



FAPESP Week Germany: Roundtable Session: Industry- University Research Collaboration (2025-03-26)

Prof. Dr.-Ing. Christian Doetsch,
Head of Fraunhofer UMSICHT
Spokesman Fraunhofer Energy Alliance
Chair »Cross Energy Systems«, Ruhr University of
Bochum

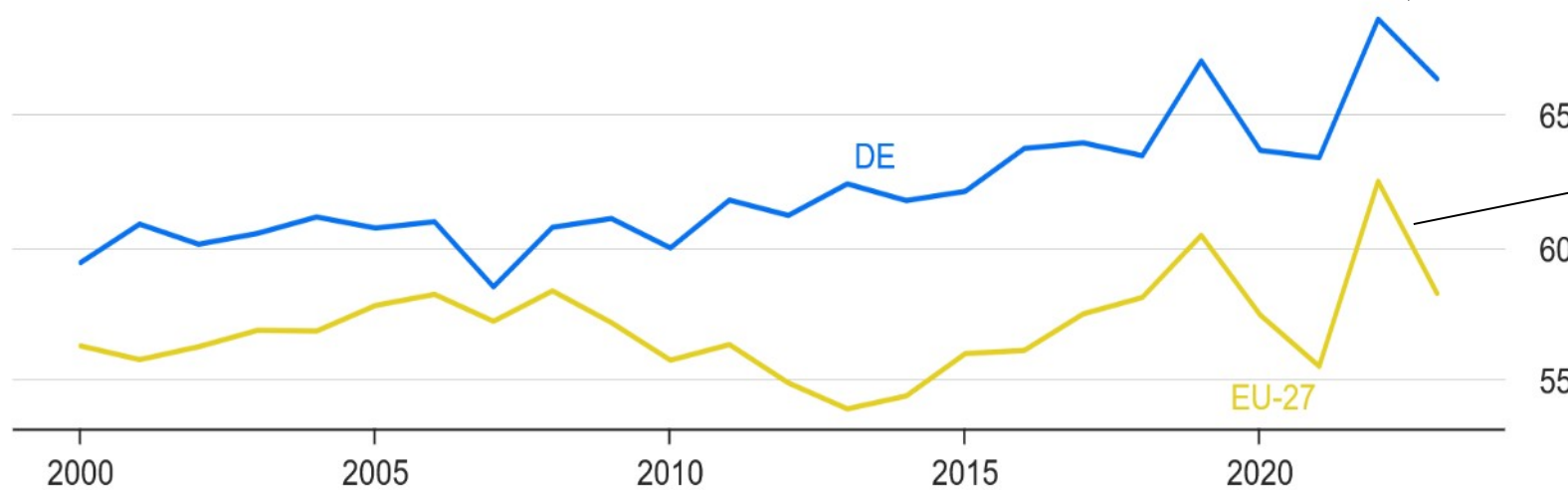


Key Fact #1

Primary Energy Import Dependence Germany | EU

Energieabhängigkeit

Anteil der Nettoimporte am Primärenergieverbrauch, in %

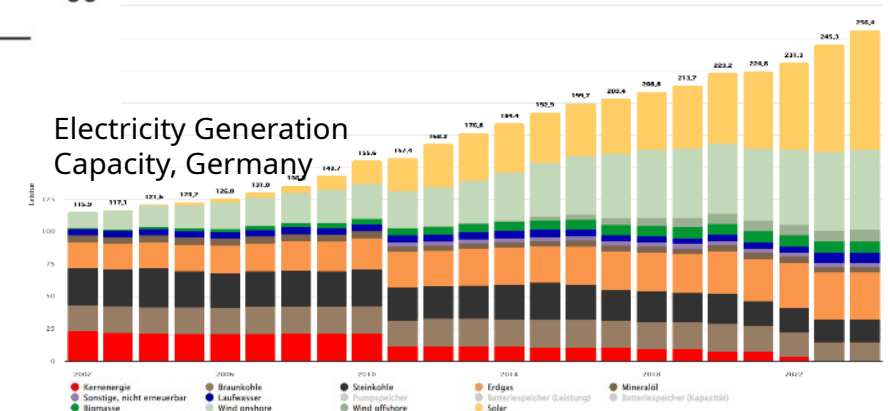


Increasing import (70%) demand, mainly due to the shutdown of lignite-fired power plants, but also due to the phase-out of nuclear energy

The same applies - to a somewhat lesser extent - to the EU

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Electricity Generation Capacity, Germany





Key Fact #2

What is the Electricity CO₂ footprint in South America and Germany?

