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Professional Education on Industrial Symbiosis, Industrial-Urban Symbiosis and Circular Economy in the Chemical Industry:

Experiences from Frankfurt Industrial Park

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Provadis School of International Management & Technology

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The Industrial Park Frankfurt Höchst

An example for Industrial symbiosis and Industrial Urban Symbiosis

Professional Education: Activities and Success Factors

Challenge Based Learning

Examples from the EIT Climate-KIC Programme

New processes need new skills on all levels

First results of our competency mapping for the industrial park

Lessons Learned and recommendations

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Center for Industry and Sustainability (ZIN)
Think and do tank for sustainable industry at Industriepark Höchst

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Mission:
We support the industry in its sustainable development

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What does the future hold for industrial parks in Germany?

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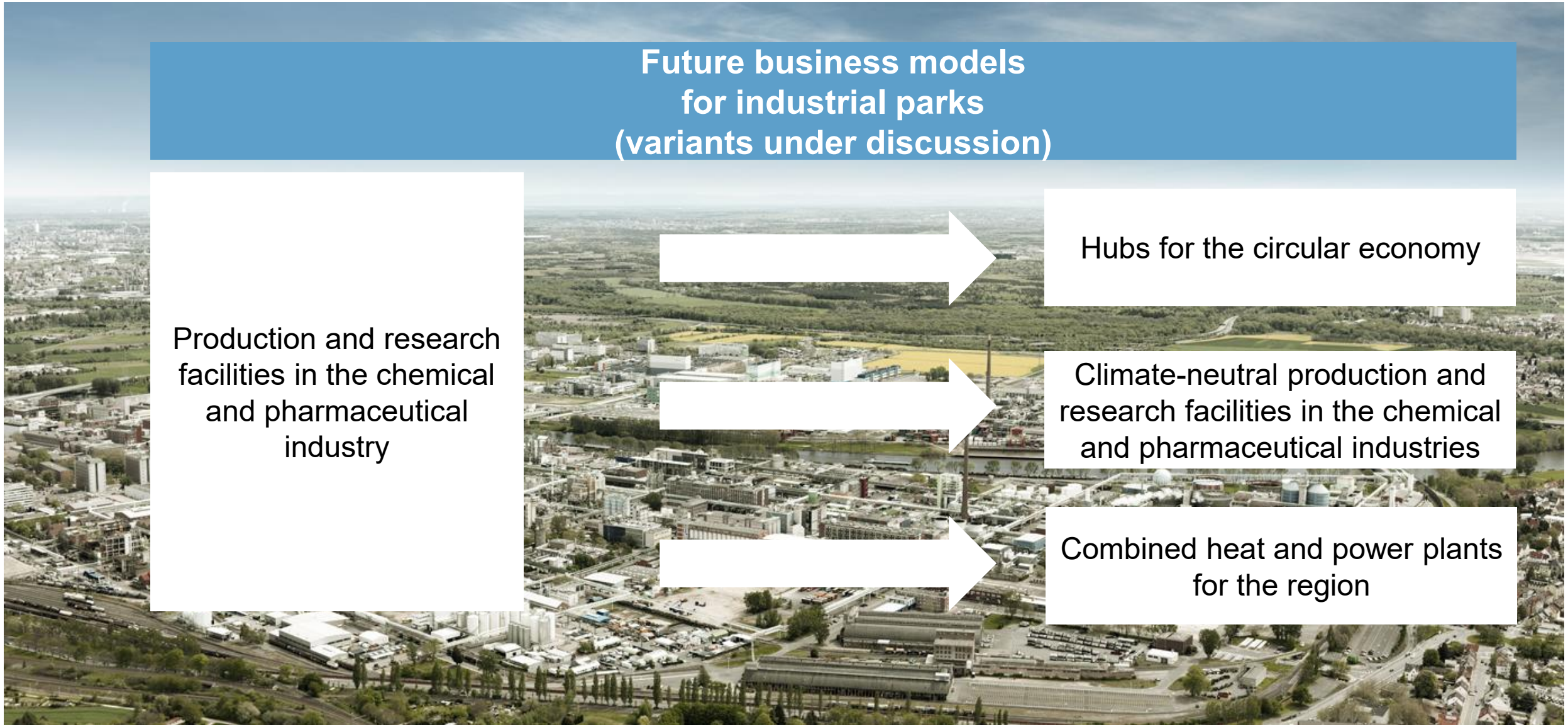
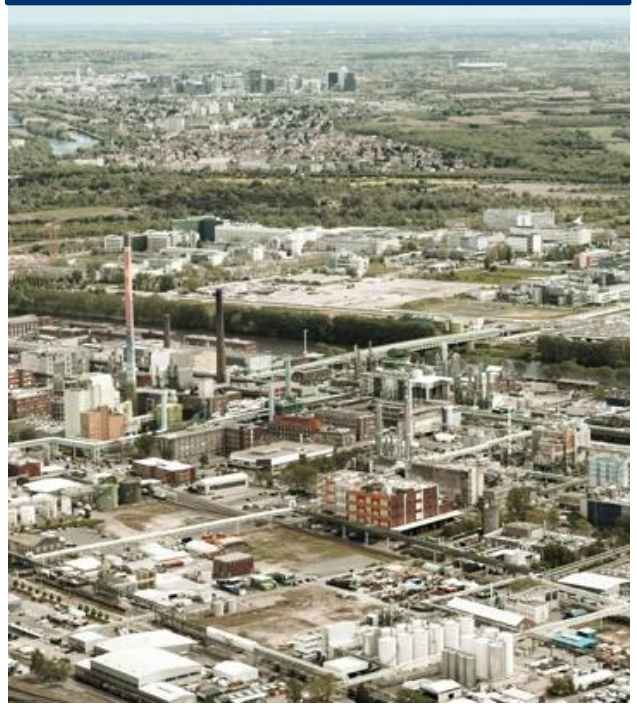
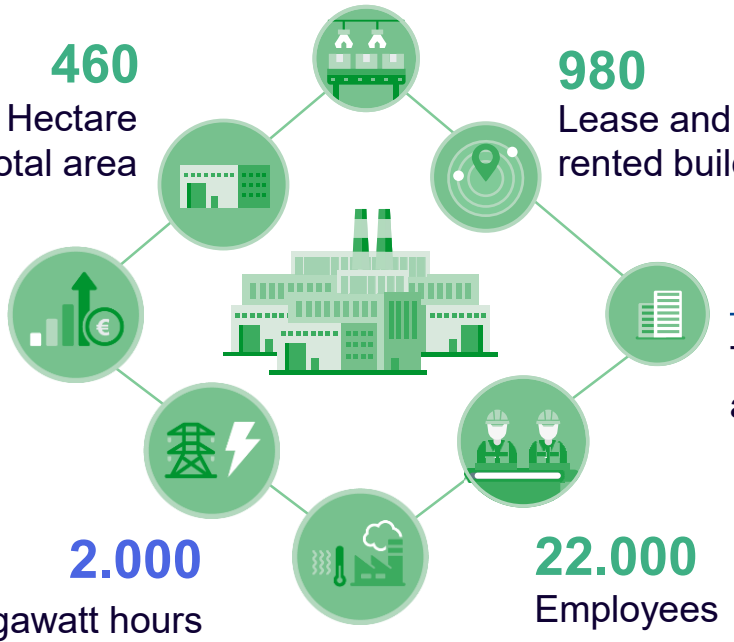


