity based on cogeneration & PV
- **100%** renewable cooling supply based on geothermal, biomass and solar adsorption
- **100%** Energy Efficiency

Powered by the Sun!

- Own PV covers up to 50% of ECB electricity demand
- PV as an architectural design element

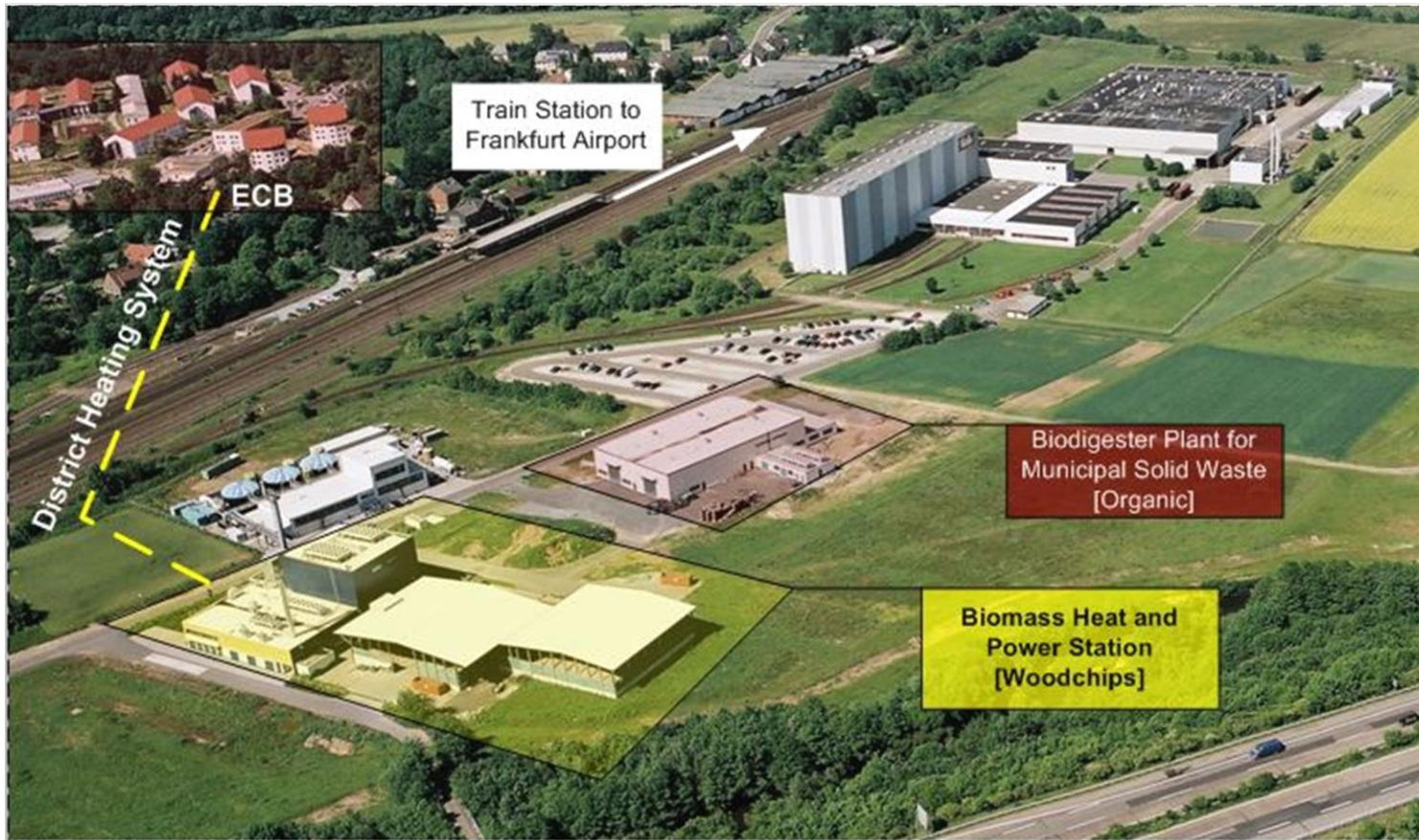


Powered by the Sun!

- Installed capacity of 4.9 kWp
- Commissioned in 2004
- Demonstration unit at a round-about

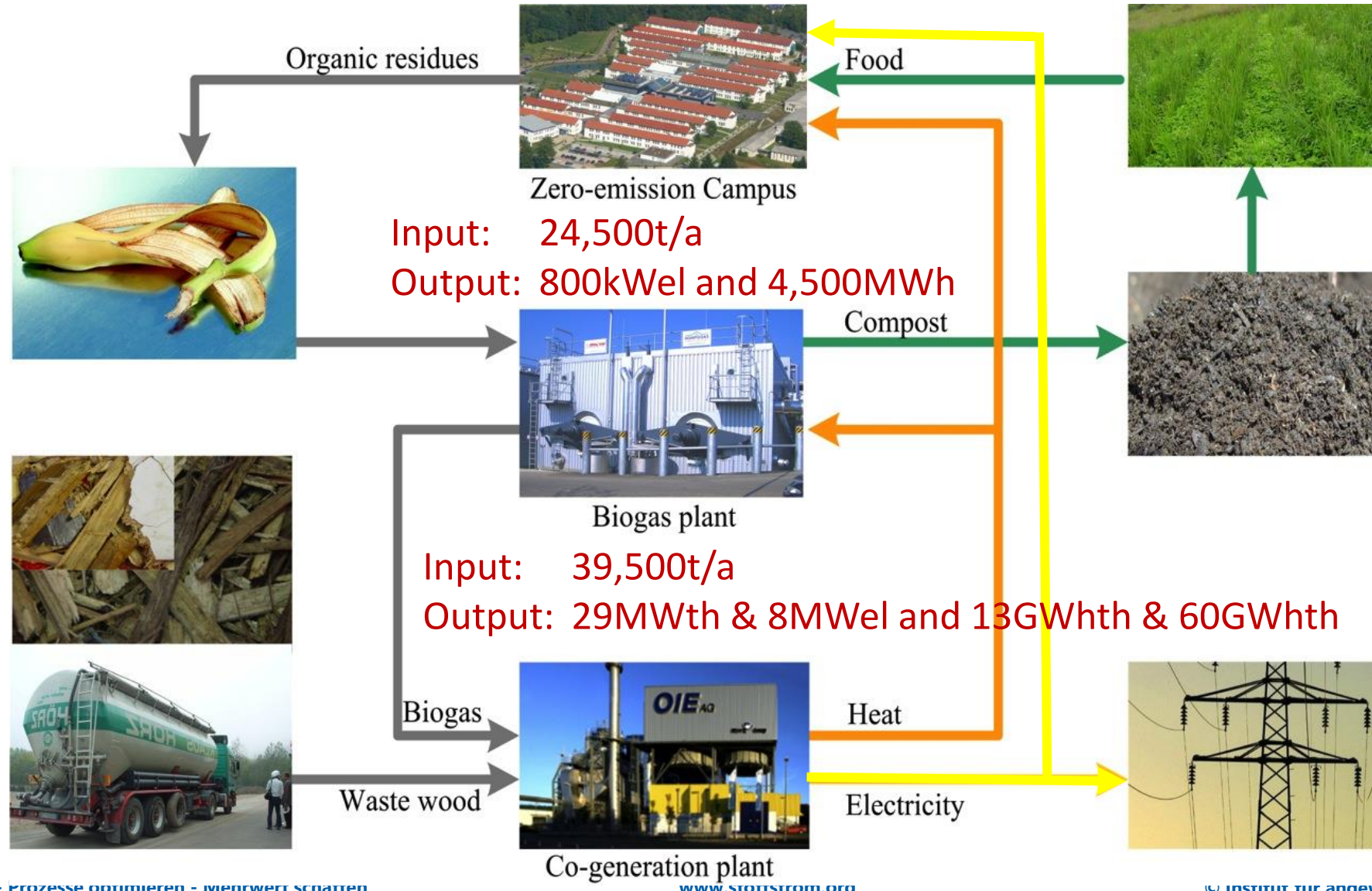


Eco-Industrial Park (Waste-to-Energy)

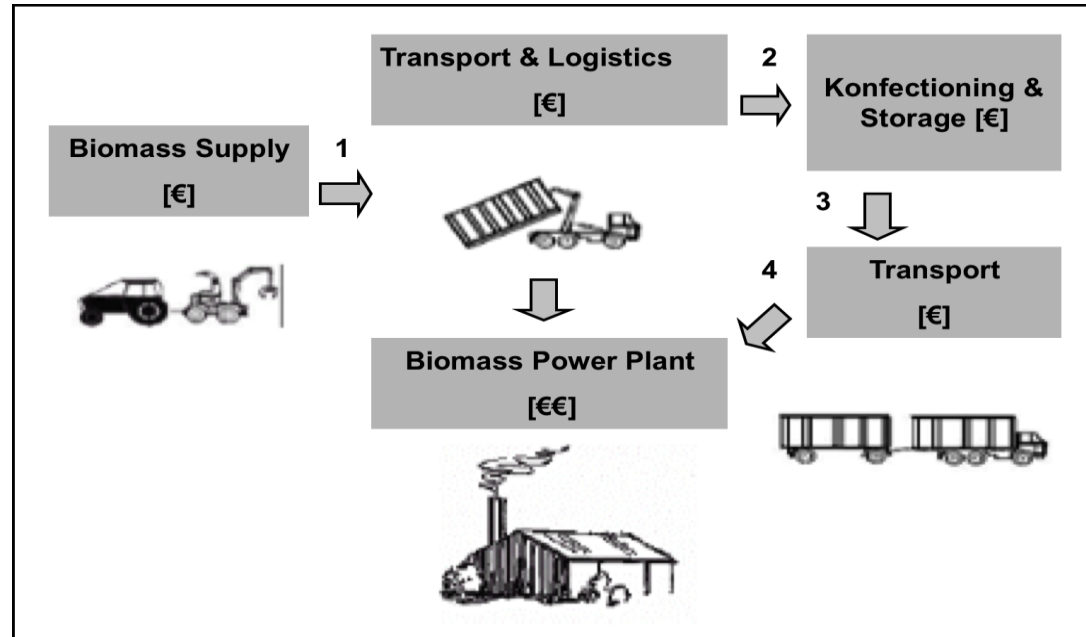
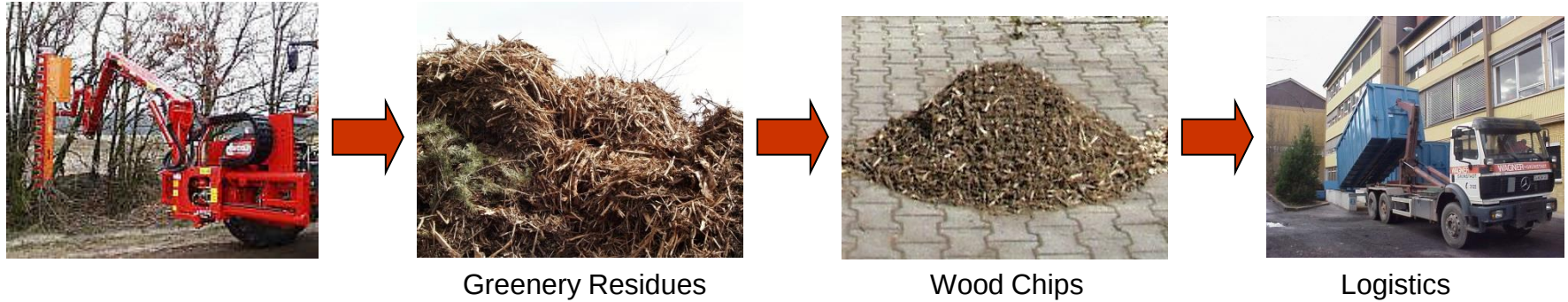


- **100%** Private company investments (40 Mio. EUR CAPEX) in Public-Private-Partnership
- **100%** Regional Added Value (35 new jobs, GHG abatement, long-term affordable energy security)
- **100%** waste problems solved without second pollutions

Eco-Industrial Park (Waste-to-Energy)



Biomass to heat



Local Heating / District Heating Grid

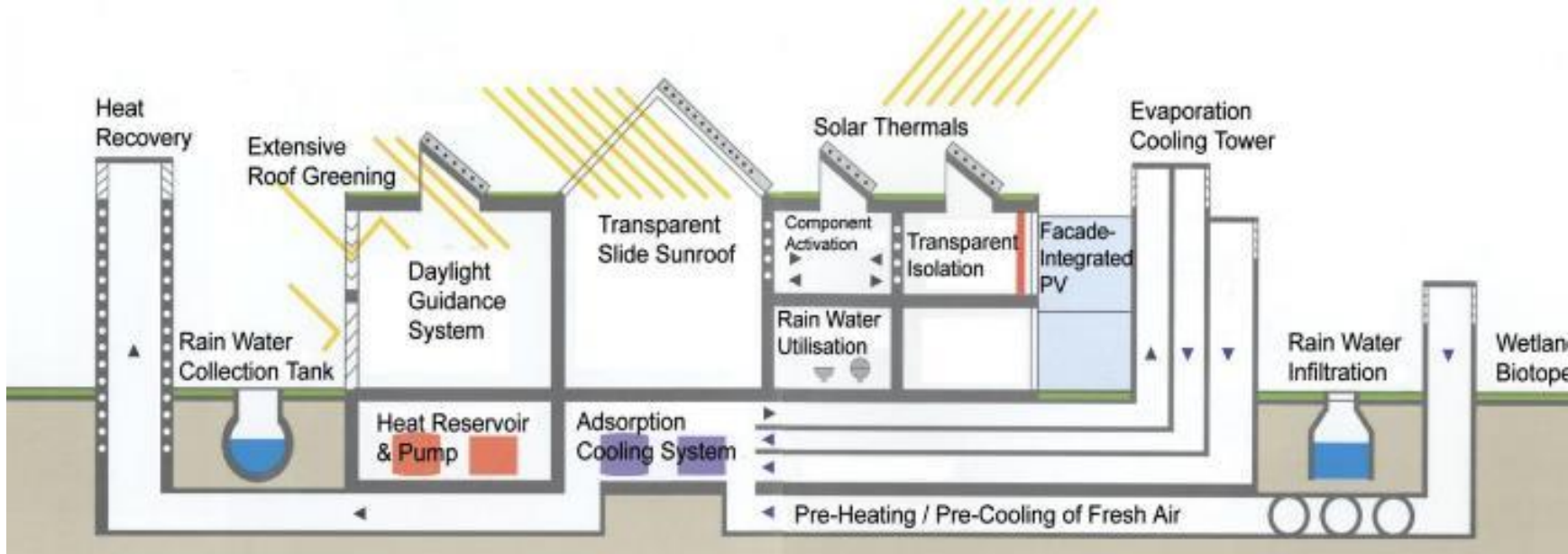


- Input: separately collected organic household waste [24,500 t/a]
 - *Biogas: 1.4 - 1.8 million m³/a*
 - *Energy Content: 1,000,000 litre oil equivalent*
 - *2,700 t/a solid fertiliser*
 - *10,000 t/a liquid fertiliser*



Zero Emission HVAC System

- Earth collectors and Air Inlet
- Utilising geothermal heating and cooling
- Free night cooling by AHU



Charged by the sun – Sustainable Mobility



- Carport with 100kWp installed capacity
- Integrated Battery storage [80 kWh]

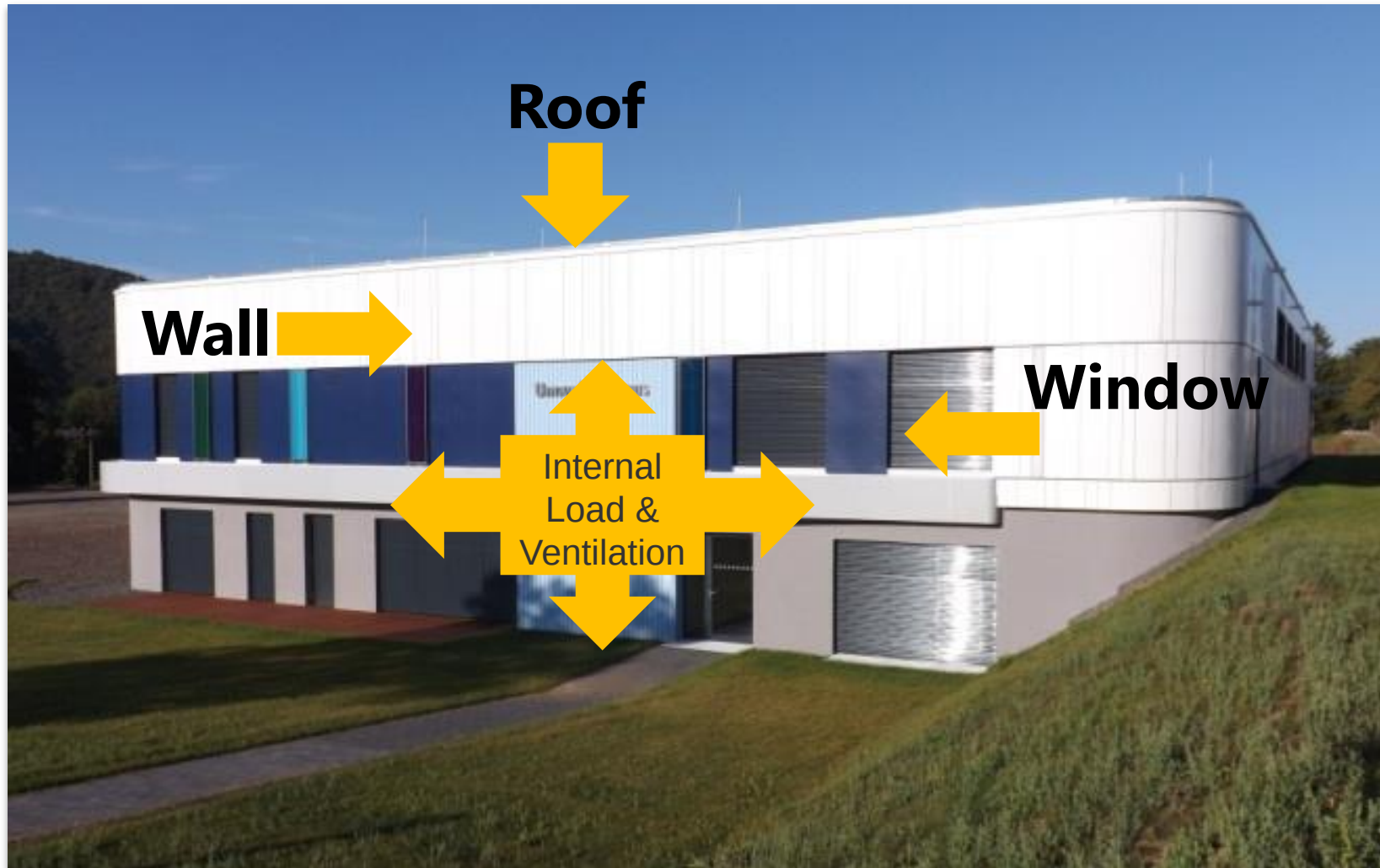


New UCB-Communication Centre

- Total Gross Floor Area (GFA): 1.932 m²
 - Double-storeyed Multifunctional room (2.420 m²)
- Initial Investment (CAPEX): approx. 4.000.000 €
- Spec. Primary Energy Demand (EnEV): 40,7 kWh/(m²/a)
- Spec. Thermal Energy Demand (EnEV): 12,8 kWh/(m²/a)