 Colombia

February 2025

72% estimated

94g
CO₂eq/kWh

Carbon Intensity

88%

Low-carbon

88%

Renewable

 Sistema Eléctrico Nacional (Chile)

February 2025

250g
CO₂eq/kWh

Carbon Intensity

65%

Low-carbon

65%

Renewable

 Central Brazil

February 2025

59g
CO₂eq/kWh

Carbon Intensity

95%

Low-carbon

91%

Renewable

 Uruguay

February 2025

34% estimated

111g
CO₂eq/kWh

Carbon Intensity

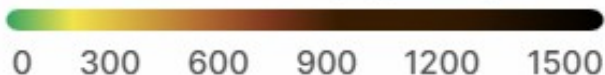
90%

Low-carbon

90%

Renewable

Carbon intensity (gCO₂eq/kWh)



 Germany

February 2025

451g
CO₂eq/kWh

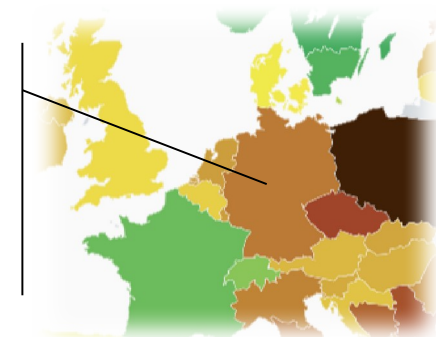
Carbon Intensity

50%

Low-carbon

47%

Renewable



Conclusion

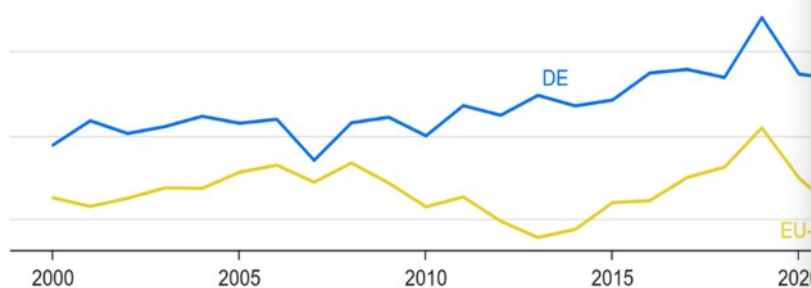
South America could Export Energy | EU and Germany will continue to import large amounts of energy