Industriepark Höchst
Mission of the Process4Sustainability cluster

Mission:
We want the transformation to be economically successful.
succeed.





120
Production Plants

The German chemical industry in compact form

460
Hectare Total area

980
Lease and rented buildings

8
One billion Euro to Investments 2000 to 2020

90
The company at the location

Potentially 90 different targets and opinions, mostly international production companies with globally oriented strategies

2.000
gigawatt hours of electricity per year

22.000
Employees

3.500
gigawatt hours of heat per year

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Pigments, polymers, coatings, dyes, salt, gases, biogas, acids, alcohols, aldehydes, amines, fungicides, herbicides, insecticides, silicates, biofuels, food additives, powders, sulphur chemicals, fluorides, functional chemicals, fine chemicals, agrochemicals, enzymes, antibodies, pharmaceutical products, ...

Process4Sustainability cluster

Shaping an economically successful transformation

The challenge

Europe wants to become CO_2 -neutral - as soon as possible, but by 2050 at the latest. The process industry and its partners are key to the success of this change: **together,** we can open up **new markets**, **save energy and raw materials, replace fossil** CO_2 sources and increasingly **use CO_2 as a resource** through **innovative solutions.**

Approach

Establishment and **management** of a **cluster.**
We translate the goal of CO_2 neutrality for individual companies and the **specific local conditions** and offer our partners practical knowledge about the **levers** of CO_2 neutrality, new **markets** and innovative **business models**. We **create future markets** by connecting solution providers with the demand side.