HVAC Load Modeling (excl. Interior loads)



Integrated Water Resource Management at ECB

- Natural water ponds and biotope system for ground water recharge
 - Avoidance of rainwater run off to sewer system
- Rainwater collection and valorisation as service (grey) water
 - Load reduction in WWT systems
- Abiotic building cooling by rainwater



Water Resource | Urine as material source

1m³ of Urin contains:



9.2	kg	Nitrogen
1.0	kg	Phosphorous
2.2	kg	Potassium

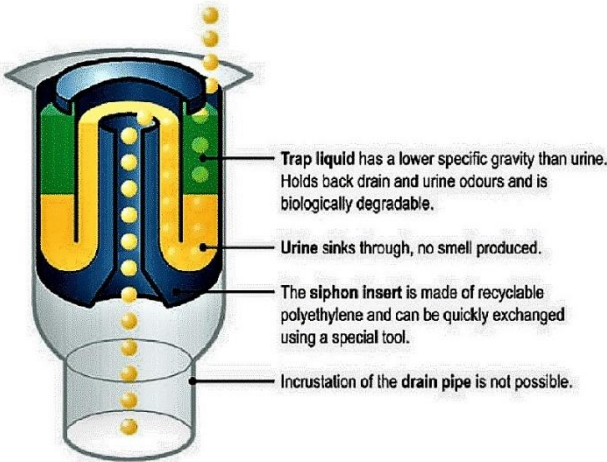
- Treatment (elimination of nutrients and energy) of 1 m³ wastewater takes on average 0.5 kWh_{El.}
- The Production of 1 kg Nitrogen takes approx. 10 kWh_{El.}
- The Exploration of 1 kg Phosphorous takes approx. 10 kWh_{El.}

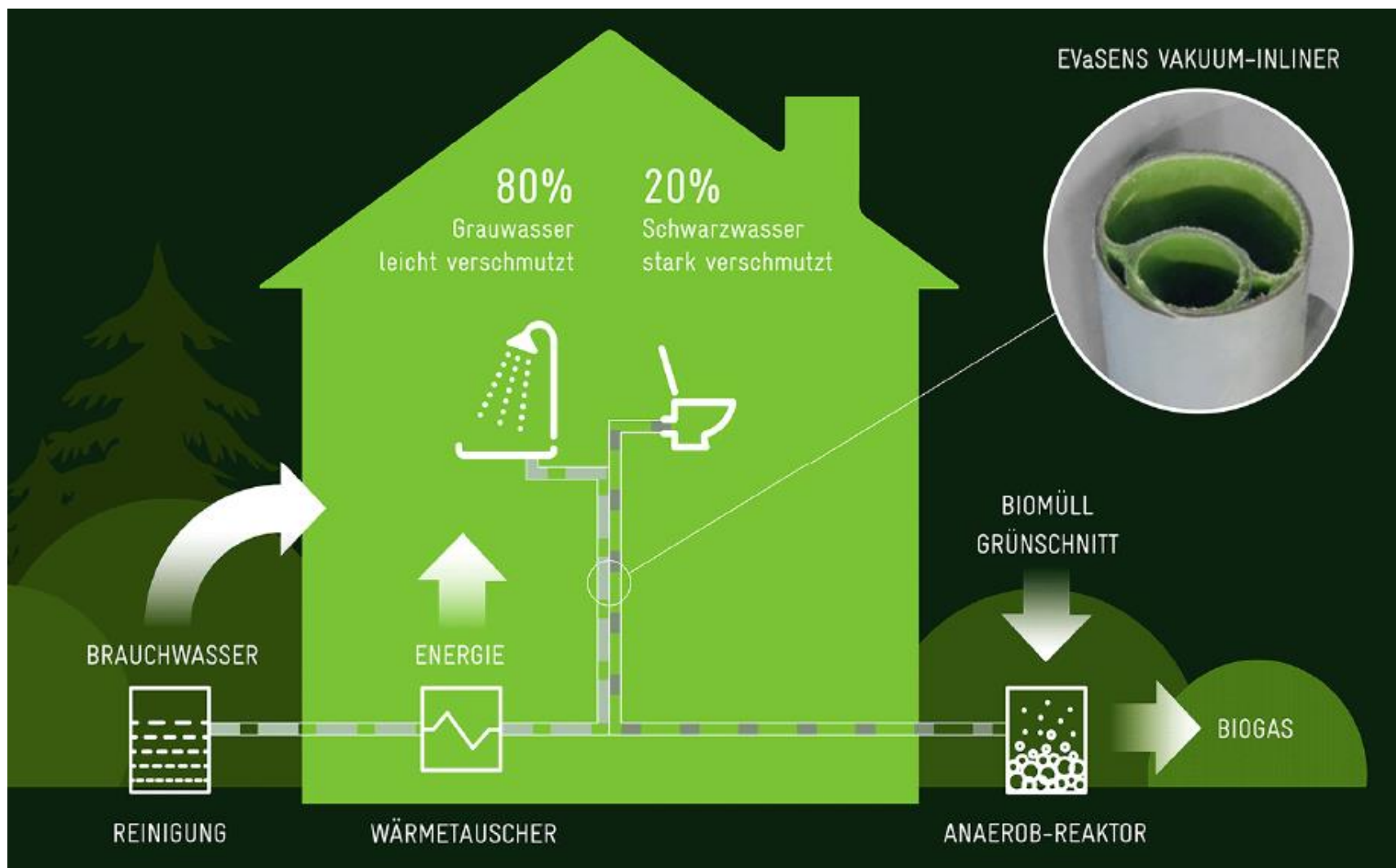


Conventional wastewater treatment destroys valuable raw materials and energy by using fossil energy and **money!**

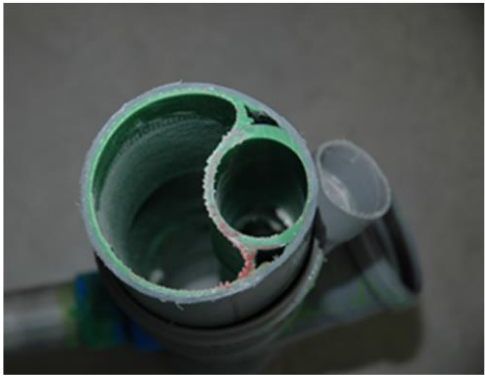
Use case – Waterless urinals

	Conventional urinals	Waterless Urinals
		
CAPEX (€)	180	250
Water demand	3.7 l/flush	none
Water price	0.0016 €/liter	
Usage (per day)	100 times/day	100 times/day
Odor trap usage		7000 times (average)
Odor trap price		18 €/trap
OPEX (€/day)	0.6 (water cost)	0.0026 (Depreciation of the odor trap)
Water use	135 m³/a (+10% for cleaning)	0.3 m³/a (only for regular maintenance)





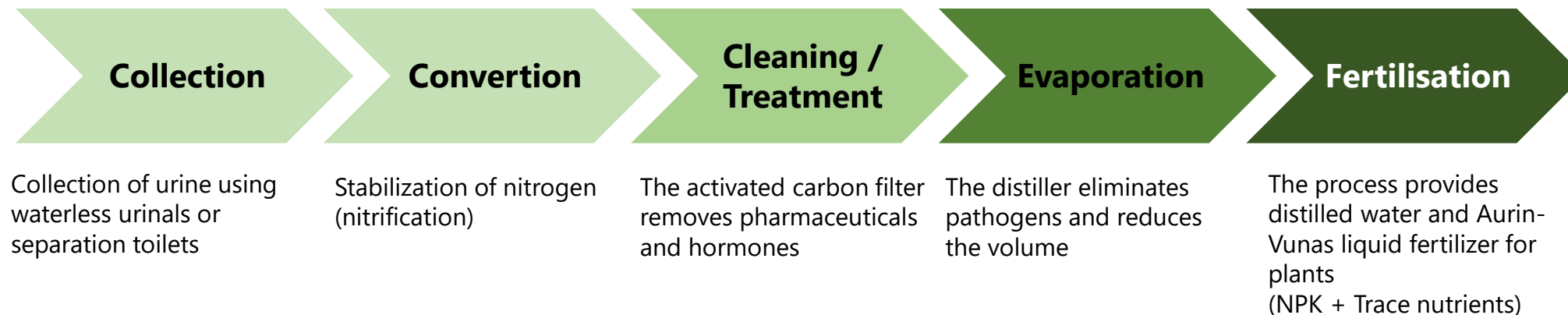
Source: Björnsen Beratende Ingenieure GmbH 2017



Objective: Development of an overall concept "Wastewater Free Environmental Campus Birkenfeld"

- Separate collection and use of wastewater and biomass potentials (household biowaste).
- Integration of a New Sanitation Concept (NASS) into an existing student dorm on the ECB.
- Double inliner system (EVaSENS), Vacuum drainage system and sanitary system

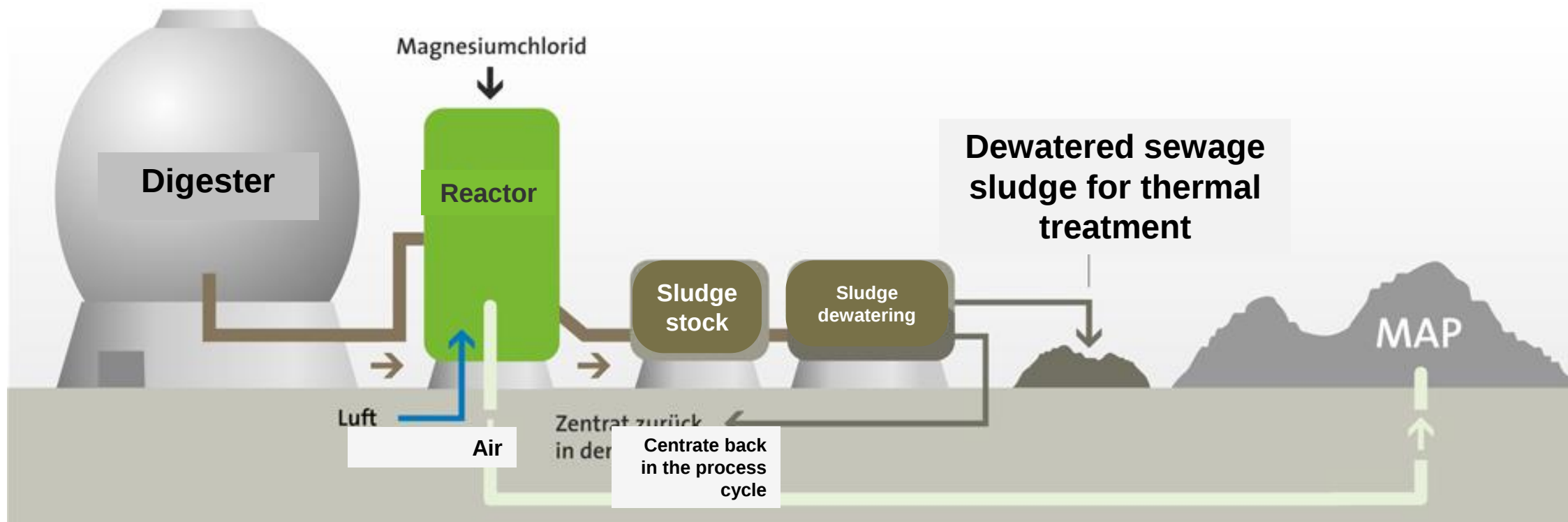
Water Resource | Urine as material source



Source: <https://vuna.ch/aurin/>; 2021

Model	Unit	NX-200	NX-500	NX-1000
max. Vol. of urine processed	l/d	200	500	1.000
Average fertilizer production (7%)	l/d	14	35	70
Production of distilled water (93%)	l/d	186	465	930
Electricity demand				
Specific demand	kWh/l Urine	0,15	0,15	0,15
Daily demand	kWh/d	30	75	150
Investments /Costs / Revenue (net)				
Treatment Plant	€	120.000 €	230.000 €	350.000 €
Maintenance	€/a	5.000 €	5.000 €	6.000 €
Energy (0,28€/kWh)	€/a	3.066 €	7.665 €	15.330 €
Sales Revenue (4€/l fertilizer)	€/a	20.440 €	51.100 €	102.200 €
Payback period	a	10	6	4

Next potentials | Nutrient Recycling (Magnesium, Ammonia, Phosphate)

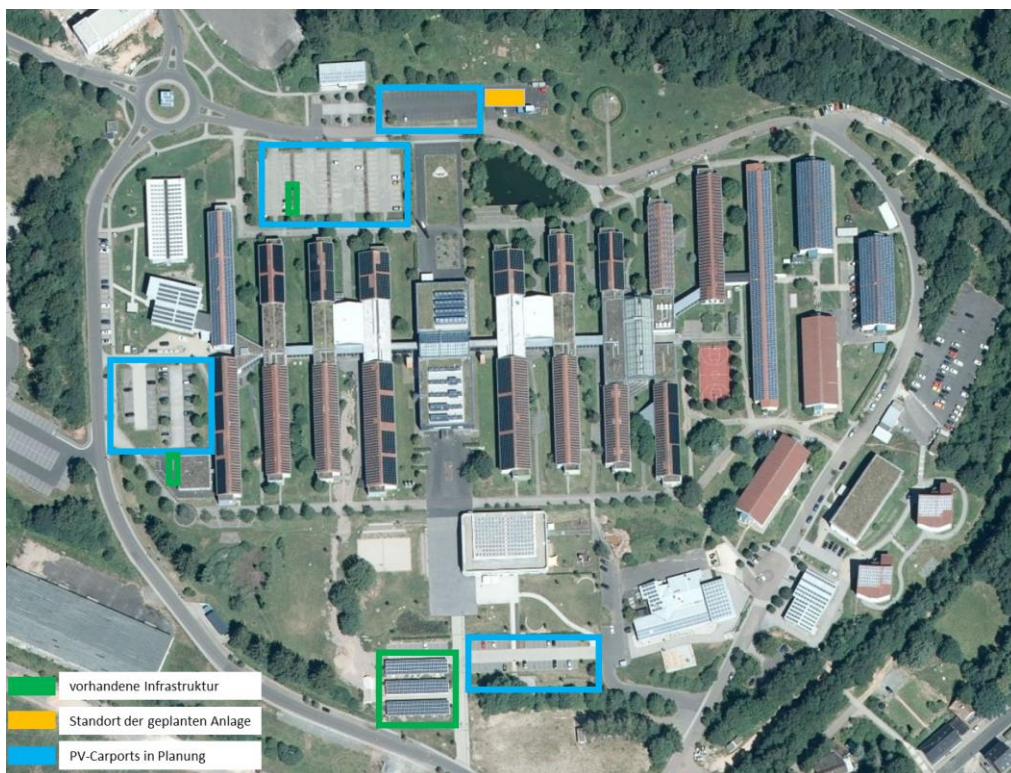


■ Products:

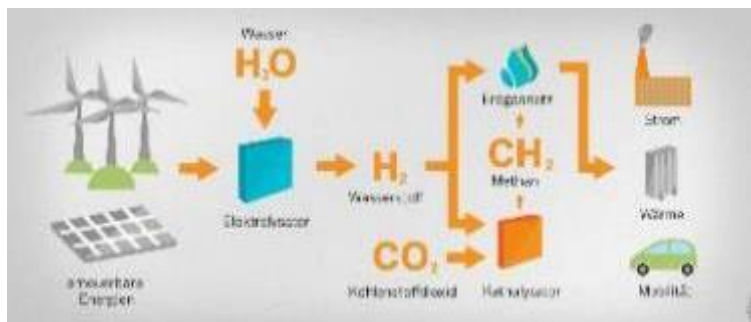
- e.g. Berliner Pflanze®
- 0,5 kg 2.50 EUR
- 2 kg 4,00 EUR
- 5 kg 10,00 EUR



One more thing...Hydrogen is our next UCB-project



- Investment of approx. 4.6 Mio. EUR
- Extension of PV-car parks to 850kWp and battery storage to 650kWh
- Installation of electrolyser, fuel cell and H₂-filling station
- RE peak load saving and sustainable commuting initiative
- Hydrogen competence centre and export knowledge (to India)



One team but plenty of visions...