Key Fact #1

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Energieabhängigkeit

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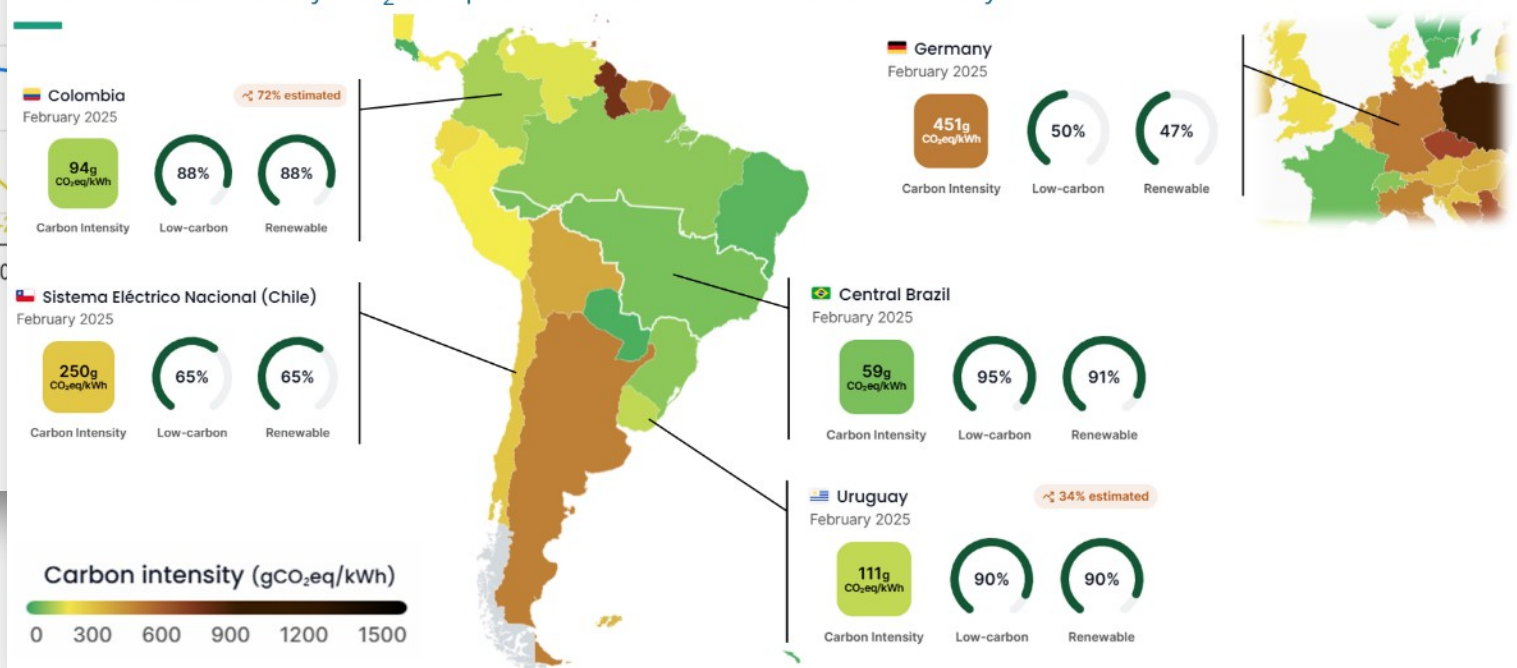


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Increasing import (70%)
demand, mainly due to the
shutdown of lignite-fired

Key Fact #2

What is the Electricity CO₂ footprint in South America and Germany?



Highlight Project Approved for 2025

IKI – DDIE - Deep Decarbonisation Innovation Ecosystem

Objectives

- Scale up **industrial decarbonisation** in the production of **cement and steel**, contributing to climate commitments of Brazil.
- **Fraunhofer IPK** contribution is focused on the construction of **technology roadmaps** and innovation projects for **deep decarbonization demonstration plants** with new industrial partnerships.

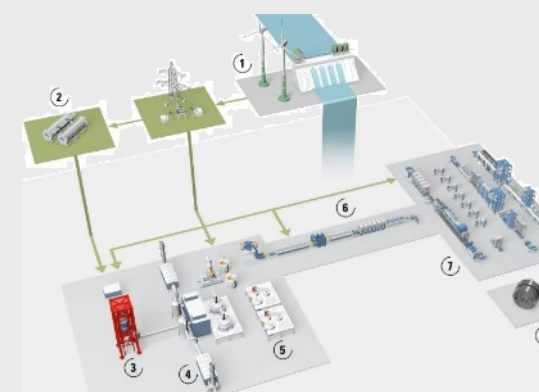
Stakeholders/ Partners

- 4 Implementing Partners
(BNDES, CNI, Fraunhofer and FINEP)
- 4 Consortium partners
(UNIDO, SENAI, Embrapii and GIZ as coordinator)

Project framework

- IKI – International Climate Initiative - 60 months
- **25M € Total / 2,500,000 € (Fraunhofer)**
- **UMSICHT and ICT** were invited by IPK to join the project

Green steel production based on H₂:

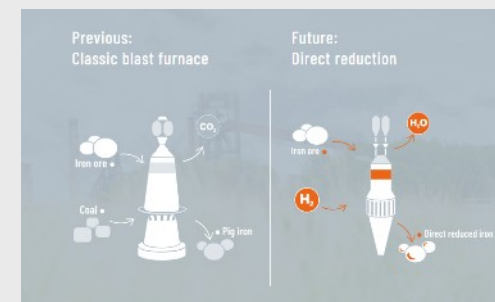


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Carbon capture technologies:



© 2024 MAN Energy Solutions SE



© Salzgitter AG

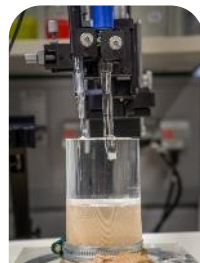


© Heidelberg Materials Norge AS

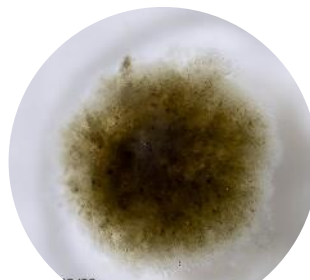
COOPERATION UFPE - RUB



Intensification of visiting research and joint supervision of PhD and master students



...2019



2024

2 PhD „sandwich doctorates“, creation a co-tutela PhD program, 3 visiting professors, institutional visits



Establishment of personal exchange program through DAAD-Probal for investigating novel technologies for resource recovery from wastewater



Preparation of bilateral research proposals

COOPERATION EMBRAPA – RUB – FRAUNHOFER –



Biomethane

Biohydrogen

Cooperative research frameworks as the “Renewable energy research network in the state of Ceará” allowed for building-up novel investigations lines and new proposals



Biomass and Biogenic Residues to Green Hydrogen?

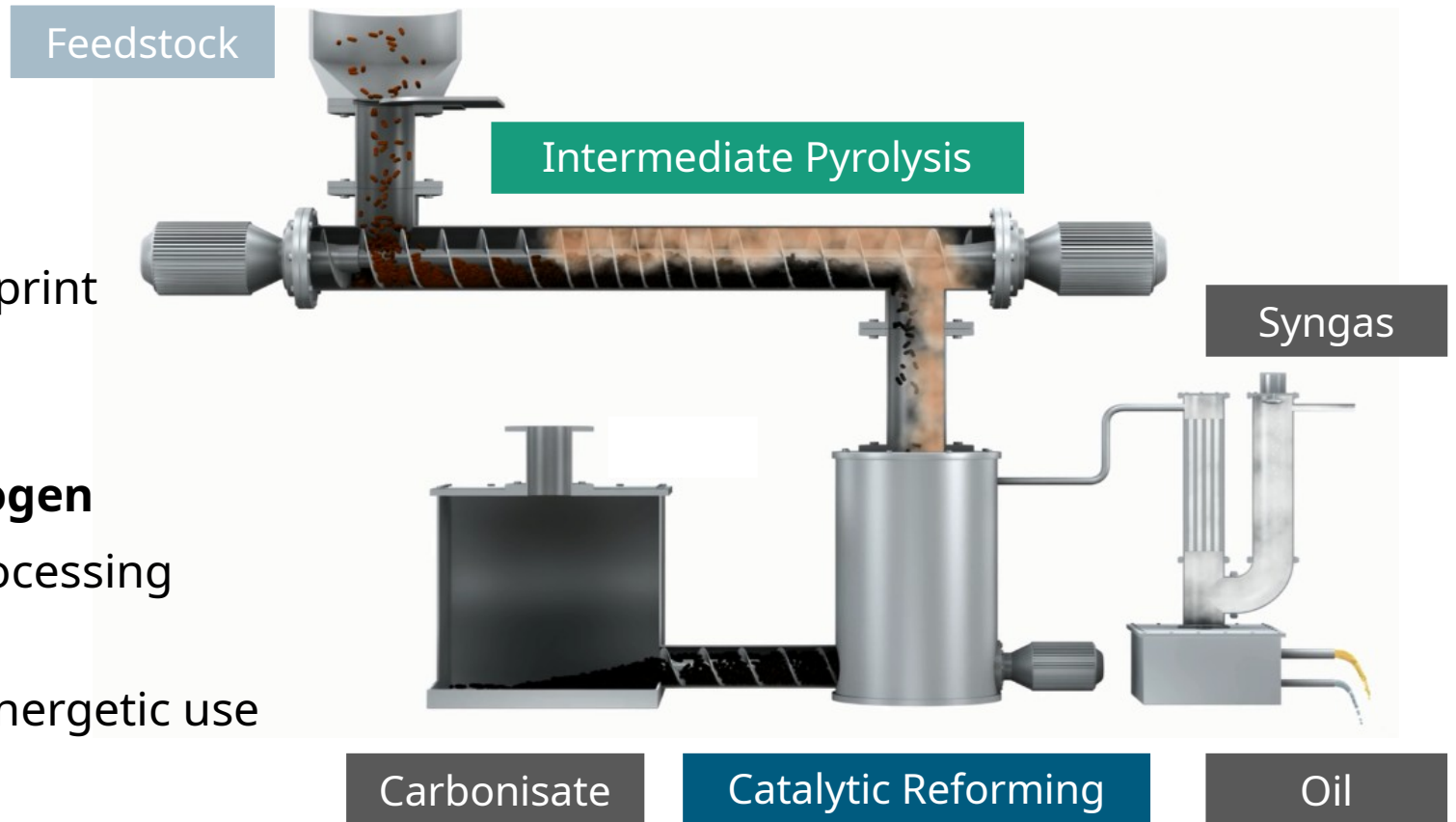
Functional principle of a pyrolysis with integrated catalytic reforming step?