Process4Sustainability is a platform for the Alliance of the Willing.

Industry partner

AMBIVATION
ARCUS
BAYER
bse methanol
CAPHENIA
Celanese
The chemistry inside innovation
CO2BIOCLEAN
INERATEC
infraserv höchst
kuraray
NEOCARBON
reverion
right
sanofi

Innovation and solution partner

DECHEMA
eit Manufacturing
House of Energy
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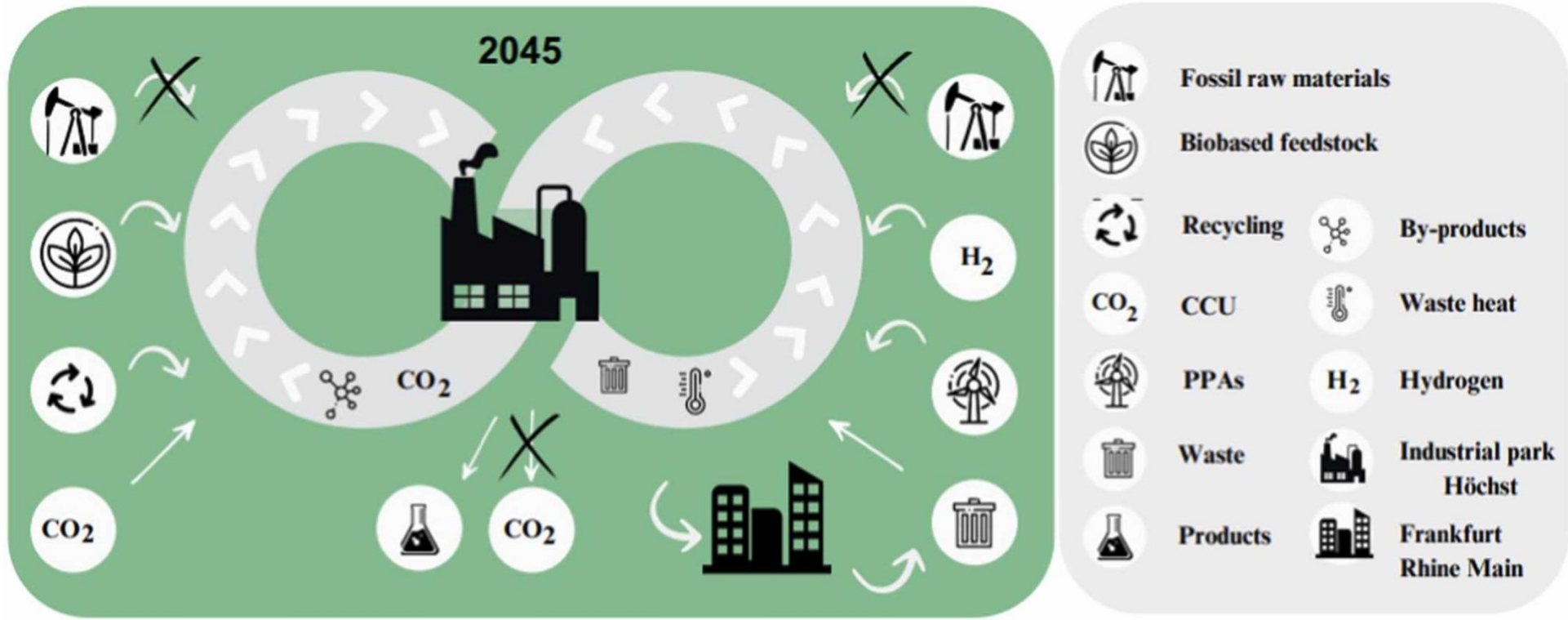
TECHNISCHE UNIVERSITÄT DARMSTADT
VCI

Current publication on industrial symbiosis and industrial urban symbiosis at the Höchst Industrial Park (2024)



[Industrial symbiosis as enabler and barrier for defossilization: The case of Höchst Industrial Park - ScienceDirect]

CO_2-neutral chemical industry 2050 – What role can chemical parks play?