- University of Applied Sciences Trier
- Non-Profit Institute
- 5 Mill Euro turnover/a
- Foundation in 2001
- 9 Professors & 80 Employees
- Interdisciplinary Team
 - Ecological Economics
 - Mechanical & Electrical Engineering
 - Policy Science
 - Spatial Planning
 - Agriculture & Forestry Engineering
 - Environmental Law



- Industrial & regional MFM coaching
- **Circular Economy & Zero-Emission strategy design**
- Technical and economical feasibility studies and business plans
- Management support
 - Energy-, GHG-, Environment management
- **Education & Capacity development**

Material Flow Management,

*Saving **money** on energy and resources and ..
using it for adding value to our people!*

Zero Emission

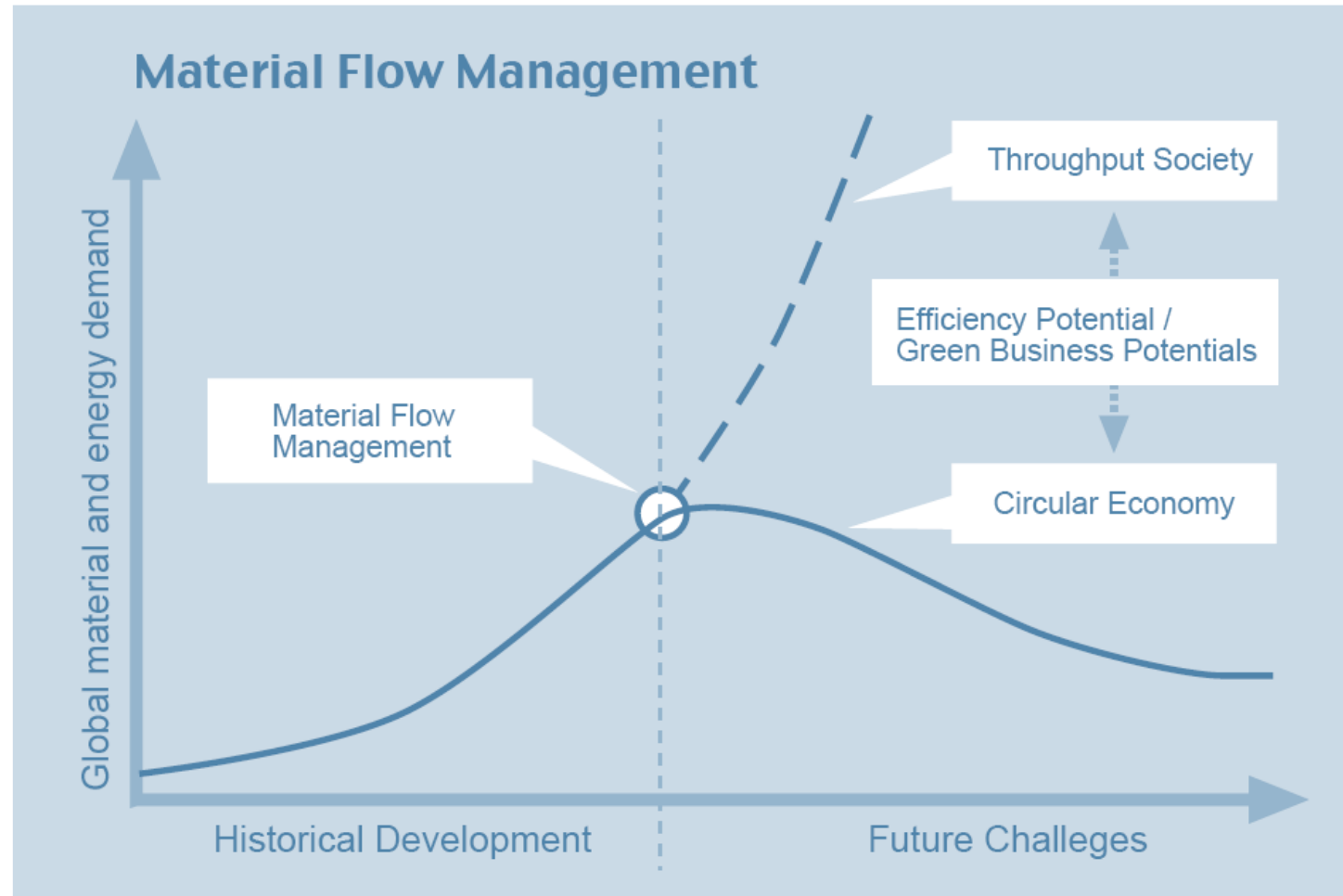
Adding value by:

- Zero Waste
- Zero Wastewater
- 100 % Renewable Energies
- Participatory Finance
- Optimized material flows

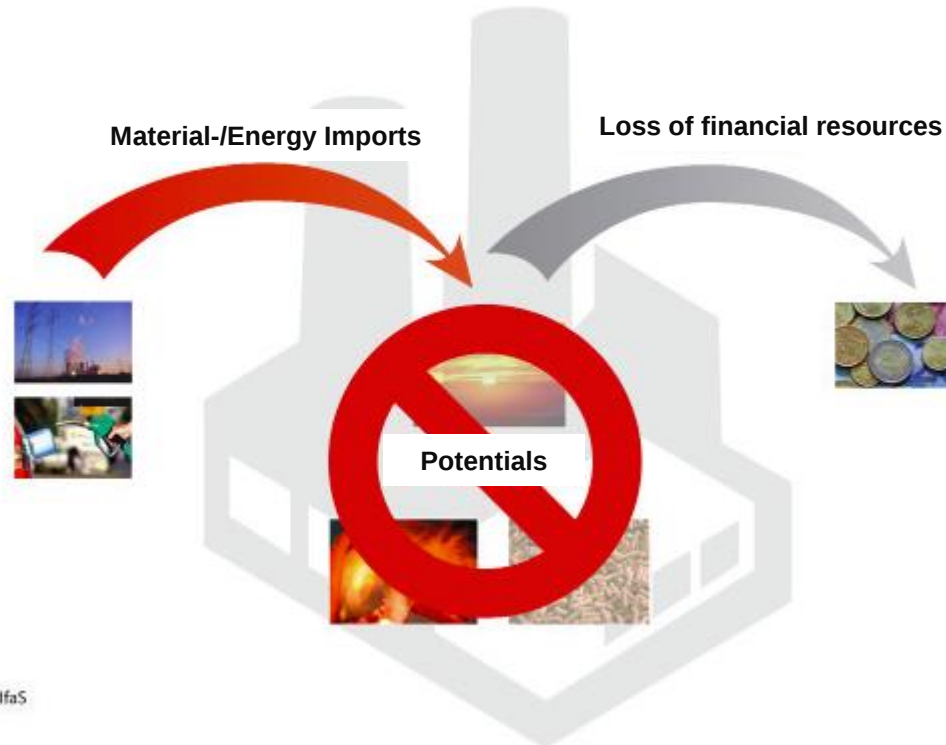


Circular Economy by Material Flow Management

Officially (but widely unknown) German policy since 1994

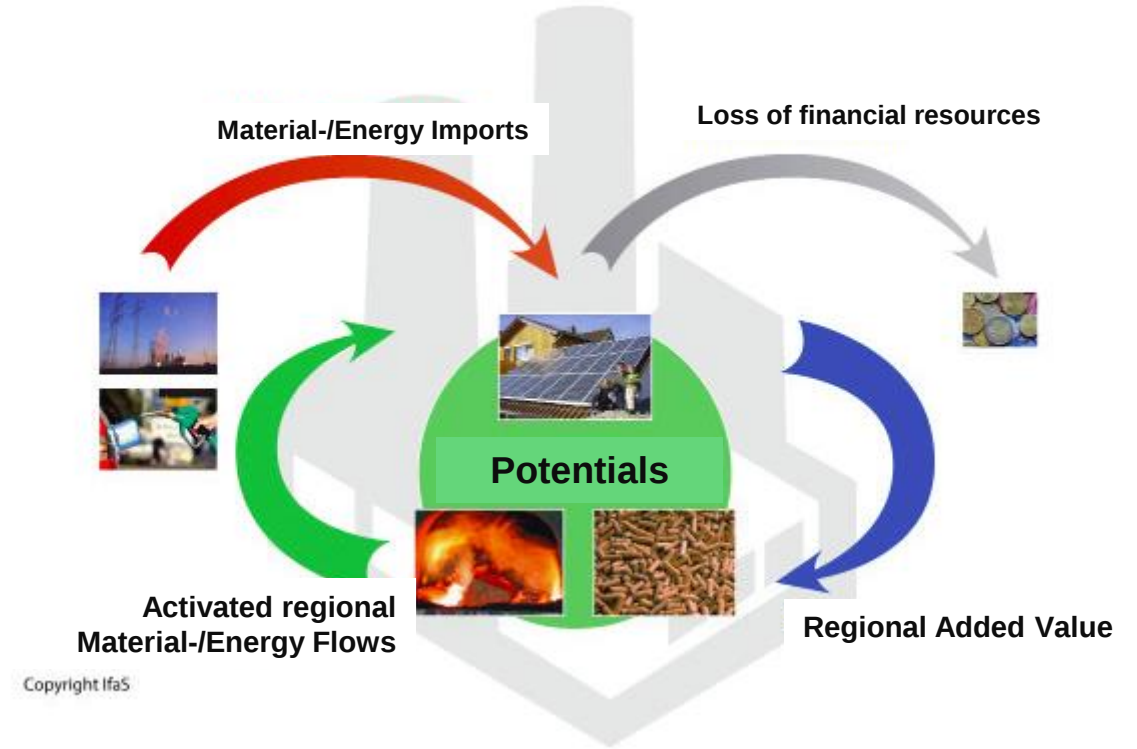


Nowadays “throughput society”



- Low CAPEX – High OPEX
- Negative Environmental impact

Vision and Goal – Zero Emission!



- High CAPEX but improved Project-IRR
- Environmental Protection and Regional Added Value, Green Investment

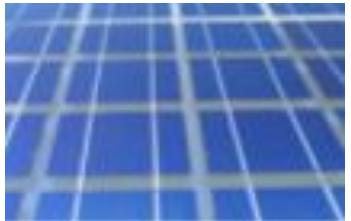
MFM Key Material Flow Potentials in Regions



Foto: H.-G. Oed



Foto: IfaS



- Water/Wastewater,
- Municipal Solid Waste
- Sewage Sludge
- Fossil End energy (electricity, heat, cold, mobility)
- Renewable Energies,
- (all sorts of) Biomass (residues)
- Buildings and Infrastructure
- Waste Fats and Oils
- Traffic and Mobility
- Special aspects like e. g. tourism
- etc.....

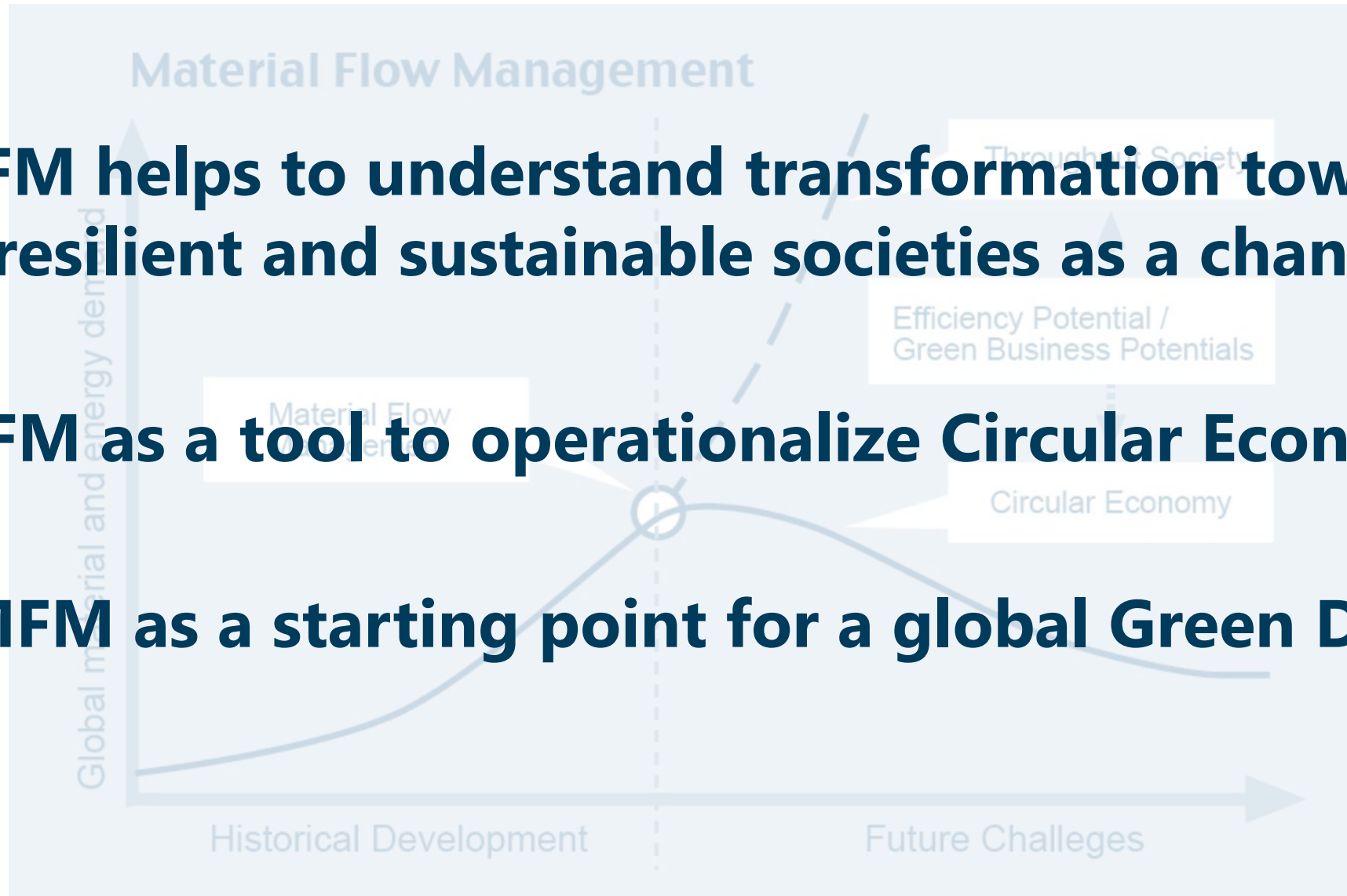
Regional Potentials



MFM helps to understand transformation towards resilient and sustainable societies as a chance

MFM as a tool to operationalize Circular Economy

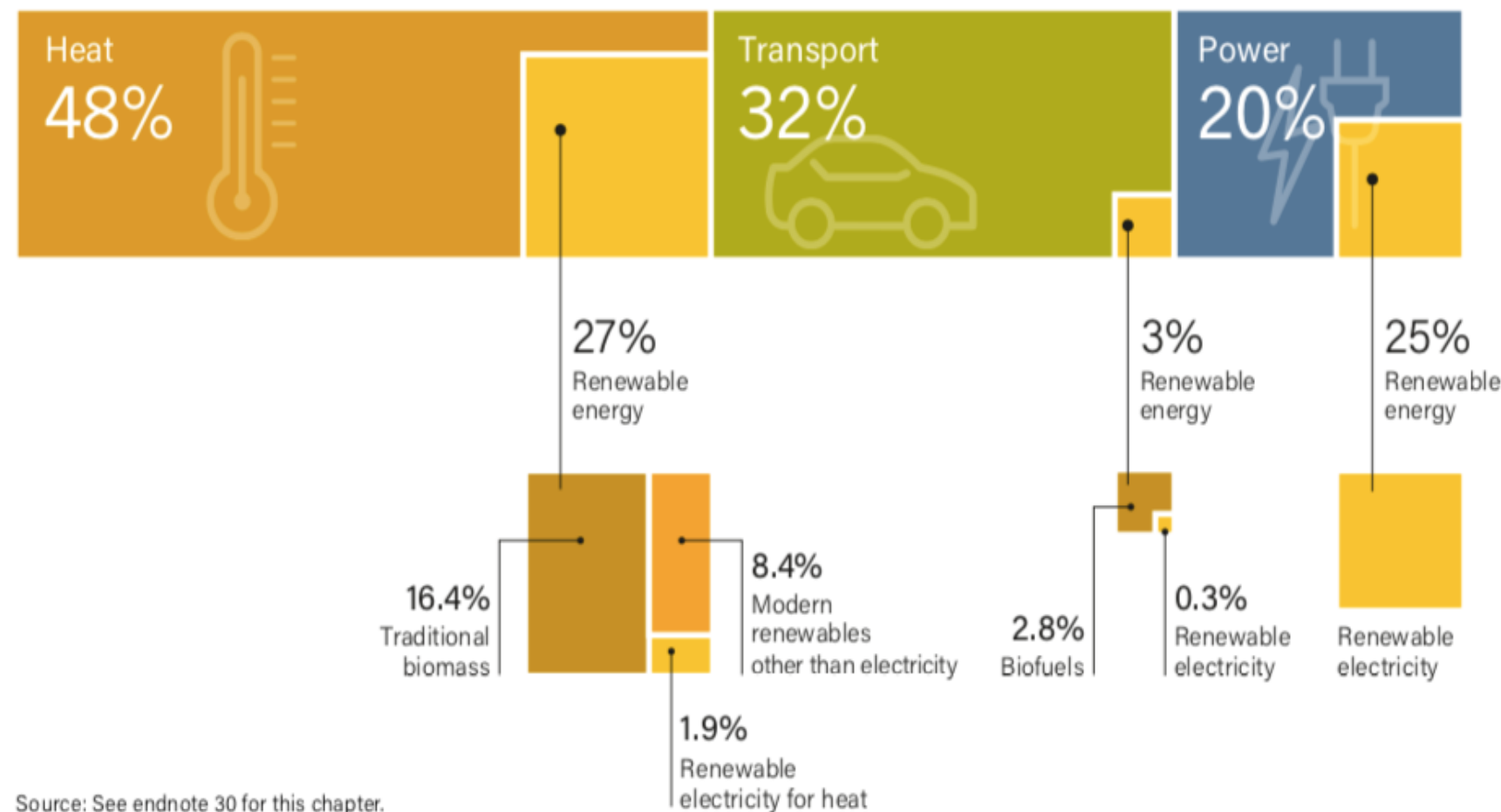
MFM as a starting point for a global Green Deal



Renewables at the core of the solution!