Use cases and outcome

- Utilization of biogenic residues
- Decentralised application possible
- Products with near-zero carbon footprint

Products

- Syngas with up to **45 % green hydrogen**
- Oil with high thermal stability for processing into standard fuels
- Coal for soil application / storage / energetic use



PROJECT: TCR Equipment for SENAI ISI Biomassa (Três Lagoas)

2 TCR units to be delivered – completely designed and manufactured at Fraunhofer UMSICHT



Pilot-Scale unit 30 kg/h

Under construction

Delivery to Brazil 09/2025



Lab-Scale unit 2 kg/h

Hot commissioning ongoing

Delivery to Brazil 05/2025



Product gas treatment

- Cyclone
- Filter
- Condensation
- Electrostatic precipitator
- Scrubber

PSA – H₂ Separation

- up to 250 Nm³/h raw gas
- 10 bar
- 4 Columns

HDO – Hydrogenation

- 30 l/h
- 110 bar
- up to 400°C

Pyrolyzer – TCR

- 500 kg/h

CHP-Unit dual fuel

- 220 kW_{el}
- 350 kW_{th}

0.5 t/h Demo-site Fraunhofer UMSICHT, Hohenburg, Germany

Green crude oil from biogenic residues

Research Cooperation with SENAI ISI BIOMASSA

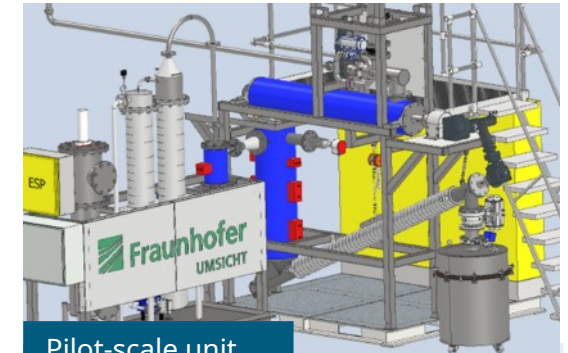
Delivery of 2 TCR-Units for the Brazilian Market



Lab-Scale unit

TCR2

- Throughput: 2 kg/h
- Usual operating time: 1-day campaign
- Feedstock: biomass and biogenic residues



Pilot-scale unit

TCR30

- Throughput: 30 kg/h
- Heating System: electrical
- Usual operating time: 2-day operation up to several weeks
- Feedstock: biomass and biogenic residues