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Infrastructure

Energy supply
- Power generation
- Electricity grids
- Heat / Steam
- Hydrogen
- Biogas
- Biomethane
- …

Disposal (Circular economy)
- Wastes
- Phosphate
- CO_2
- …

Sustainable raw materials available

Innovation Campus

Initiation and participation in funded innovation projects

Settlement of innovative start-up companies

Pilot and demonstration plants for PtG, PtL and PtX

First-of-its-kind systems for sustainable processes

Industrial infrastructure in place

Networks

Formation and active participation in networks with chemical companies

Experience has shown that regional clusters offer significant synergies

Close cooperation with universities and research institutions

Entire value chain present

Example: Industriepark Frankfurt Höchst as an innovation campus

The place for upscaling new technologies

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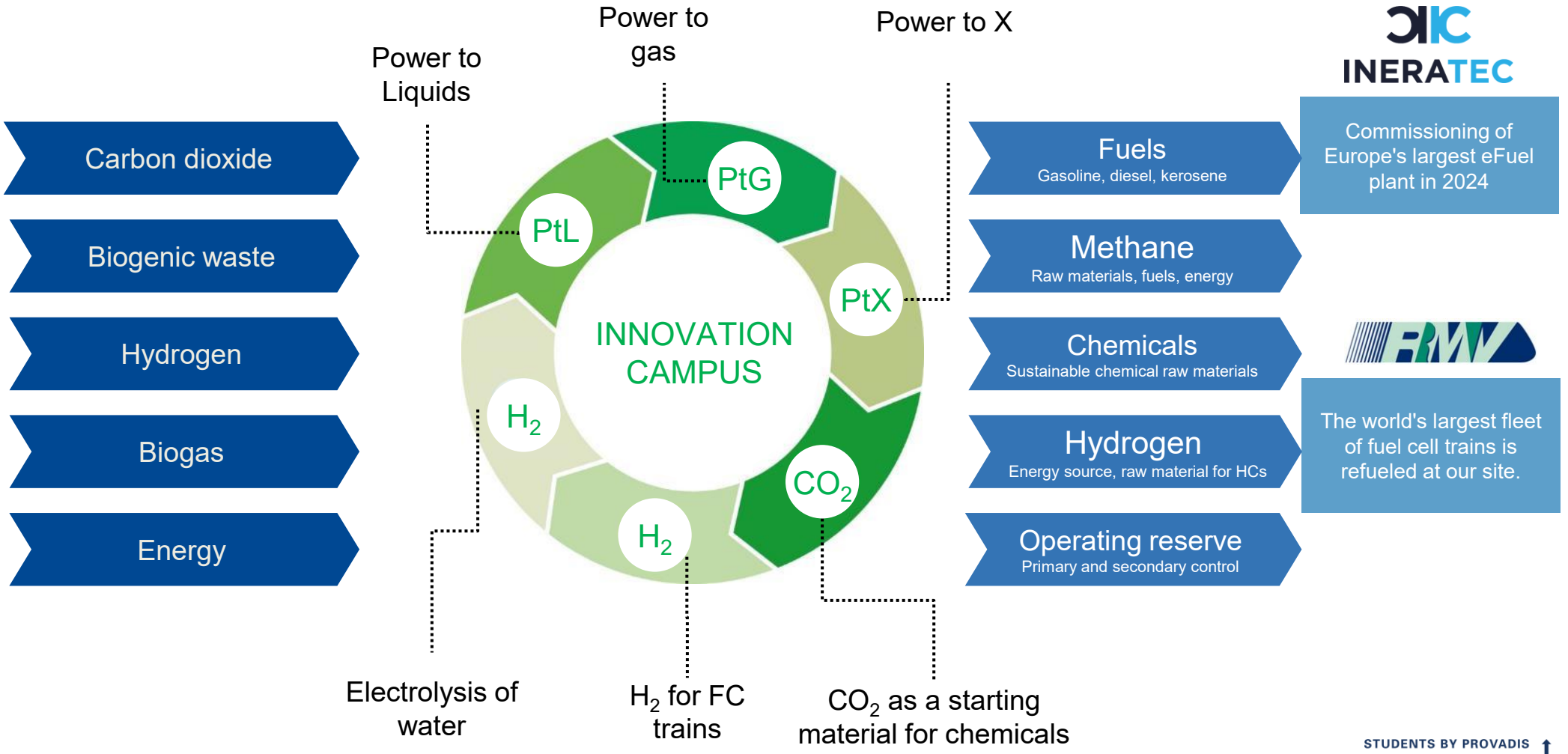

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Center for Industry and Sustainability

Let‘s create a sustainable industry together

Transforming Industries

We are supporting the industry to become more sustainable, reduce CO_2 emissions and benefit from digitalization. Through our projects we identify options for industry defossilization and new business development.