- Energy efficient housing with heat pumps and solar cooling
- New e-mobility concepts
- 100% RE electricity supply and storage
- **Technology is available, mature and economically interesting!**

FIGURE 3. Renewable Energy in Total Final Energy Consumption, by Sector, 2015



Source: See endnote 30 for this chapter.

When you are poor... you should invest in your potentials

**Annual Energy Import and Loss
of Purchas Power in the County
District: approx. 290 Million €**

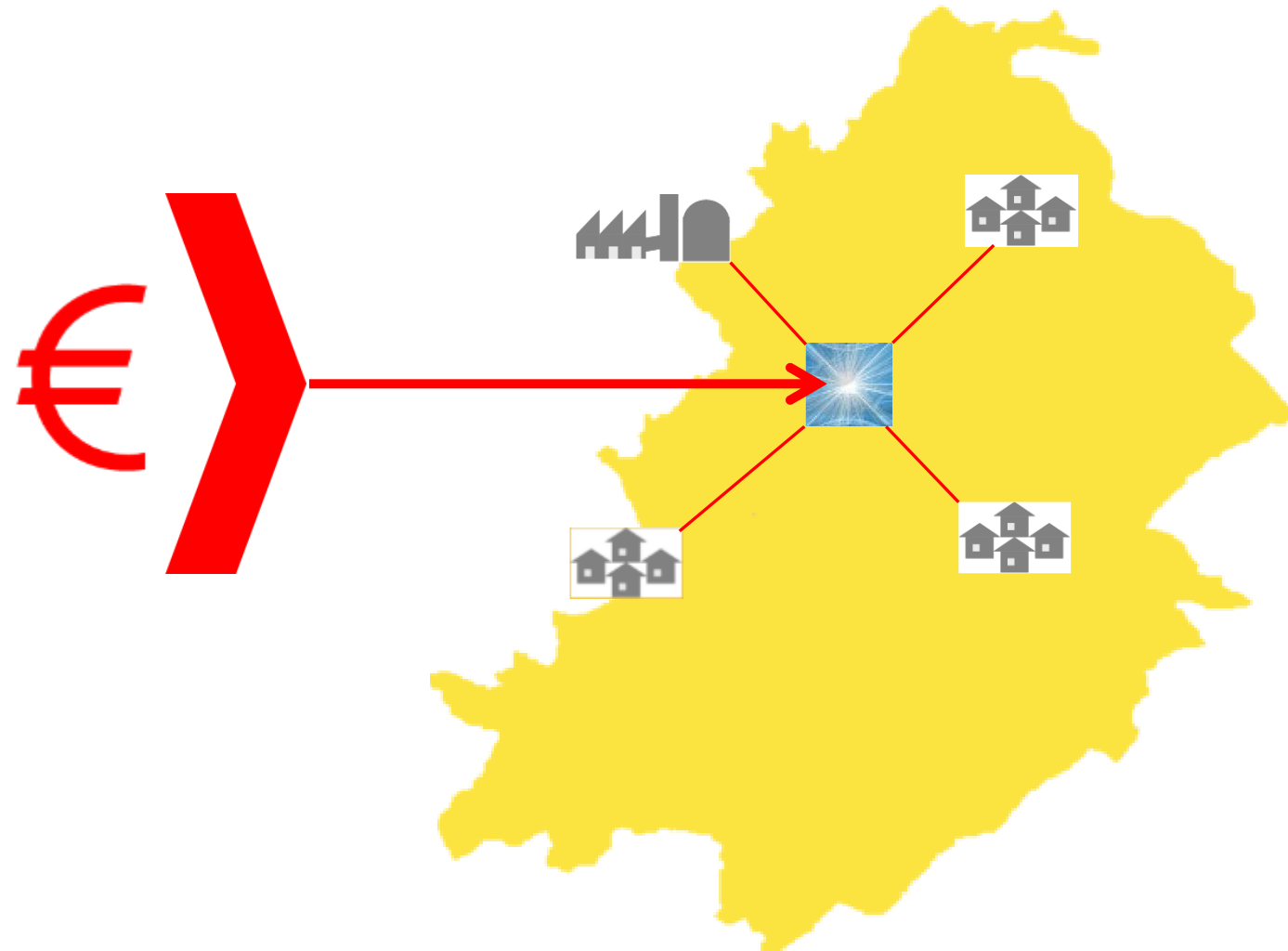


Total expenditure on
energy imports in the
Federal Republic of
Germany in **2011:**
87 Mrd. €
23% more than 2010

Objective of Zero Emission:

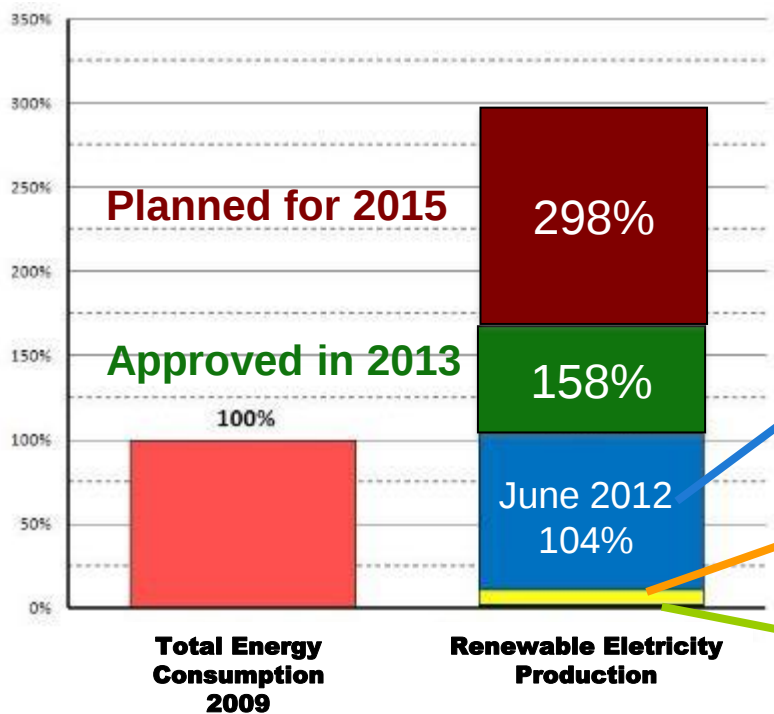
Through improvements in energy efficiency and introduction of renewable energies we convert energy import costs into regional jobs and value added!

Seed money needed to incubate added value



Darstellung EE-Symbol: © guukaa

Total electricity demand
473 Million kWh in 2009



Hydropower
Ø national 3,3 %



from 2010: Pilot project in the river Rhein close to St. Goar

Wind Energy
June 2012: **93,59 %**
Ø national 7,5 %



Photovoltaics
June 2012: **9,01 %**
Ø national 4,0 %



Biomass
June 2012: **1,86 %**
Ø national 5,5 %



149 turbines

2.404 plants

14 plants

Rural Districts as Energy Exporter for Urban Areas!

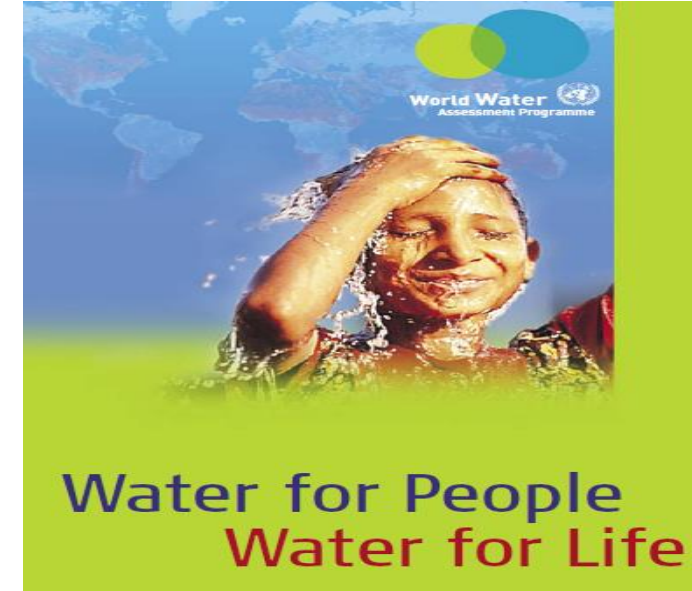




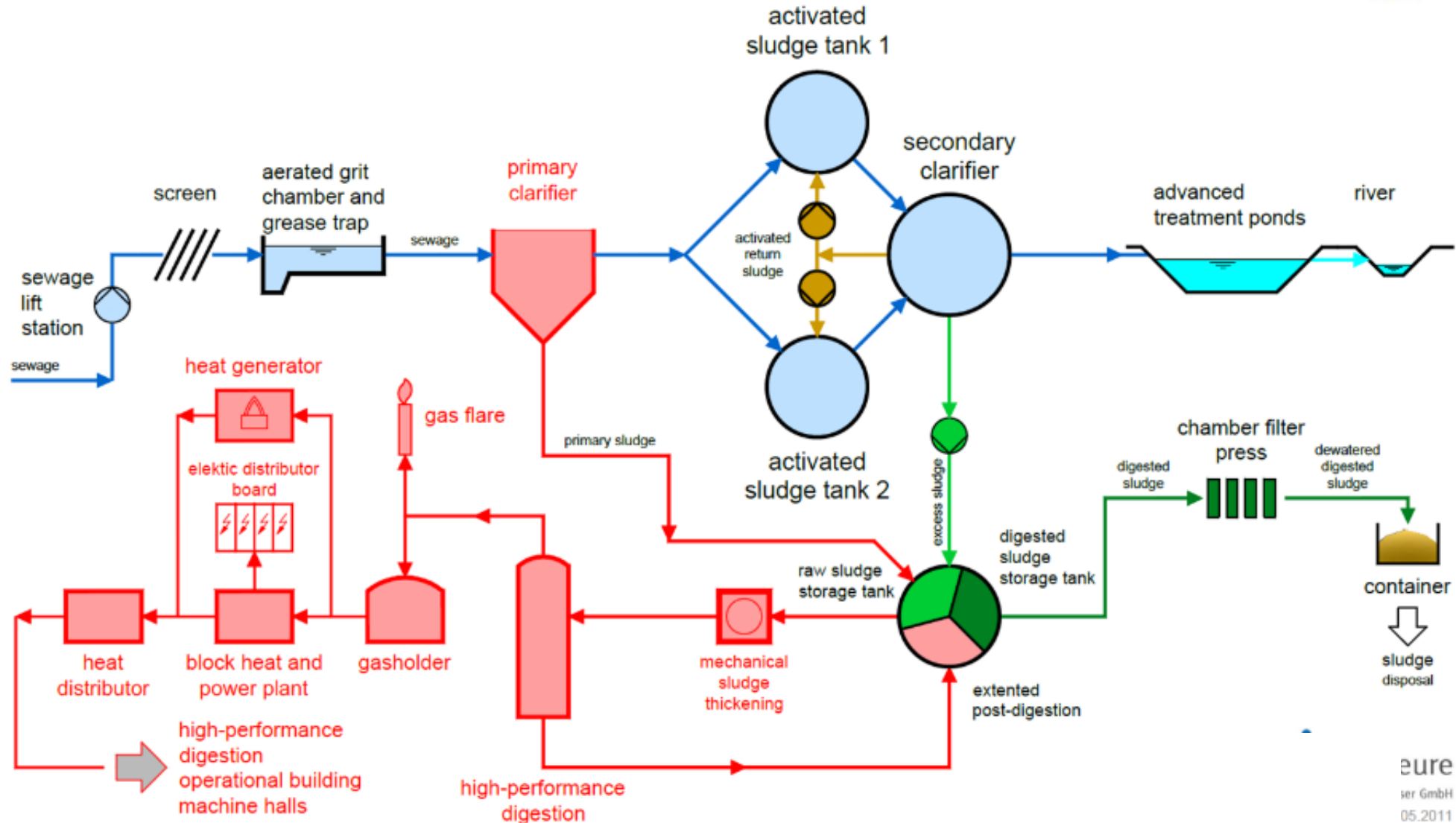
- Intelligent new wastewater treatment designs with minimised capacity (and investment)
- Optimisation of existing WWT structures
 - Energy efficiency and energy “autarky” of existing WWTP by anaerobic digestion of raw WW/sewage sludge
 - Re-use of pre-treated water for irrigation (semi and arid area)
 - Production of fertilizer substitute by digestate