SENAI ISI BIOMASSA

Tres Lagoas
Mato Grosso del Sul

TCR-Systems for waste
biomass conversion and
H₂-production

Implementation of value
chain from waste-to-fuel



TCR – Feedstocks

High potential of input materials

- Variable biomass, biogenic residues, bio-waste and mixtures (>70% DM) can be used as feedstock
- More than **90 biogenic waste materials** already tested
- **Examples:**
 - Agricultural residues
 - Digestate
 - Sewage sludge
 - Spent grains
 - Paper residues
 - Leaves
 - Biowaste
 - ...

Biogenic residues from Brazil to be tested soon! Sugarcane, Eucalyptus, Macauba, Poplar, Pine, Jathropa etc.



What are Challenges, Hurdles, Experiences in bilateral Cooperation Brazil - Germany

What was good?

From the very beginning, there was a strong drive among the Brazilian partners to utilize biomass and biogenic residues. Innovative technologies for this purpose are being sought worldwide. What's also exciting here is that SENAI wants to implement technologies along the entire value chain: from residues to fuels, green hydrogen, and biochar. These technologies will be demonstrated locally, thus laying the foundation for commercialization in Brazil.

What were the challenges?

The concept of the SENAI facility was a bit difficult to grasp at first. (Federal States, Research, Education, and Training). Communication in English has worked very well at the project level so far. However, training local staff wasn't always easy; a Spanish-Portuguese-speaking colleague from UMSICHT helped with this.

What was really difficult?

Legal and contractual aspects. Due to the size of Fraunhofer and SENAI, there was naturally some contractual "coordination" at the beginning. Fortunately, however, there is now a framework agreement between SENAI and Fraunhofer, which we have also used for our ongoing projects.



Daschner, Robert

Leitung Advanced Carbon Conversion Technologies



Contact

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Thank you for your attention!



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Fraunhofer Energy Alliance

Biography Speaker

Prof. Dr.-Ing. Christian Doetsch



Contact



Organization / Position	Head of Institute, Fraunhofer UMSICHT Spokesman Fraunhofer Energy Alliance Chair „Cross Energy Systems“ at Ruhr-university Bochum
About	<p>Prof. Christian Doetsch (born 1969) holds a doctorate in chemical engineering with a focus on energy and process engineering. His specialties are cross-sector energy systems (including modeling/simulation/optimization), energy storage, power-to-X technologies such as electrolysis and chemical conversion into valuable materials and energy sources. This technology and system experience is necessary for the implementation of sustainable, local energy systems as well as the production and use of green hydrogen.</p> <p>Since 2014, Prof. Doetsch has held the chair for "Cross Energy Systems" at the Faculty of Mechanical Engineering at the Ruhr University Bochum. In his courses, he combines technological research with systemic analyses and an economic perspective. In 2015, Doetsch co-founded the award-winning start-up Volterion, which has developed redox flow batteries and has since successfully commercialized them. The founders received the Joseph von Fraunhofer Prize for this in May 2021. He is internationally networked through the IEA (International Energy Agency), among others; he gained longer-term experience abroad during a stay at the University of British Columbia (Canada).</p> <p>In 2022, Christian Doetsch took over the management of the Fraunhofer Institute UMSICHT in Oberhausen together with Prof. Manfred Renner. With its more than 600 employees, Fraunhofer UMSICHT develops processes and materials for the institute's key topics - circular economy, carbon management, green hydrogen and local energy systems - with a budget of > € 70 million.</p> <p>Since 2024, Christian Doetsch has also been spokesperson for the Fraunhofer Energy Alliance.</p>



Anderson Correia ✓



ipt IPT - Instituto de Pesquisas
Tecnológicas

- Professor and former President of the Aeronautics Institute of Technology
- Former President of CAPES
- President of IPT – Technological Research Institute of São Paulo State Government



Inauguration of ITA-Fraunhofer
Project Centre



IPT – Instituto de Pesquisas Tecnológicas

Technological Research
Institute of São Paulo State
Government

We are present at 7 locations in

IPT Figures (2024)