Accelerating Sustainable Businesses

We conceptualized the EIT Climate-KIC cleantech accelerator and managed it both regionally and internationally. We offer start-ups mentorship and support with sustainable business model development. For organizations we develop business creation and matchmaking formats.

Educating Change Makers

We create learning opportunities for national and international change makers. Our formats (e.g., workshops, trainings, summer schools) focus on real-life challenges and bring latest knowledge in effect. We make knowledge work!

20+ high-impact projects on regional, national and global scale with partners from academia, industry and public authority.

Key Facts since 2016

Cooperations with 50+ companies

350+ start-ups in 13 countries supported

2.500+ participants in our education formats

Activities with a funding of 18 million euros

Selected Projects

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CO_2-Neutrality: Cluster Process4Sustainability

Process4 Sustainability

HESSEN Hessisches Ministerium für Wirtschaft, Energie, Verkehr, Wohnen und ländlichen Raum

Management of European Cleantech Accelerator

eit Climate-KIC

Climate-KIC is supported by the EIT, a body of the European Union

Sustainable Industrial Area (SIA) Management Courses with GIZ

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Sustainable Industrial Area Management

Projects with impact in 30+ countries

Status as of October 2024

Professional Education: Guiding principles

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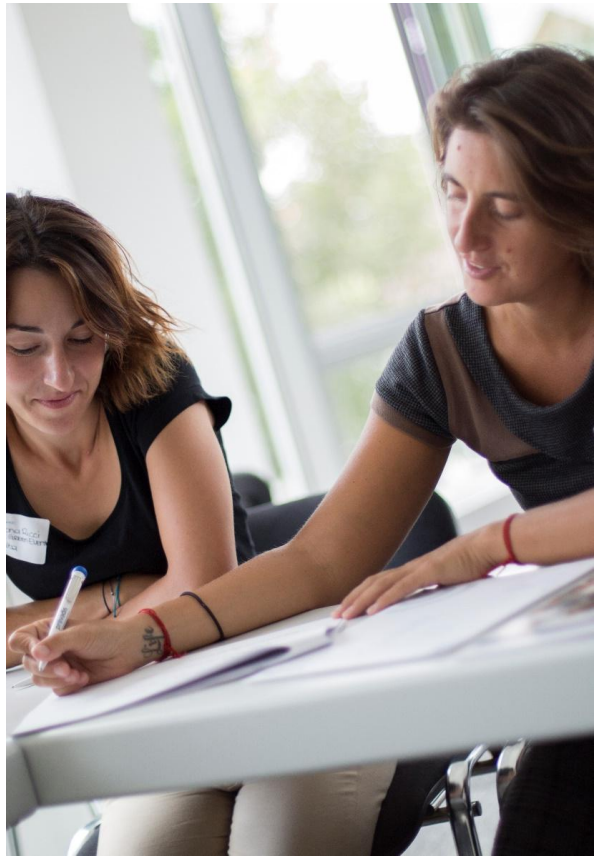

1. **Challenge based learning:** The basis for defining professional education offers are innovation challenges faced by practitioners.
2. **Action / application orientation:** Participants should not only absorb knowledge, but also apply new knowledge, tools and methods to real existing problems, challenges and endeavors
3. **Interdisciplinary approach:** Innovations are often created at the interface of disciplines.
4. **Modular approach**
5. **Personalized learning:** Learning formats ensure that people can shape continuous learning under their own motivation and direction.
6. **Role of the trainer: trainer as a coach**
7. Make use of the **knowledge triangle** between education, research institutions and business

A Framework of Professional Transferable Competences for System Innovation: Enabling Leadership and Agency for Sustainable Development

JoBC_2017_Vol14_Iss1_Lehr_Auch.pdf

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EIT Climate KIC PhD interdisciplinary Summerschool
Energy Transition in Frankfurt

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Achieving the energy transition

Two-week intensive program for international doctoral candidates

Approach

Discussion with experts from science, politics, and business and development of ideas for the city of Frankfurt under the guidance of professional coaches.