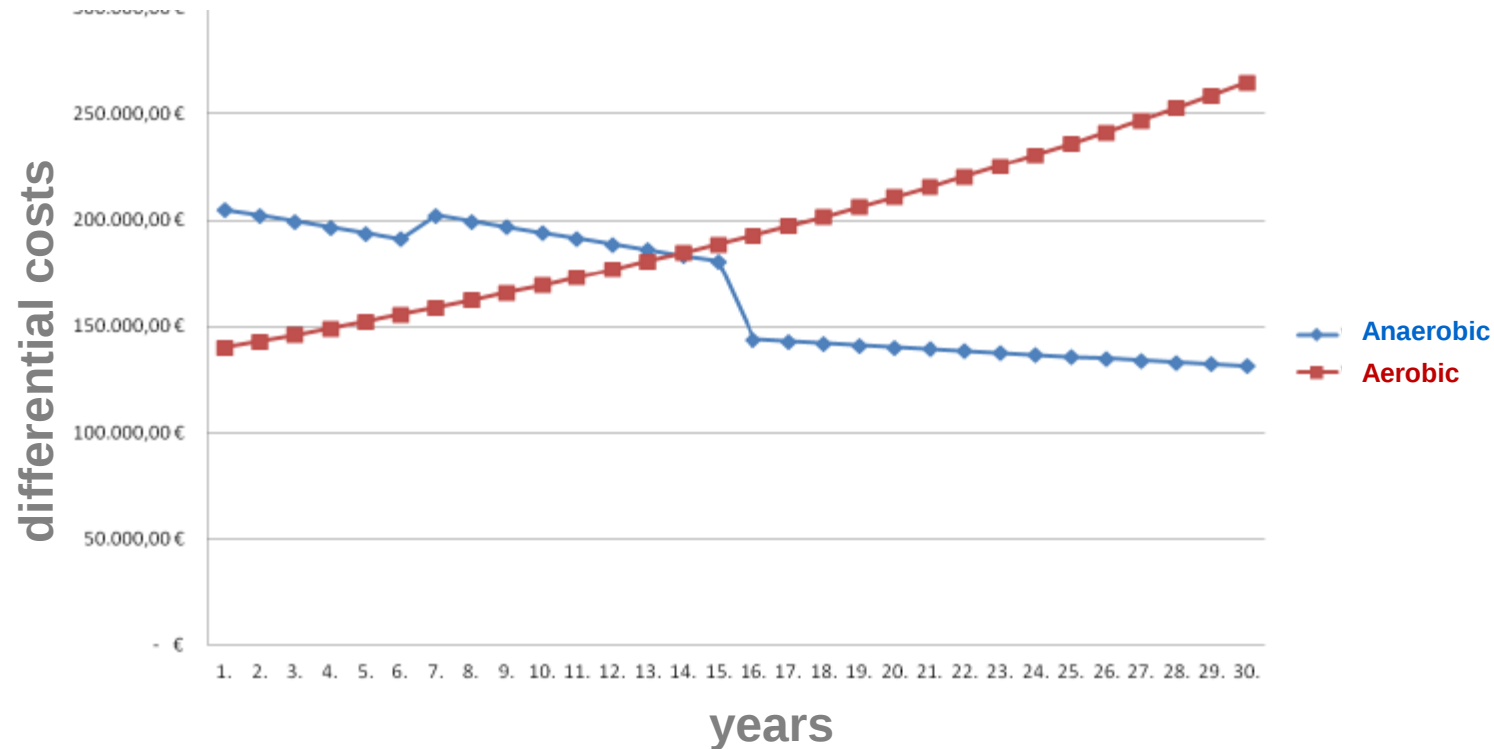
Sewage sludge drying by Thermo-System



Energy positive WWTP



Aerobic versus Anaerobic sludge stabilization



Source: Dipl.-Ing. Stefan Krieger, HYDRO-Ingenieure Energie & Wasser GmbH, 2011

Throughput economy vs. Circular Economy



Energy from non-renewable/finite resources



Energy from renewable resources

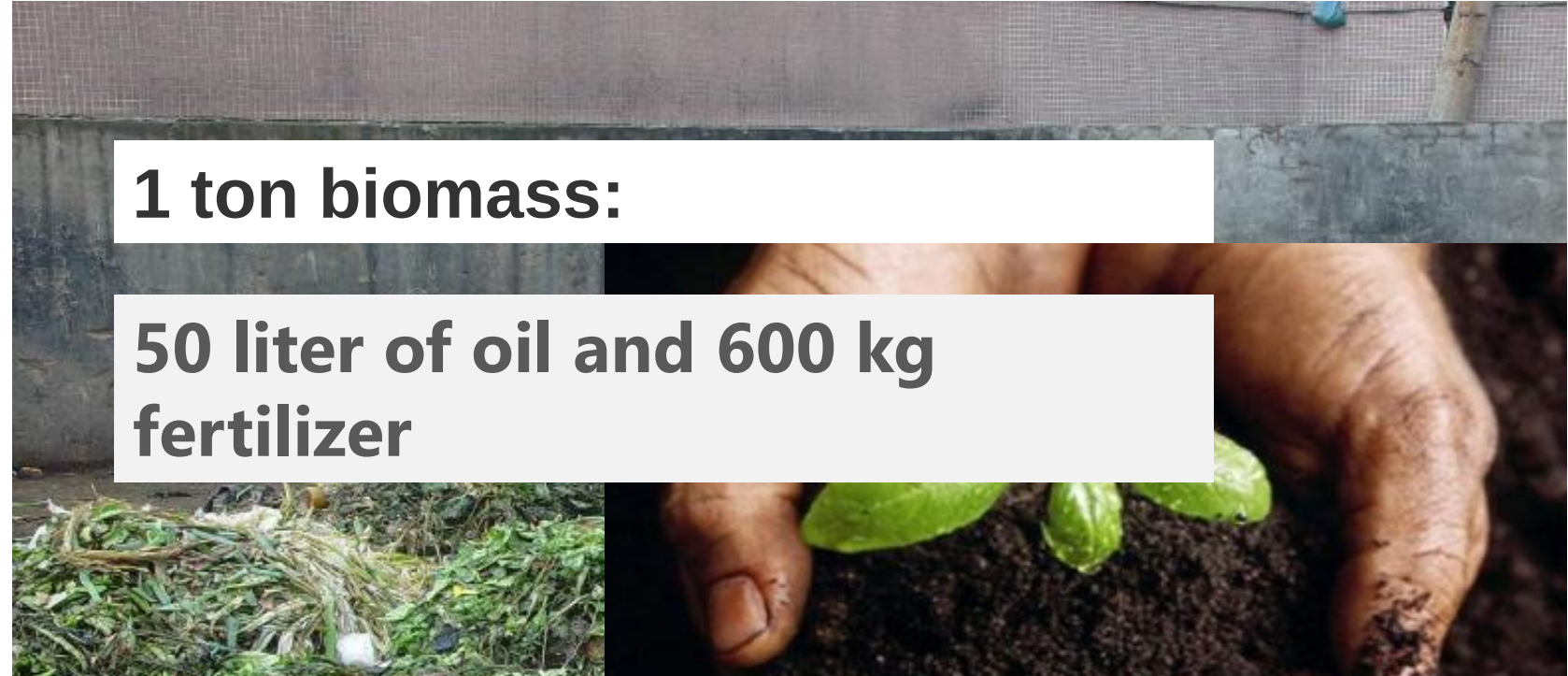
Towards Circularity

Source: <https://twosidesna.org/US/paper-and-the-circular-economy/>. Accessed April 10, 2019



- Understand the system
- Review data provided
- Mapping and sampling
- Pricing the unprized
- Comparison to BAT
- Listen to weak signals

➡ Communicate!



1 ton biomass:

**50 liter of oil and 600 kg
fertilizer**

Or Waste

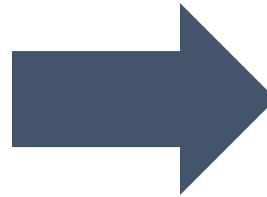
From linear to circular...



Landfills



Landfill Foz do Iguacu, Brazil. Source: Martínez, 2019



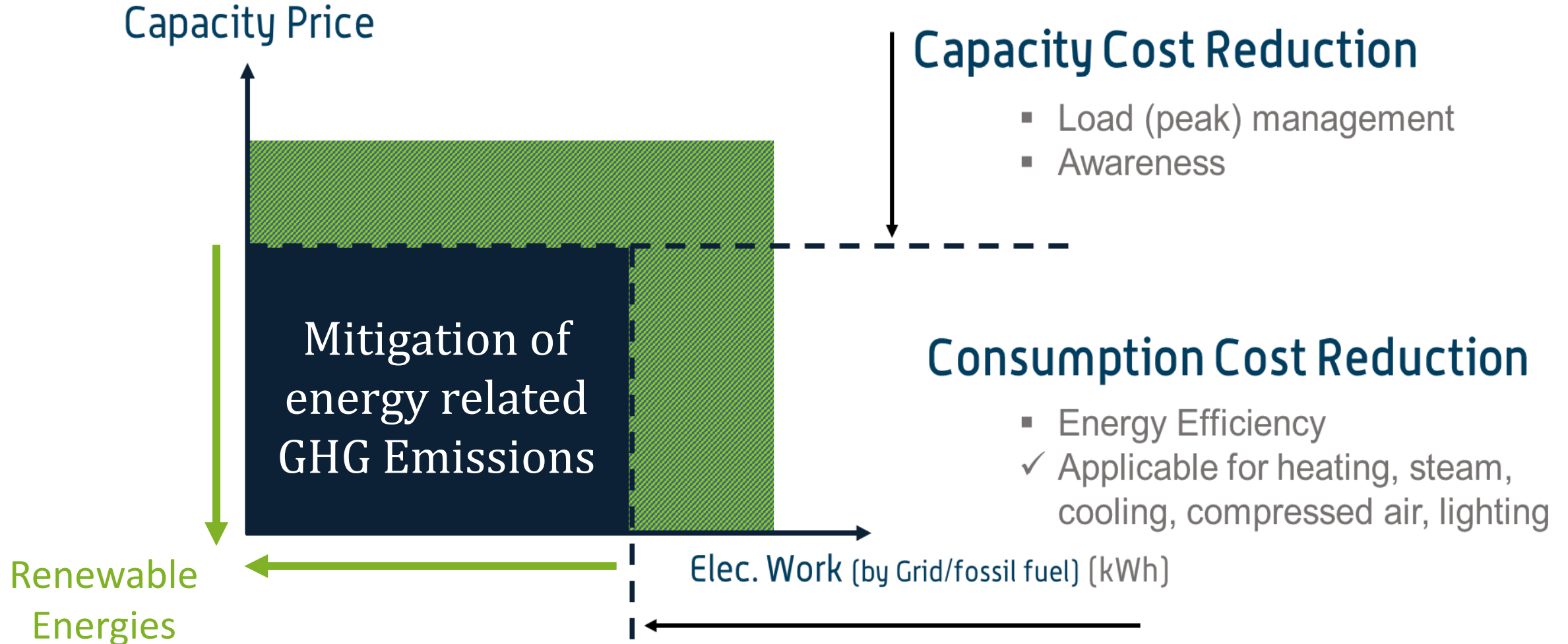
Resource Centers



Rhein-Hunsrück Entsorgung. Source: RHE, 2022

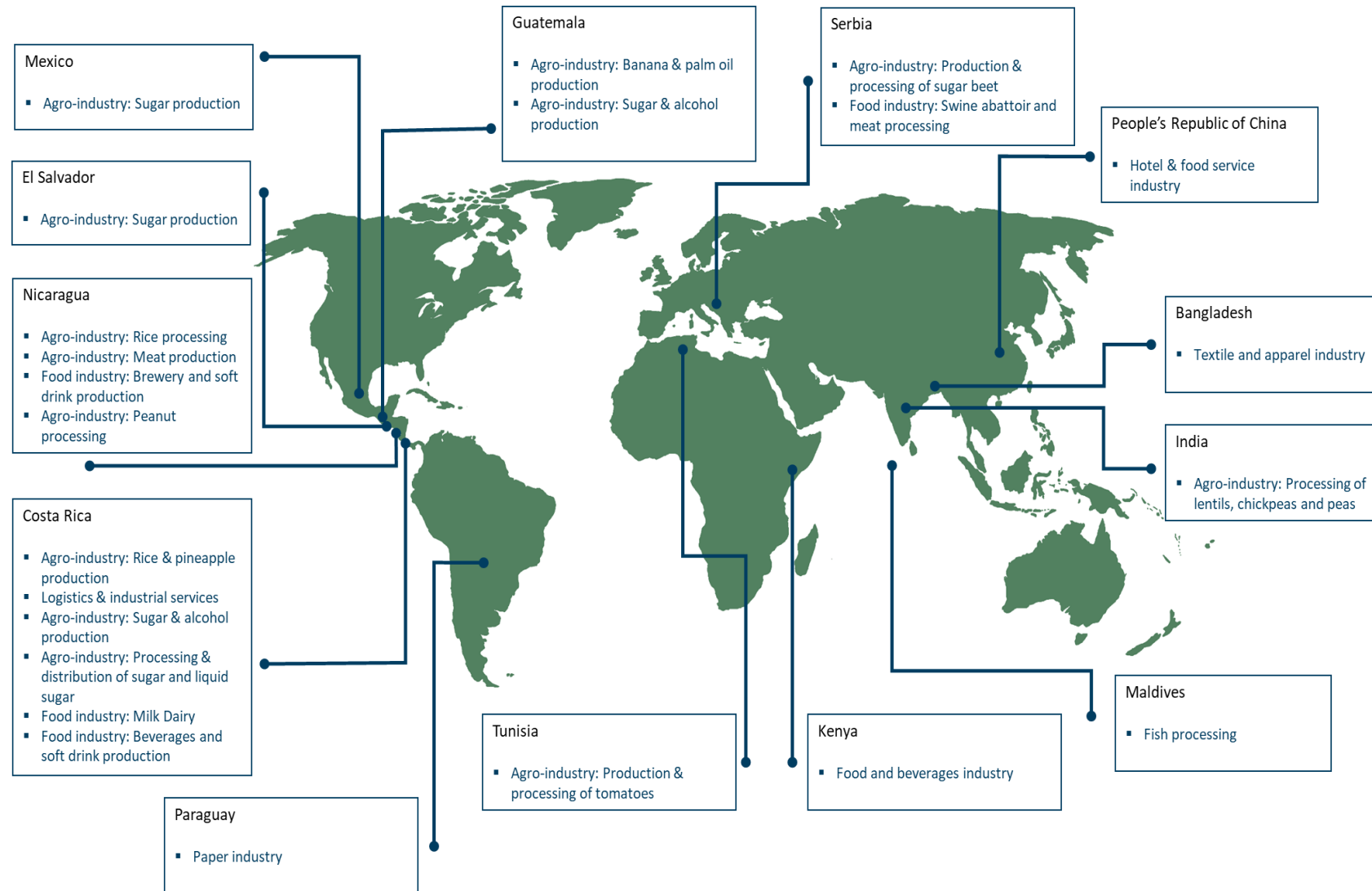
IfaS- International projects





REC- Resource and Energy Checks

8-years of Industrial Energy and Resource Efficiency Optimization



Accumulated Potentials

Renewable Energies 263,661 MWh

Energy savings 1,510,159 MWh

Cost savings 50,962 Mio. USD

GHG Mitigation 349,221 t CO₂eq.

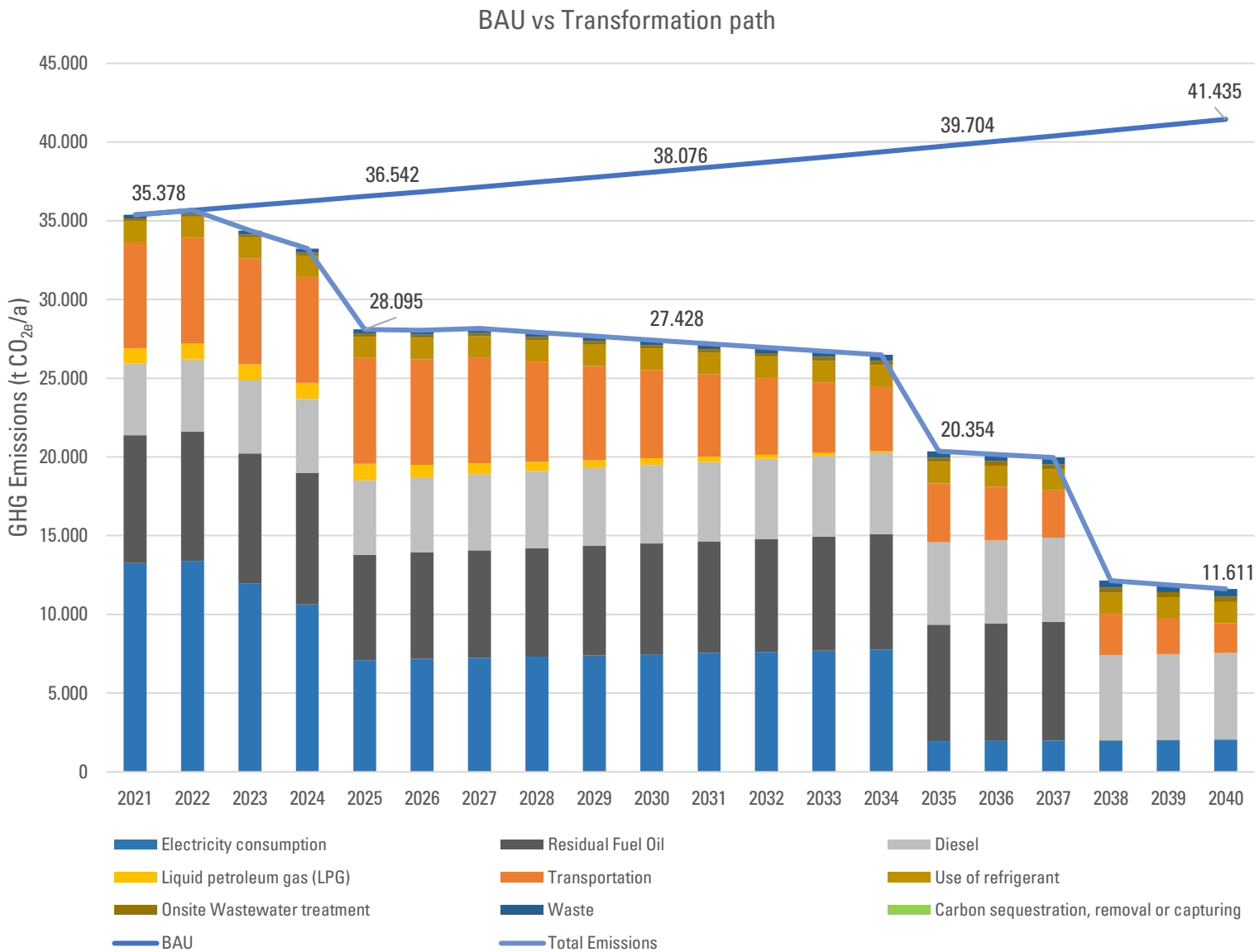
CAPEX 148,007 Mio. USD

Decarbonisation Pathway through Resource & Energy Efficiency

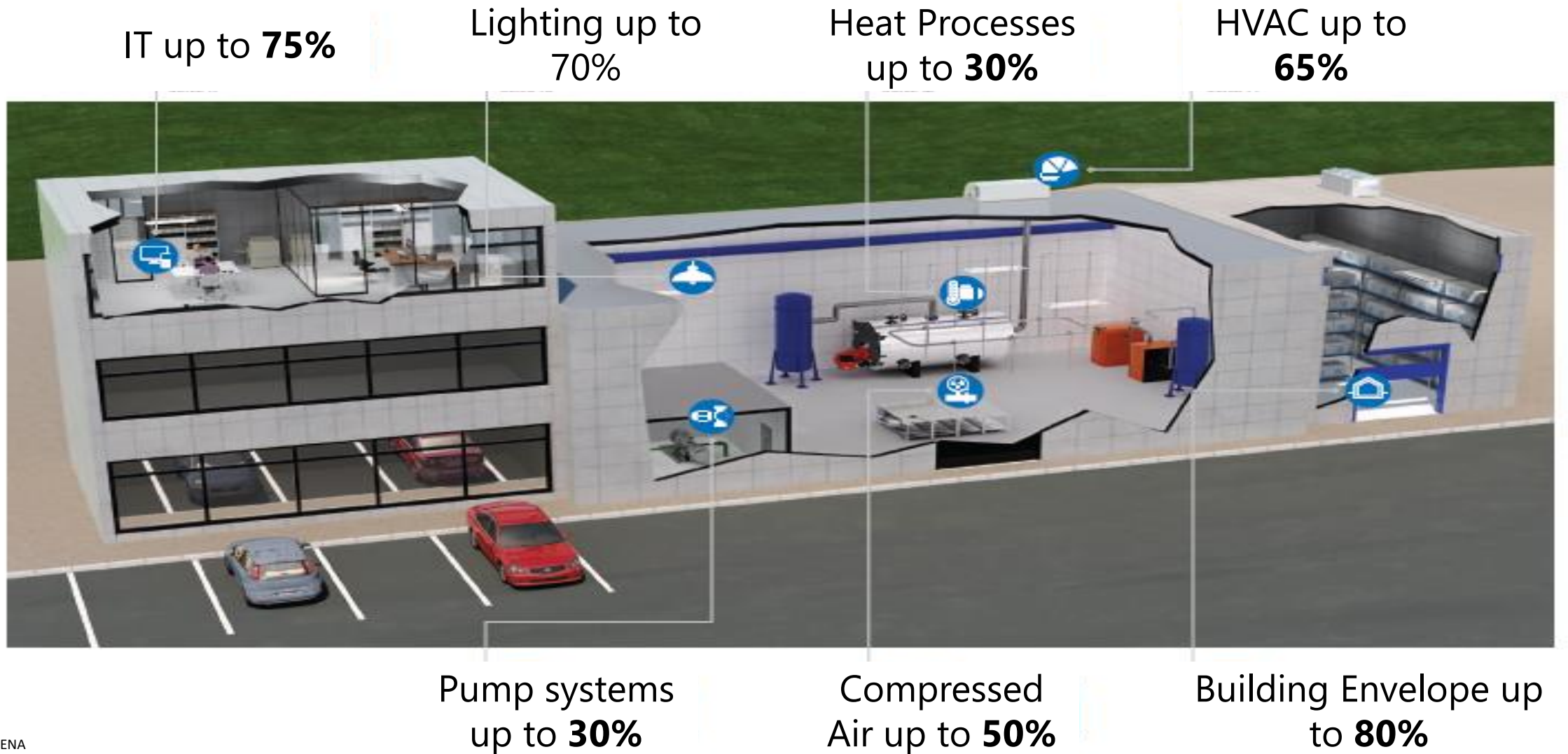
Transformation actions (Example of Brewery)		
Year(s)	Action/ Improvement	Savings (%)
2023 - 2025	Motor and Pump efficiency	10% annual savings
2023 - 2025	Improved Illumination	2.55% Over three years
2025	1 MWp PV system	10% Solar fraction
2025	1.5 MW Biogas (1,500 hours full load operation)	14.2% RE supply
2025	Reduce HFO use for Stem	20% from rapid stem generation
2025	Rapid steam generation	-2% from electricity
2026	LPG savings due to E - Forklifts	25% Savings in 2026
2026 - 2035	LPG savings due to E - Forklifts	100% over 9 years (LPG ZERO)
2028 - 2040	Fuel savings in Transport	70% Over 12 years time
2035	10 MW Wind and PV	75% of Grid electricity
2038	HFO Zero – By green H ₂	100% HFO consumption