125 years



> 1,000
Employees



> 3,165
CUSTOMERS



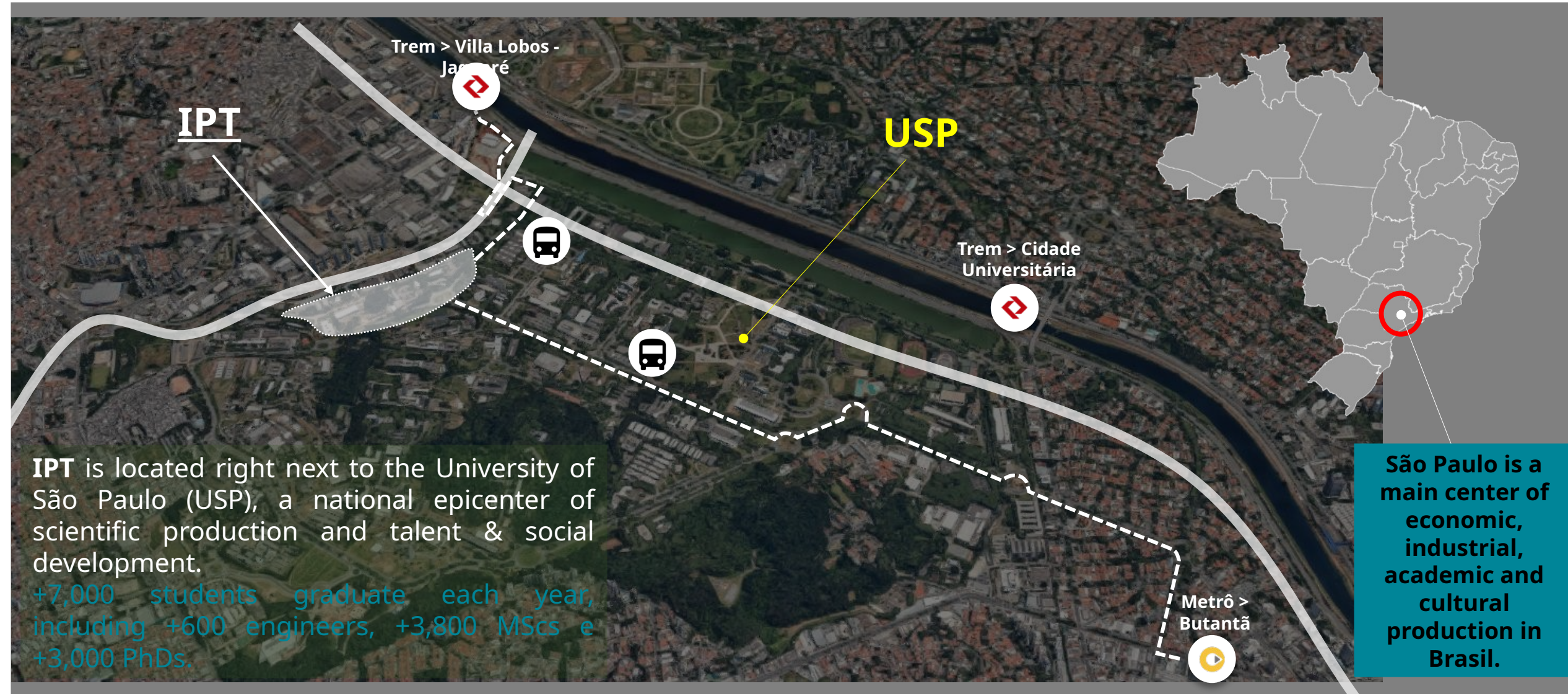
> 16,078
DOCUMENTS
ISSUED



> 2,000 PROCEDURES
AND STUDIES



SÃO PAULO CAMPUS



HUB E PARCEIROS DE INOVAÇÃO ABERTA



WORLD
ECONOMIC
FORUM

INOVA TALENTOS



SIEMENS

SIEMENS
energy



Google

V2COM
WEG Group



SEMPRE
CERVEJARIA
ambev



inteli
instituto de tecnologia
e liderança

Lenovo



VALE
NOKIA

INTEGRALMEDICA

AstraZeneca



BUSINESS UNITS

BIONANO

CITIES, INFRASTRUCTURE AND ENVIRONMENT

ENERGY

BUILDING AND CONSTRUCTION

ADVANCED MATERIALS

DIGITAL TECHNOLOGIES

REGULATORY AND METROLOGICAL
TECHNOLOGIES



Iasmin Center – Applied AI R&D

- An applied R&D center to help further AI in the Brazilian industry, with emphasis in intelligent manufacturing solutions
- 6 private partners collaborating with partial funding and defining the main challenges and lines of research
- 23 partner research institutions (of which 8 are international, including Fraunhofer and RWTH Aachen University)
- A joint effort in a program structured by the government of Brazil (MCTI), FAPESP and CGI.br



Patrocinadores fundadores



Instituição sede



Instituições participantes

Nacionais



Internacionais



Empresas



SCIENCE CENTERS FOR DEVELOPMENT (CCD)

Carbon Neutral Cities

ipt

INSTITUTO DE
PESQUISAS
TECNOLÓGICAS

HOST INSTITUTION:

International ICTs

UNIVERSITIES AND R&D
INSTITUTIONS

USERS

SOCIETY REPRESENTED BY THEIR
INSTITUTIONS



**Sustainable
Development**

Participating Institutions	QTY
Funding Agencies	1
Brazilian ICTs	9
International ICTs	7
Companies	9
Associations, NGOs	7
Governmental Agencies	7
Total	40

**INNOVATION
MODEL**

PUBLIC
SECTOR

PRIVATE SECTOR

- USP: IAU, FSP, GEO, Poli (3 departments), IEA, EACH, and FAU
- UNIFESP: Institute of Marine Studies and Institute of Science and Technology
- UFABC: Center for Mathematics, Computing, and Cognition (CMCC) and Engineering, Modeling, and Applied Social Sciences (CECS)