Areas of action

New technologies, changed energy usage behavior, new partnerships with the surrounding area.

Result

Various innovative approaches that demonstrate the potential of the city of Frankfurt as a real-world laboratory for green transformation.

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EIT-Climate-KIC: Pioneers into Practice Program
Cross-sectorial learning journey

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Joint project
in 20+
countries

Pioneers into Practice (PiP)

Networking and promoting innovation among international skilled workers and companies

The Pioneers into Practice (PiP) program brings sustainability experts together with companies, universities, public authorities, and NGOs to jointly develop innovations for dealing with climate change.

Approach
Participants acquire new skills in system innovation and transformation through e-learning, workshops, and group projects. They then apply their skills in practice during a project assignment abroad.

Our task
We coordinate and support the preparation, matchmaking, and follow-up process. New skills in personnel management are promoted and developed.

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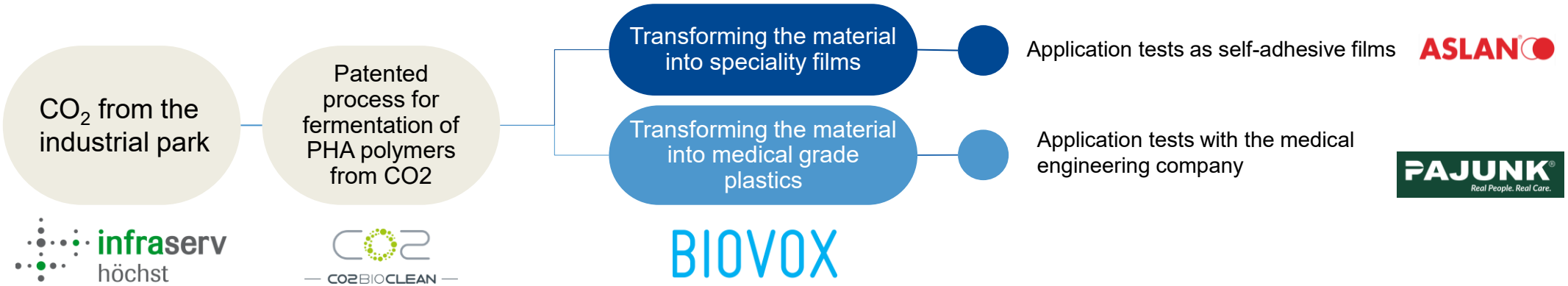
From Learning to Applying: Collaboration brings new Circular Innovations

- The **Start-Up CO2 BioClean** produces biodegradable polymers from biogenic CO_2 and hydrogen
- Construction of a **test facility at the industrial park in Frankfurt** to evaluate the scalability of the process

From one process to a whole "value creation network"

In collaboration with the Innovation Space BioBall:



➡️ Partners work with different timelines, different demands on the products and different interests and sometimes even with different languages.

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TransBIB - National transfer network to accelerate the industrial bioeconomy

The industrial bioeconomy integrates biological resources, processes, and principles into industrial and economic activities

-> An important part of the circular economy

Connects about 40 regions in Germany working on a circular bioeconomy

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What competencies are needed for a successful transition in the chemical industry ?

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- The further the transition progresses, the more important it is to include all employees in educational activities

- The biologization of chemistry is already advancing, e.g.
  - Fermentation skills are increasingly being asked
  - Handling the denatouration of ressources becomes a new challenge for biobased processes

- Workers will need upskilling and reskilling to adapt to new technologies, sustainable practices, and evolving consumer demands
  - The German Vocational Education and Training (VET) systems play a central role in preparing the workforce for these changes, ensuring that skills development aligns with the needs of the green and bio-based economy.

- First results (based on literature research and expert interviews):
  - Beside technical skills, soft skills become increasingly important for skilled workers

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Lessons Learned and recommendations

1. Professional Education on Industrial Symbiosis and Industrial Urban Symbiosis encompasses **knowledge**, **skills**, **attitudes**
   - Don‘t forget about the skilled workers in the laboratories!

2. **Practical challenges** and **economic opportunities** should be at the center of any learning programme.

3. **Cross-sectorial** and **cross-disciplinary learning** are essential for closing resource loops
   – Enhance implicit learning through network activities

Contact

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