Assumptions: Increase of electricity consumption for E-Forklifts will be covered through RE. Load balance, Demand-side-response and Batteries

Potenziale erkennen - Prozesse optimieren - Mehrwert schaffen

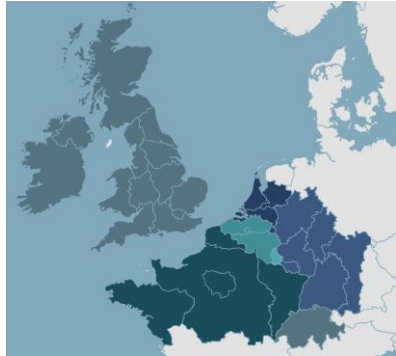


Examples: Energy efficiency potentials



Source: DENA

TRANSFORMing single use plastic and creating a CE-business model



Interreg 
North-West Europe
TRANSFORM-CE
European Regional Development Fund

EU FUNDING
€ 5.96 m

TOTAL BUDGET
€ 9.6 m

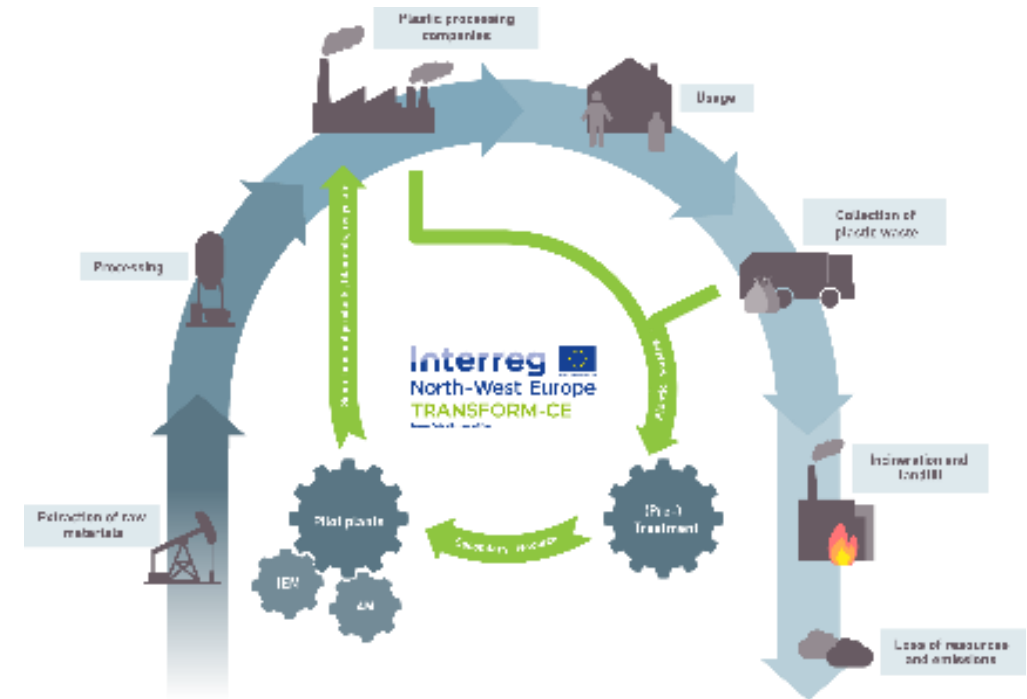
TIMELINE
2019-2023

COUNTRIES
UK, BE, NL, DE

Closing the loop and increasing resource efficiency of plastics!

Using polyolefin plastic waste in intrusion-extrusion moulding and additive manufacturing

- Construction of two pilot plants
- Technical specifications to ensure market uptake of recyclates and filament
- Circular economy models along the value chain



<https://www.nweurope.eu/projects/project-search/transform-ce-transforming-single-use-plastic-waste-into-additive-manufacturing-and-intrusion-extrusion-moulding-feedstocks-and-creating-a-new-circular-economy-model-for-nwe/>

Recycling Rampe 4.0



- Analysis of requirements for circular economy the existing system
- Striving for higher quality recycling for a mixed plastic fraction (approx. 4,500 t / a)
- Evaluation of strategies and (technical) possibilities for the waste treatment
- Evaluation of technical possibilities for sorting and processing of selected plastic fractions
- Testing and evaluation of the results of plastic sorting in pilot plants (air sifting, NIR sorting)



Source: Tomra Sorting GmbH, 2022

ROYAUME DU MAROC



Ministère de l'Énergie, des Mines
et du Développement Durable



- Part of the Support Program for the Reform of the Energy Sector in Morocco financed by the European Union.
- **Objectives of the study:**
 - Development and implementation of a strategic valorization of biomass on an industrial scale.
 - Diagnosis of the biomass energy sector in the agriculture, forestry and waste sectors.
 - Proposal for a national strategy for biomass energy recovery and prospective scenarios.
- **Project Partners:**
 - IfaS – Institute for Applied Material Flow Management
 - Jacobs Engineering SA - Team Maroc

Technical Potential

■ 6,6 Mio. MWh/a from the Agricultural sector

- Cattle farming: 2,8 Mio. MWh/a
- Arboriculture: 2,2 Mio. MWh/a
- Aviculture : 1,0 Mio. MWh/a

■ 3,5 Mio. MWh/a from the Forestry sector

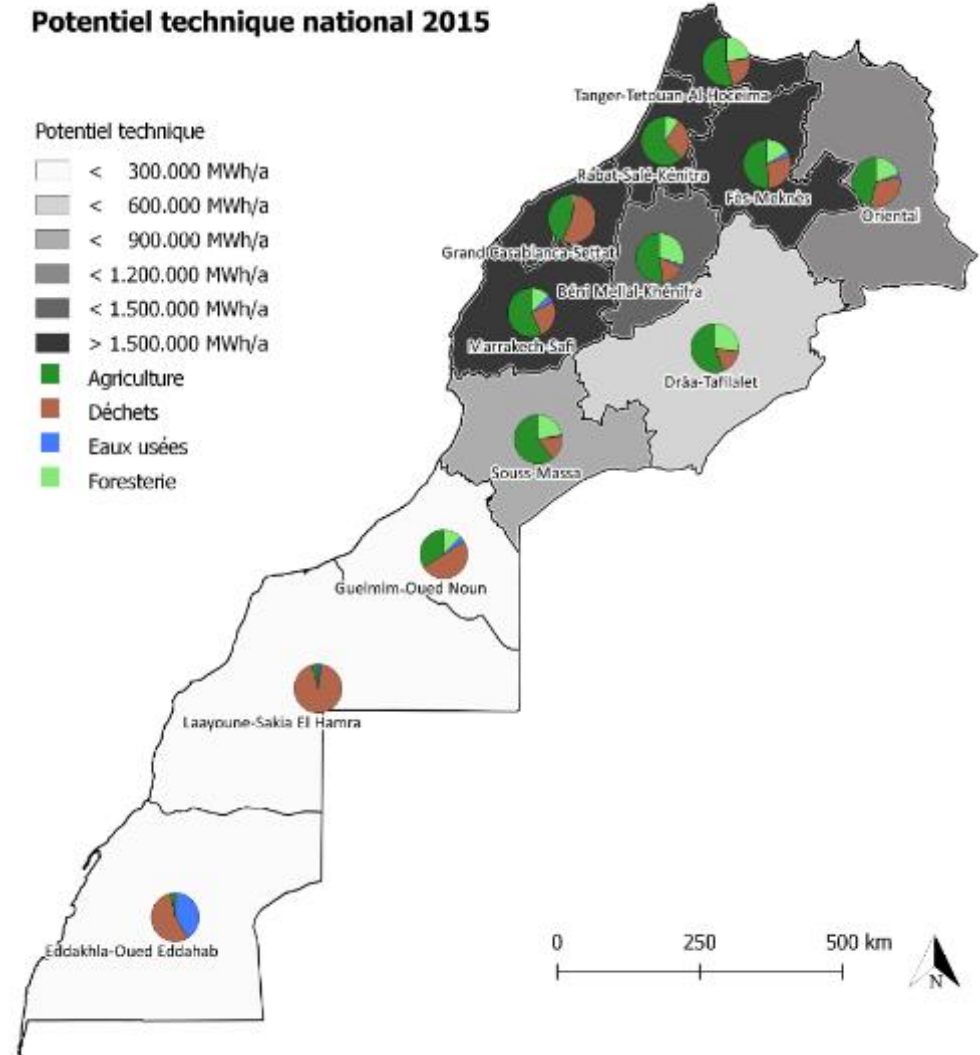
- Natural Growth : 2,6 Mio. MWh/a
- Reforestation : 1,8 Mio. MWh/a
- Industrial Wood: 0,9 Mio. MWh/a

■ 3,0 Mio. MWh/a from the Waste sectors

- Municipal Solid Waste : 1,8 Mio. MWh/a
- Industrial Agrobusiness : 0,7 Mio. MWh/a
- Greenery Waste : 0,5 Mio. MWh/a

■ 0,2 Mio. MWh/a from Waste Water

- Incineration : 0,1 Mio. MWh/a
- Digestion : 0,09 Mio. MWh/a.



Local Sustainable Energy Systems in Senegal



Applied Research Project funded by the Federal Ministry for Research and Education:
CLIENT II – International Partnerships for sustainable innovations

Funding: 1,9 Mio €

Objectives:

- Development and implementation of a strategic cooperation in the sector of sustainable energy systems between Germany and Senegal.
- Exchange of applied technical knowledge and technology transfer as a national strategy support in energy efficiency and renewable energy sectors.

Model Regions in Senegal:

- City of Saint Louis (210.000)
- Commune of Balinghor in the region of Ziguinchor (3.000)

Project Duration: 01.04.2019 to 31.03.2022 (36 months)

www.bmbf-client.de/projekte/losens



Potenziale erkennen - Prozesse optimieren - Mehrwert schaffen



www.stoffstrom.org



© Institut für angewandtes Stoffstrommanagement (IfaS)

Municipal Partnerships for Sustainability. Senegal and Germany

Balinghore
500 Jobs Created
Energy Access
Sustainable Communal Farming

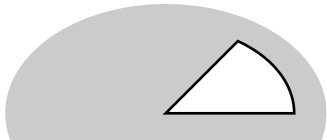


Nohfelden
ICEW 2019
Social Responsibility
Strategy Development

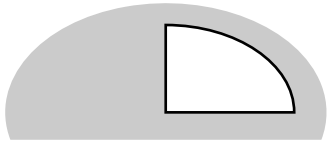




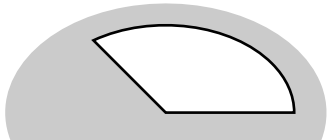
Field visits and cultural exchange



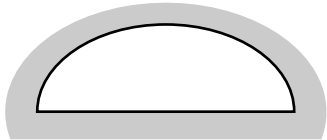
Working together towards a sustainability strategy



Value Creation oriented project development



Fundraising & Implementation



ENGAGEMENT
GLOBAL

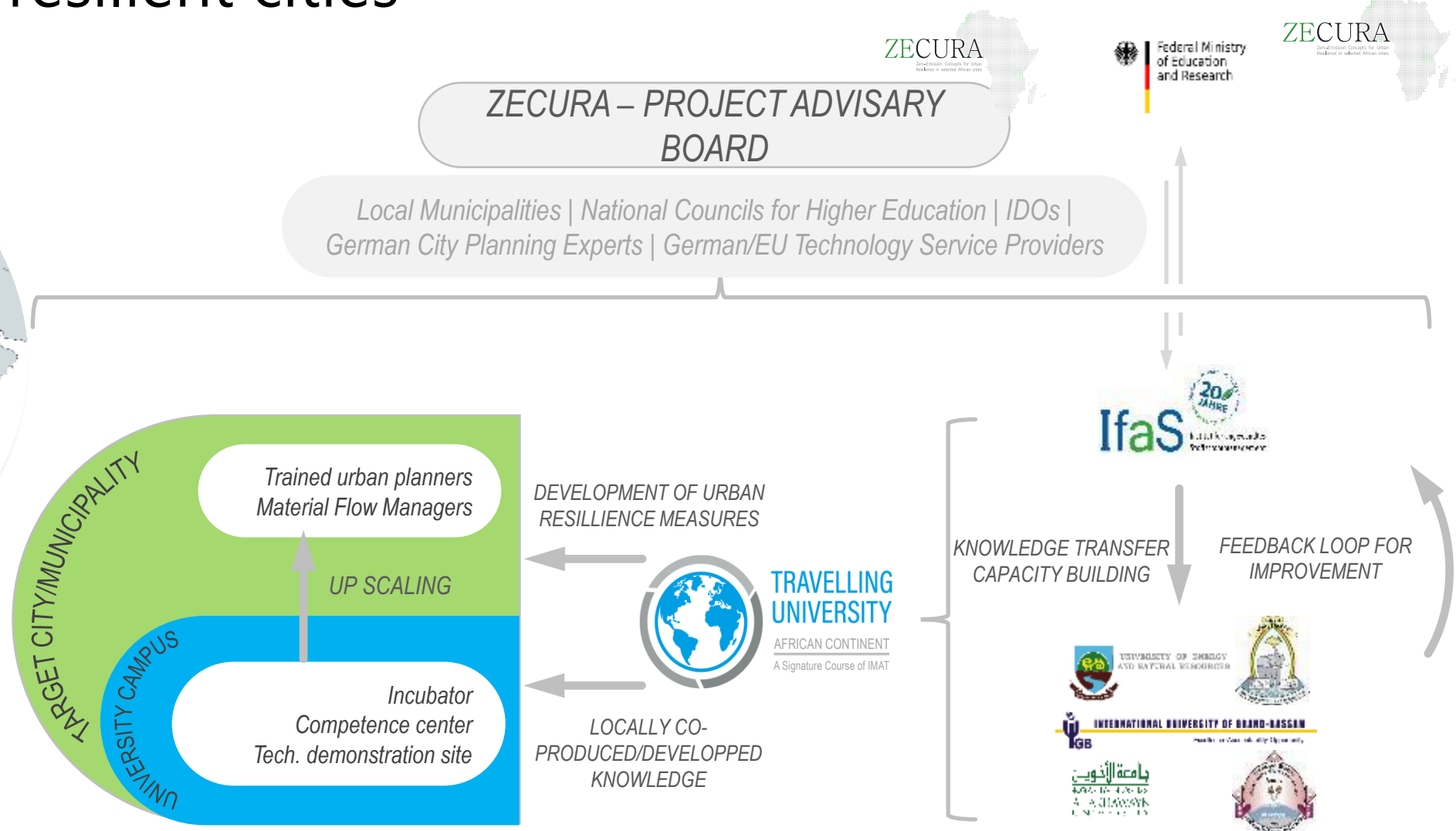
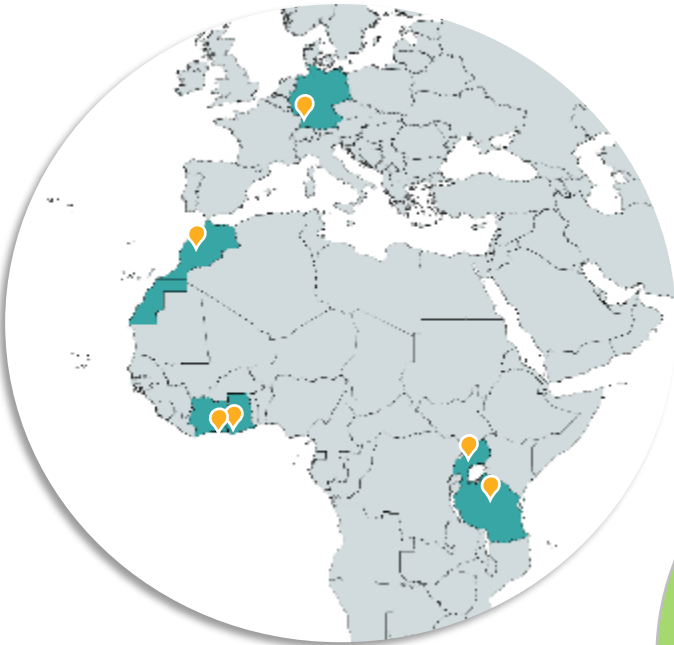
Service für Entwicklungsinitiativen



Zero Emission Concepts for Urban Resilience in selected African cities

Linking ZE-C to resilient cities

■ ZECURA



<https://zecura.info>

Technical Assistance in developing a Zero Carbon Pathway for DHG charcoal products in Namibia (1)

Project Description

Project Target:

- Analysis of the carbon footprint of DHG's charcoal products from Namibia
- Identification of improvement options and associated definition of a carbon-free pathway

Project Partner:

- DHG Vertriebs- und Consultinggesellschaft
- Supplier of potting soil, bark mulch, wood fuel, charcoal and charcoal briquettes.