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**SÃO
PAULO**
GOVERNO DO ESTADO

Brazilian delegation visit in Germany at October/2023

Focus on decarbonization and sustainable alternative fuels

Companies, institutes and
Embrapii/FINEP



Alexandre Tuzzi
Presidente, Tuzzi Sistemas
Automotivos S/A



Anderson Ribeiro Correia
Diretor-Presidente, Instituto
de Pesquisas Tecnológicas do
Estado de São Paulo - IPT



Antônio Rogério Bégio
CEO, BFC Produtos e serviços
para solda



Daniel da Silva Motta
Gerente de Inovação e de
Tecnologia, Serviço Nacional
de Aprendizagem Industrial
- SENAI



Érico Flaviano Coimbra Paredes
Diretor técnico, Biosul -
Associação dos Produtores de
Bioenergia de Mato Grosso do
Sul



Fernando Iria dos Santos
Gerente Sr. de Estratégia
e Planejamento Instituto
Eldorado



Igor Manhães Nazareth
Diretor de Inovação e Rela-
ções Institucionais, EMBRAPII
- Empresa Brasileira de Pes-
quisa e Inovação Industrial



Alida Soar Gomes
Assistente de pesquisa e
consultoria do Fraunhofer IPK



David Carlos Domingos
Head of Department do
Fraunhofer



José Borges Frias Jr.
Diretor de Inovação Corporativa,
Siemens



Luciano Rodrigo Pinto
Gerente de Processos, Projetos e
Serviços, Sabó Indústria e Comércio
de Autopeças



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FINEP - Financiadora de Estudos
e Projetos



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Pedro Gayer de Araujo
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mento e Inovação, CTG Brasil



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Carlos Alberto Schuch Bork
Superintendente de Projetos de
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Sylvia Amaral Romanelli
Especialista de Inovação da DTI/
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Leonardo Duarte Paiva
Analista de Inovação da DTI/CNI

Thank You!

Dr. Anderson Correia

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