Funding & Region

Project Funding:

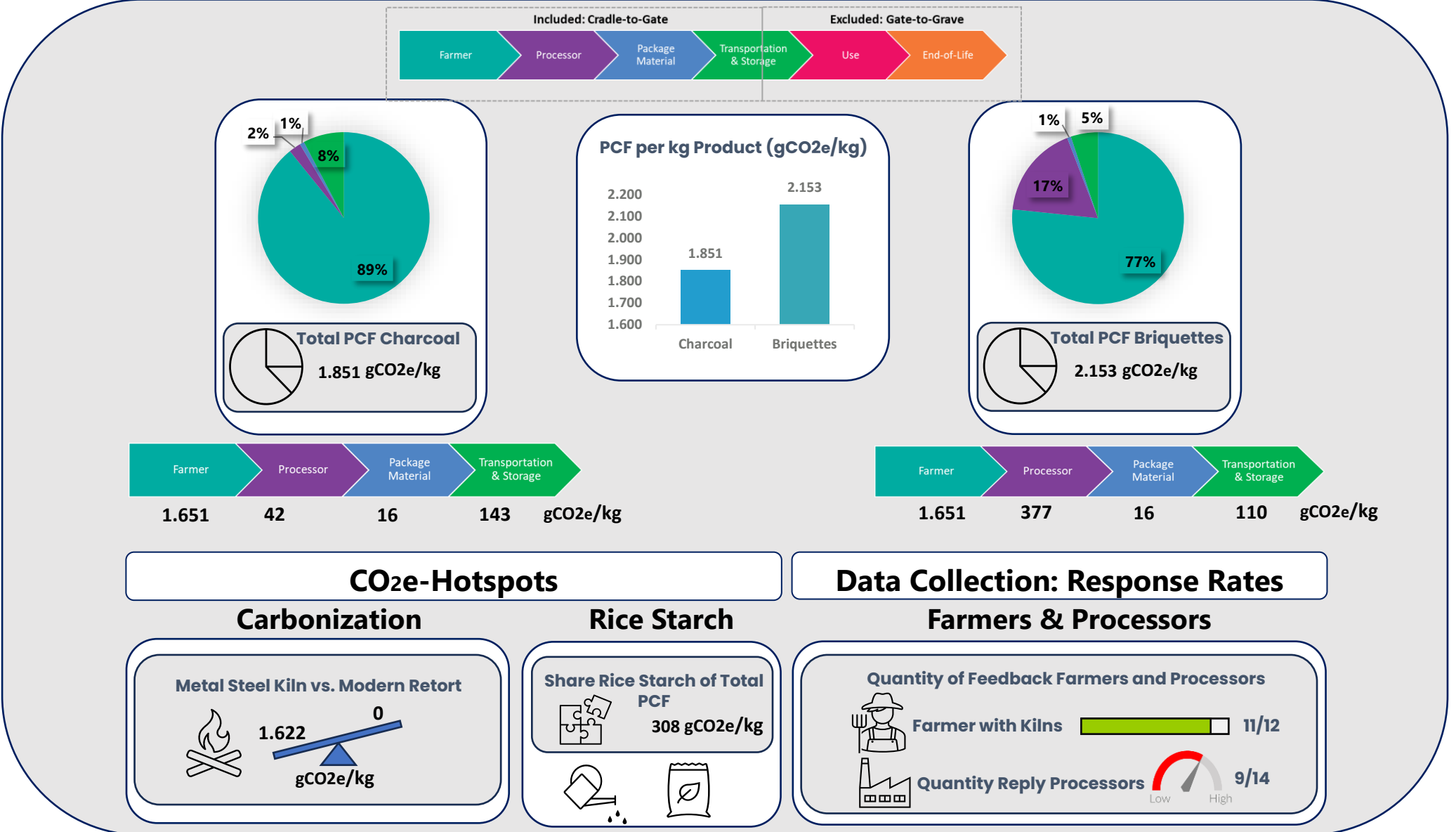
- Total Budget: 369,107 EUR
- Deutsche Investitions- und Entwicklungsgesellschaft (DEG)
- DHG

Project Region – Namibia:

- Present bush encroachment problem
- Charcoal production as a regional value-added factor

Further information on DHG at the ICEC at 2:00 pm

Technical Assistance in developing a Zero Carbon Pathway for DHG charcoal products in Namibia (2). Example: Dashboard – PCF-Analysis



ButoVal Project in Namibia

- Bush to Value (ButoVal)
- Funding volume: 1.865.040 EUR
- Project duration: 36 months (01.04.2023 – 31.03.2026)

Objectives:

- Retard, stop, and reverse the ongoing bush encroachment of savanna land in Namibia through socio-ecologically optimized measures combined with new multifunctional land use.
- Development of sustainable, efficient, and locally adapted biomass harvesting and processing methods for three different regions.
- Upscaling the existing bush-feed, fuel, and charcoal production.
- Joint development and implementation of a sustainable capacity building program within the framework of building a bioeconomy and research center with the help of Namibia University of Science and Technology (NUST).

SPONSORED BY THE



Federal Ministry
of Education
and Research



NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY



CLAAS



Development of Biomass Industrial Parks

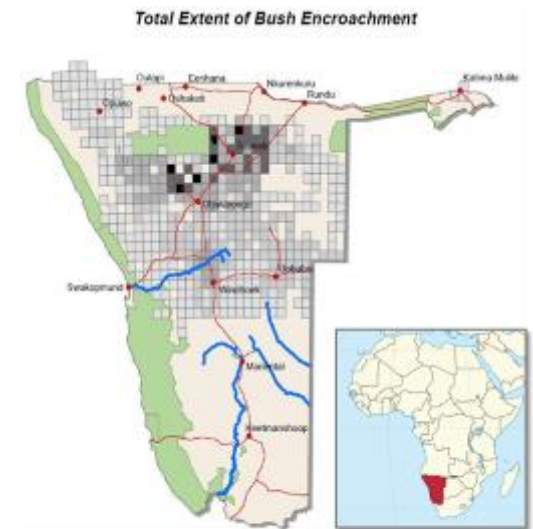
Problem

- >30-45 million ha of productive rangeland bush encroached at an annual growth rate of 3-5%
- Severe impact on biodiversity, groundwater recharge and livestock productivity
- Annual agronomic losses of 100 million EUR due to reduced rangeland productivity (2/3 of total productivity)



Opportunity

- >300-450 million tons of standing “unwanted” but valuable biomass with annual growth of 9-18 million tons
- Increasing demand on regional and international markets
- Socio-economic benefits: rangeland restoration, climate change adaptation, employment, energy supply and transition



"Bush Encroachment is a National Disaster"
Hon. Min. MAWE, National Rangeland Policy 2012



Development of Biomass Industrial Parks





1. Development of a workshop for government representatives for the development of a Circular Economy Strategy for the Province of Kasai Central (February 2022)
2. Development of a scoping mission for the analysis of the current municipal waste management in the City of Lubumbashi (September 2022)
3. Planning of a Circular economy strategy for the Province of Kasai Central (*in negotiation*)
4. Planning of a regional resource master plan for the Region Kananga in cooperation with the institute ISDR (*in negotiation*)



Impressions from waste and wastewater situation in Lubumbashi (IfaS, 2022)

Study tour on sustainable development and resource management



1. Technical site visits
2. Participation on the International Circular Economy Week
3. Workshop development on sustainable development
4. Networking with German Municipalities and Districts



For 15 Participants from: Cameroon, Congo, Ghana, Ivory Coast, Mali Tanzania and Uganda,,

24th to 28th October 2022



Sahara Renaissance Project (SAREP)

In a Nutshell: Greening the Desert for

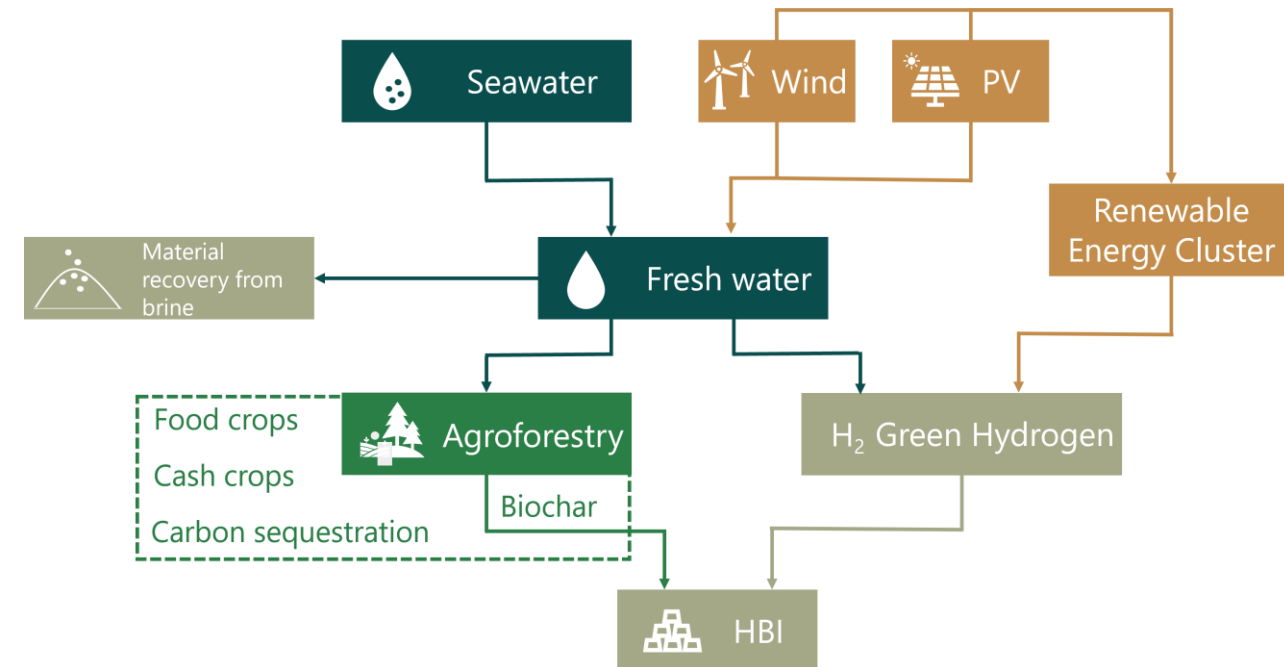
- Green Business Opportunities
- Climate Change Mitigation & Adaptation
- Regional Development & Migration Prevention
- Biomass Products for Industry

As a European Industry Initiative:

- SYNLIFT
- proGEO
- EGC Mauritania
- Jatropower
- KSB
- ...

First Step:

- 650 ha agroforestry system with respective desalination capacities
- Investment Volume: 60 Mio €



This area could be a **green** carbon storage and (bio)**oil** producing land!!

Storing up to 130 t CO₂/ha/year

Producing approx. 2,000-liter biofuel/ha/year

Producing up to 80 t dry matter woody biomass / year/ha

Generating 2000 jobs per 10.000 ha



Coast of Mauritania (2,000,000 ha)

Mauritania – Mali – Algeria – Niger – Chad -Sudan



Initial Area

Test plot 650 ha

Capacity Land [ha]	650
Capacity Water [m³/d]	20,000
Reverse Osmosis [€]	35,000,000
Energy [€]	10,000,000
Back-up (off-grid) [€]	5,000,000
Agriculture & Infrastructure [€]	4,225,000
Development Capital [€]	5,775,000
Total Capital Demand [€]	60,000,000
LCoW [€/m³]	0.7-0.8
IRR [%]	2.8
PBP [a]	18.1
NPV [€]	12,000,000

Long-Term Vision

1st stage of expansion 65,000 ha

Capacity Land [ha]	65,000
Capacity Water [m³/d]	2,000,000
Reverse Osmosis [€]	1,750,000,000
Energy [€]	500,000,000
Back-up (off-grid) [€]	250,000,000
Agriculture & Infrastructure [€]	422,500,000
Development Capital [€]	
Total Capital Demand [€]	2,922,500,000
LCoW [€/m³]	0.3-0.4
IRR [%]	11.9
PBP [a]	3.3
NPV [€]	2,270,000,000

International programs

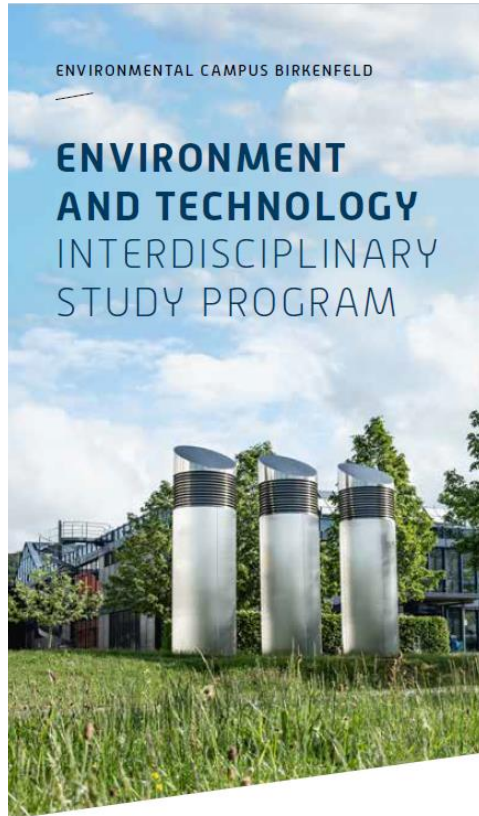


**One-semester-exchange semester
exploring sustainability in Germany**

**B.Eng “Sustainable Business and
Technology”**

**MSc./MEng in International Material
Flow Management**

International Study Programs for Sustainability



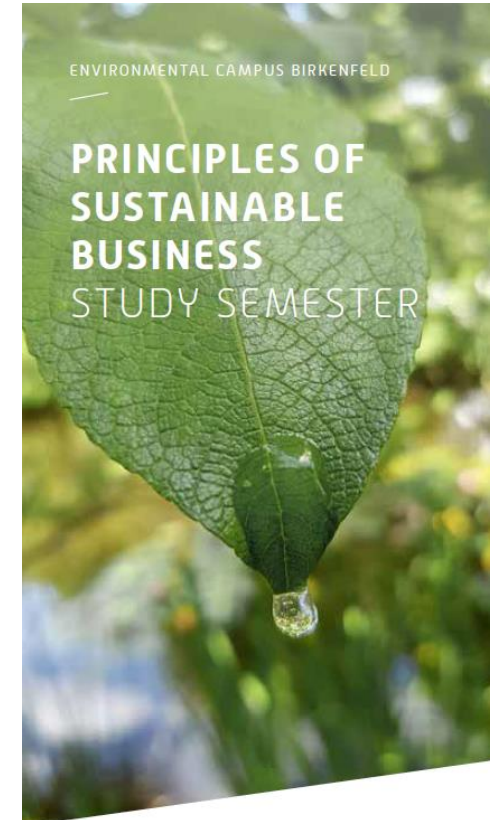
ENVIRONMENTAL CAMPUS BIRKENFELD

ENVIRONMENT AND TECHNOLOGY INTERDISCIPLINARY STUDY PROGRAM



ENVIRONMENTAL CAMPUS BIRKENFELD

SUSTAINABLE COMPUTER SCIENCE INTERDISCIPLINARY STUDY PROGRAM



ENVIRONMENTAL CAMPUS BIRKENFELD

PRINCIPLES OF SUSTAINABLE BUSINESS STUDY SEMESTER

Global education network



IMAT
INTERNATIONAL
MATERIAL FLOW MANAGEMENT

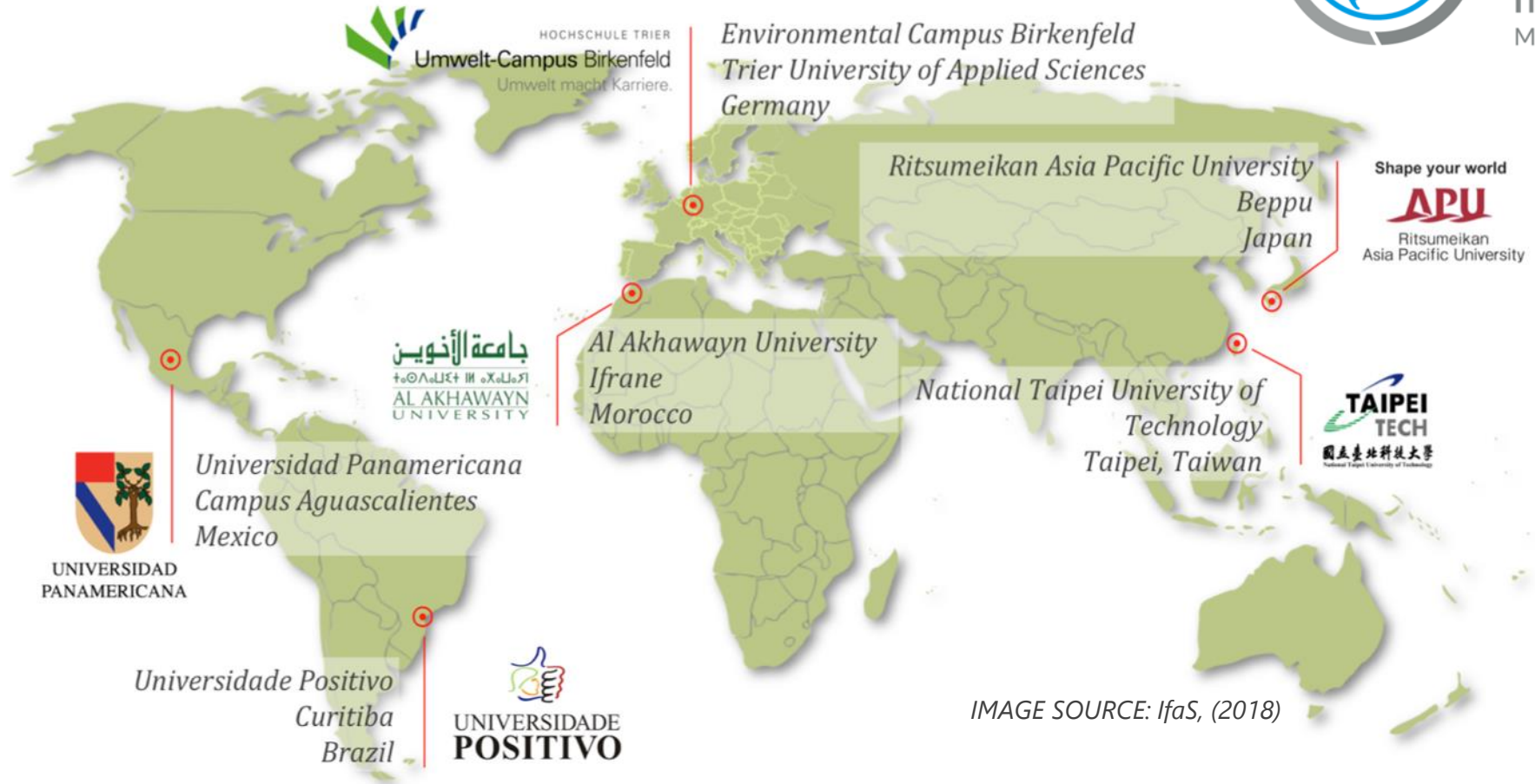
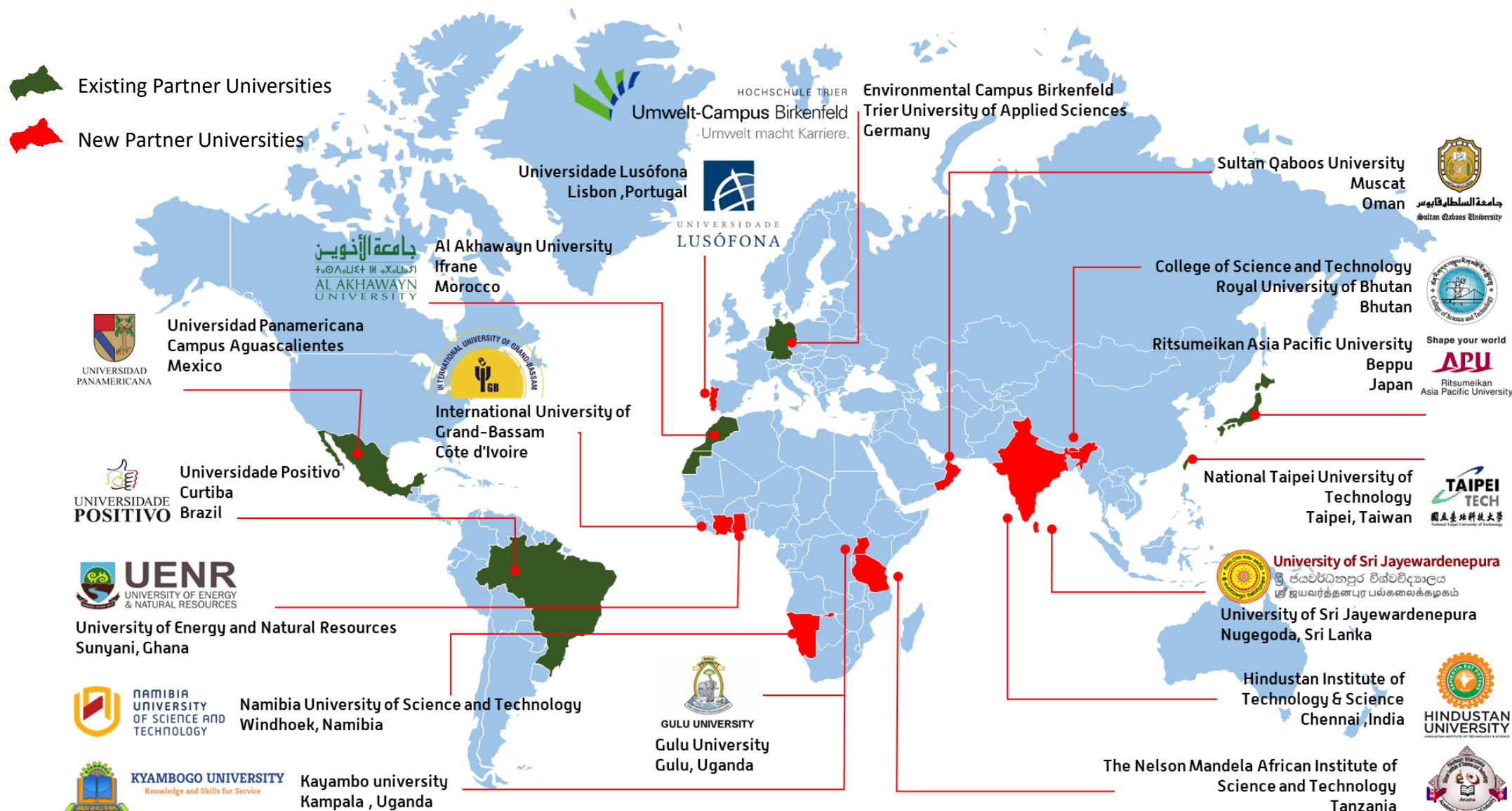


IMAGE SOURCE: IfaS, (2018)

- More than 200 IMAT alumni in more than 50 countries since 2004
- Combined education and export promotion: GreenTec- Made in Germany

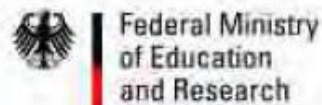
IMAT| Combining Education, Research and Export Promotion



IMAT = Product of Germany

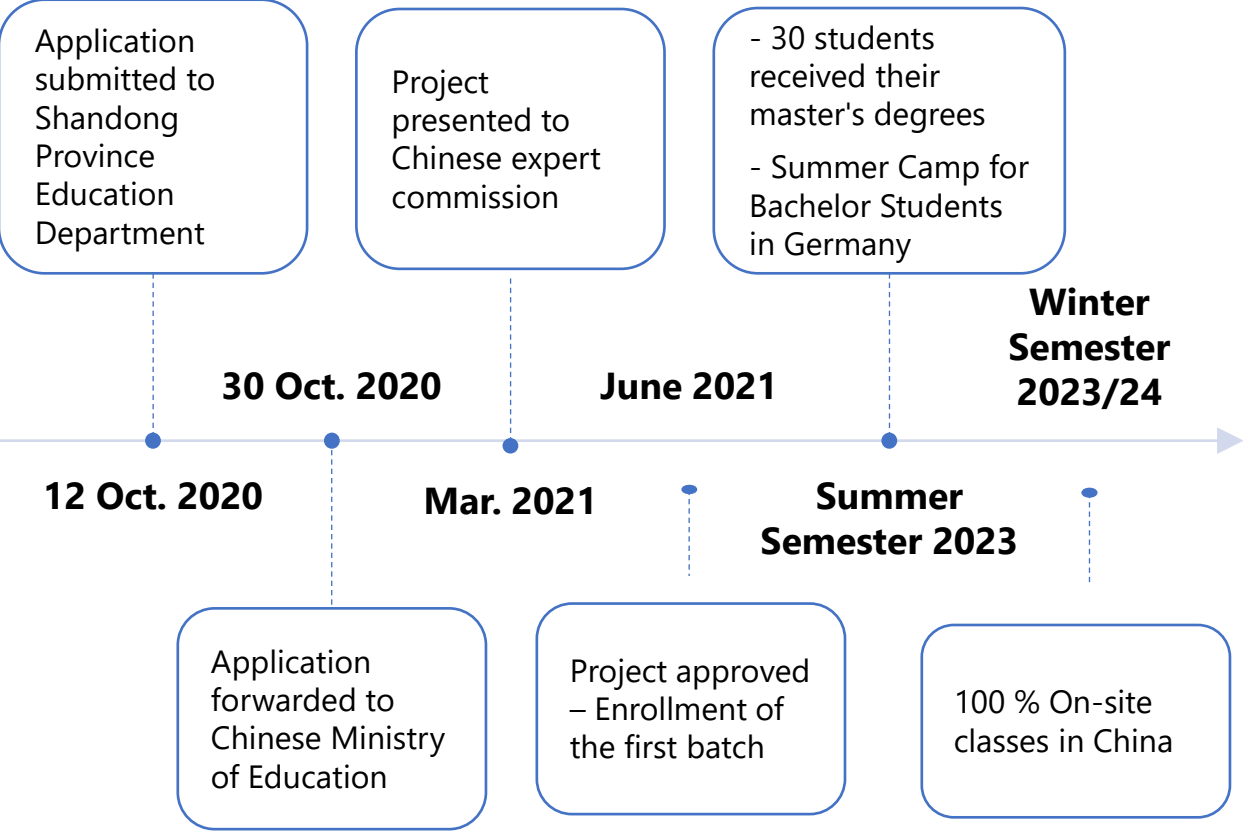


- IMAT study programs were inaugurated under the patronage of the German Federal Minister of Environment in 2004
- German–Japanese IMAT program was supported by the German Federal Ministry of Education and Research (BMBF) / German Academic Exchange Service (DAAD)
- Registration as UNESCO Education Project
- Supported by the State Government of Rhineland-Palatinate



Deutscher Akademischer Austausch Dienst
German Academic Exchange Service

Establishment of a Cooperative Institute with 3 Bachelor's and 1 Master's Program in China



IfaS, 2023



Double Degree Program with Foshan University, China

- **Project Partner:** Foshan University and Beijing Shijieboya International Education & Technology Co. Ltd.
- **Project Start:** 2019
- **Project Goal:** Establishment of a Double Degree Program in the English Sustainable Business and Technology Bachelor's Degree
- **Implementation:** 3 semesters in China, and upon successful entrance examination, a group of the best students are allowed to study in Germany for one year. After passing the courses in Germany, they also receive a degree certificate from the University of Applied Science that is valid in conjunction with their Foshan University degree certificate. Various modules from Hochschule Trier are incorporated in the first three years.
- **Current Status:** The first group of students has just arrived in Germany and will begin their graduation in Germany this semester.



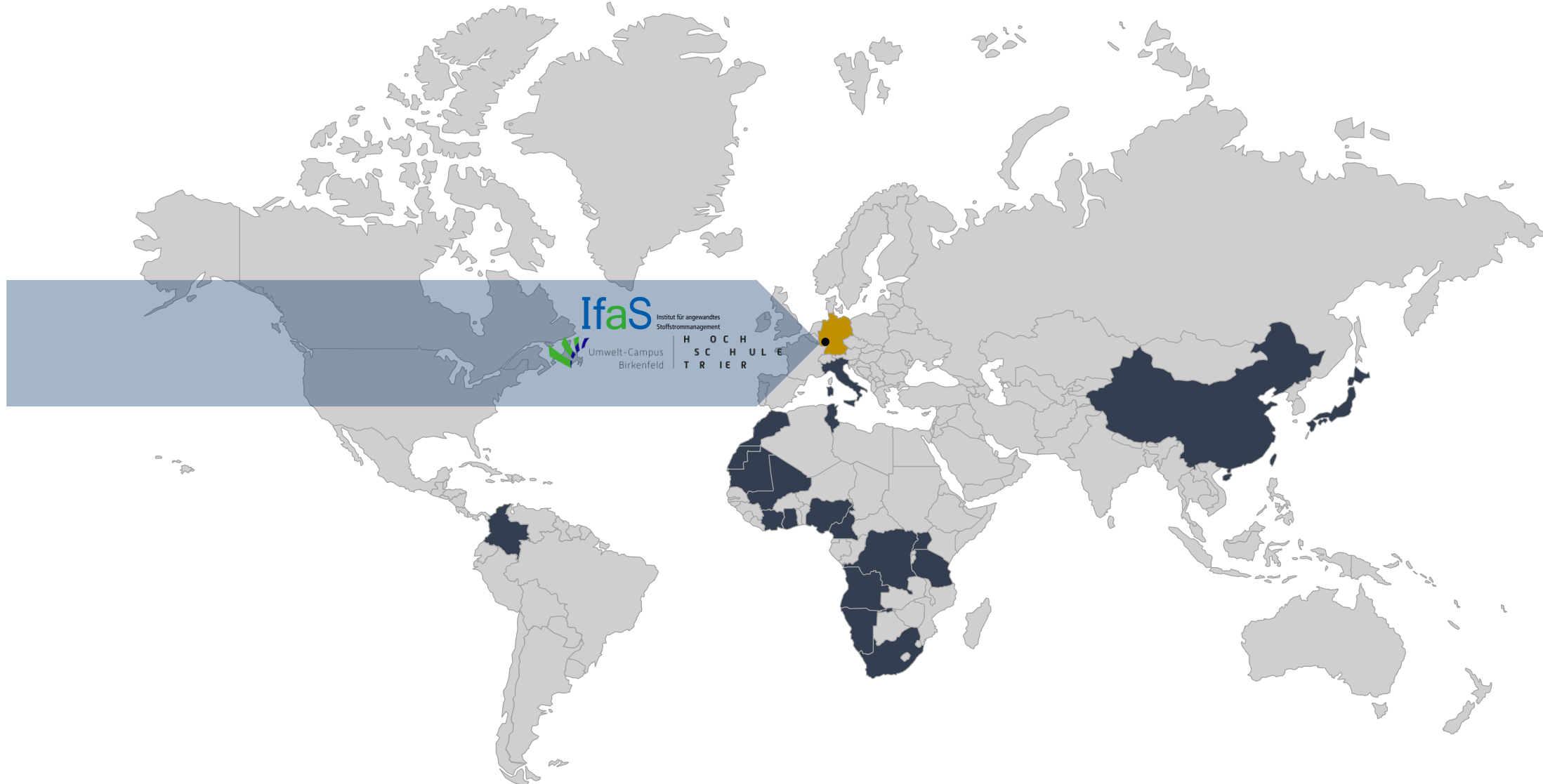
Circular Economy week 2023

Introduction



- Provide an understanding on the challenges, strategies, **technologies** and **opportunities** offered by Circular Economy, Zero Emission and Material Flow Management
- Provide an understanding on the IfaS' regional Material Flow Management and Circular Economy approach methods
- Provide an overview on innovative CE & ZE technology and services offered by German SME's
- Encourage you to establish new international networks with companies, public sector participations from Germany and other delegations

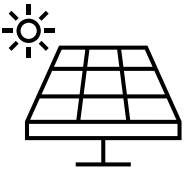
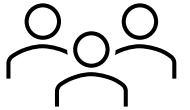
ICEW participants 2023: 80 Participants worldwide!



Enjoy the week with us and get interesting new project ideas!

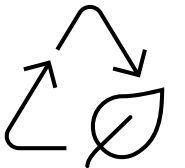
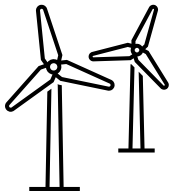
Monday, 09th October

- Welcome address and introduction
- Technology Site Visits
 - **Environmental Campus Birkenfeld.** Zero Emission Campus
 - **Zentrale Abfallwirtschaft, Kaiserslautern (ZAK).** Municipal waste management facility



Tuesday, 10th October

- Technology Site Visits
 - **Energy Landscape, Morbach.** Repurposing ammunition depot to park for Renewable Energies
 - **Rhine-Hunsrück Entsorgung, Kirchberg.** Municipal waste-to-energy disposal facility

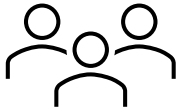


Please find all the information and documents in our webpage www.icew.de

Agenda ICEW (2)

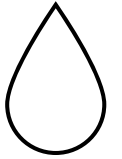
Wednesday, 11th October

- 14th International Conference on Circular Economy
- Gala Dinner



Thursday, 12th October

- Technology Site Visits
 - **Stadtwerke Trier.** Energy autarky wastewater treatment plant
 - **Wasserwerk Trier.** Utilities and fresh water supply of Trier Municipality
- Dinner reception hosted by Mr. Wolfram Leibe, Mayor of Trier



Friday, 13th October

- Individual Agenda & Meetings
- Wrap-up workshops and/or Departures





Prof. Dr. Peter Heck
Director of IfaS



Econ. Marco Angilella
***Co-Head International
Department***



Dr. Felix Flesch
***Co-Head International
Department***



Evi Hubig
Head of Administration

International Project Managers



Dr. Gerhard Ohlde



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Eng. Gaël Nounkoua



Eng. Jackeline Martínez M.Sc.



Morimi Tokuyama M. Eng.



Eng. Sarah Semlali



Gustavo García, M. A.



Eng. Lea Ecker



Jan Weiten, M. A.



Eng. Meriem Drissi Sbai

IfaS International Team: Education Department



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***Head IMAT Masters
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Administration



Aurelie Kono
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Julia Schmidt
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Julia Veckes
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Director of IfaS



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Dr. Felix Flesch,
***Co-Head International
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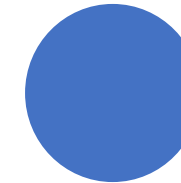
Research assistants



Iluliana Zainullina



Guy Noel
Defokue



Junyi Yao



Niklas Mitterle



Bhushan Suresh
Chaudhary



Ulrich Seuqip Kue



Umwelt-Campus
Birkenfeld

H O C H
S C H U L E
T R I E R



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IfaS

Vielen Dank für Ihre
Aufmerksamkeit