HZB Helmholtz Zentrum Berlin

Industrial Collaboration Meets Synchrotron Science: *Catalysis for Sustainable Fuels*

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Deputy Head – Strategy Department Energy and Information

Research – Industry

Collaborations

The 8th RD20 Conference 2026 – CSIR ICC, Pretoria, South Africa



Accelerating Innovation

1. Global partnership for a global challenge

Combining complementary German and South African strengths to advance SAF through shared science, expertise and industrial capabilities.

2. Deep research–industry integration

Connecting research and industry through short, iterative feedback loops from catalyst development to piloting and scale-up.

3. Capacity building for lasting impact

Developing the next generation of scientists through mentoring, exchanges and training, while building lasting international networks.

CARE-O-SENE:
where Research meets Impact and Innovation

CARE-O-SENE
Catalyst Research for Sustainable Kerosene

Federal Ministry of Research, Technology and Space

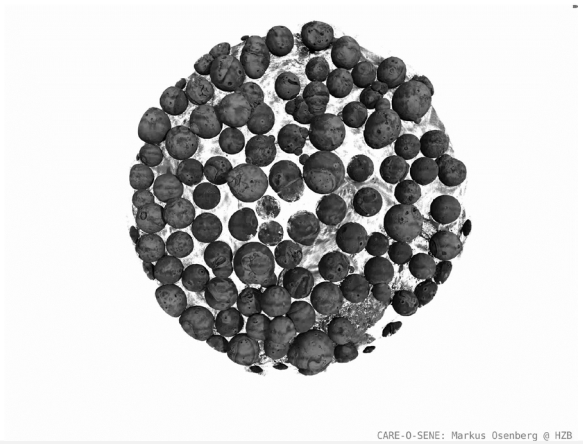
Project Launch



CARE-O-SENE project (40 Mio. EUR) jointly led by HZB and Sasol

launched by:
Chancellor Olaf Scholz and
South African President Cyril Ramaphosa
at Sasol Ltd. In Johannesburg (2022)

High-End Analytics



CARE-O-SENE: Markus Osenberg @ HZB

AI-driven Multi-scale imaging on catalysts at BESSY II

New Catalyst Development



The first catalyst produced on a semi-commercial scale with a yield of over 80% for sustainable kerosene

From catalyst characterization to industrial demonstration: Rollout in 2026 by Sasol Ltd.

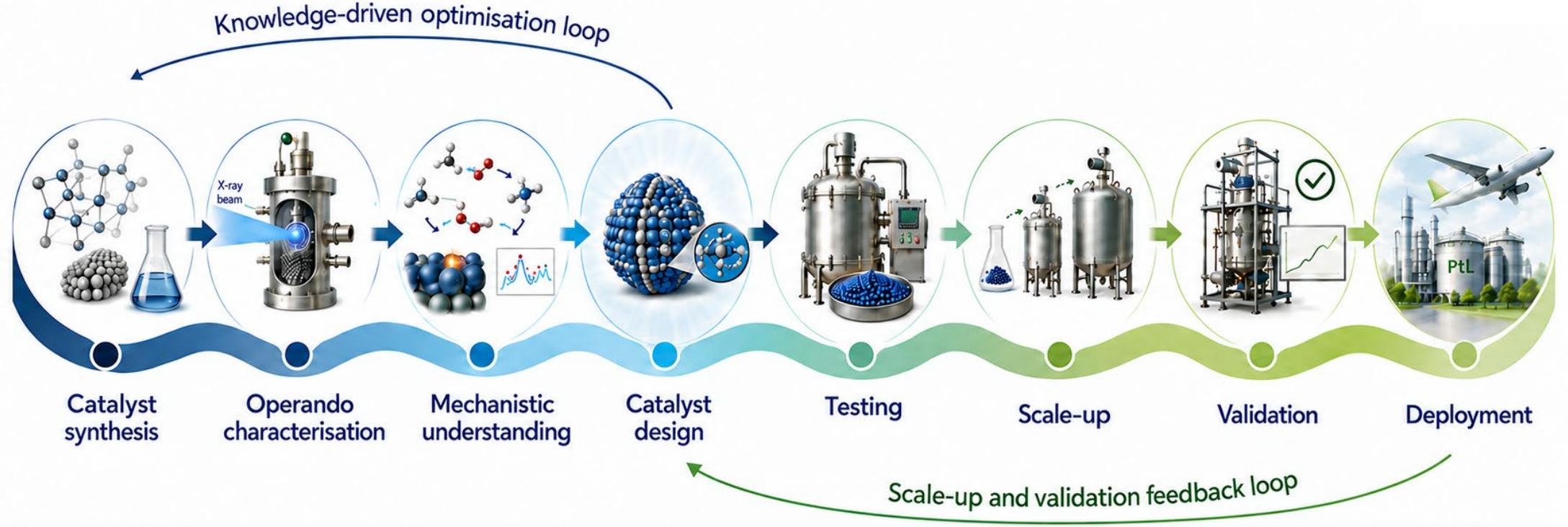
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From fundamental insight to industrial deployment

An integrated innovation pathway for sustainable aviation fuels

CARE-O-SENE
Catalyst Research for Sustainable Kerosene

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Conventional catalyst development and scale-up can be a long road
(Risk mitigation takes time)

- Creates a pathway to **accelerate future applications**
- Advances the “state of the science” of **cobalt PtL catalysts**
- Access to **state-of-the-art characterization** and modeling tools **accelerates understanding and feedback loops**

From synchrotron science to industrial application

BESSY II (HZB), KARA (KIT) and Sasolburg (Sasol)

Catalysts Evolution

- Active phases change during reaction
- Metal-support interactions are dynamic
- Structure under reaction differs from *ex-situ* observations

Operando Synchrotron Science

- Track oxidation state and structure
- Capture transient states
- Probe catalysts at realistic conditions

Industrial Impact

- Explain deactivation mechanisms
- Identify drivers of selectivity
- Enable more reliable catalyst design



From atomic-scale insight to industrial catalyst performance

Delivering high-impact scientific knowledge…

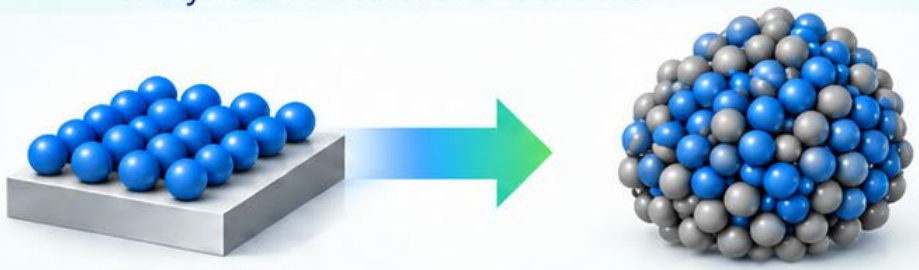
1 Integrated multiscale catalyst research

Links synthesis, atomistic modelling, operando characterization and reactor engineering in one research framework.



2 Bridging model systems and technical catalysts

Connects well-defined model systems with complex supported Co catalysts under realistic FT conditions.

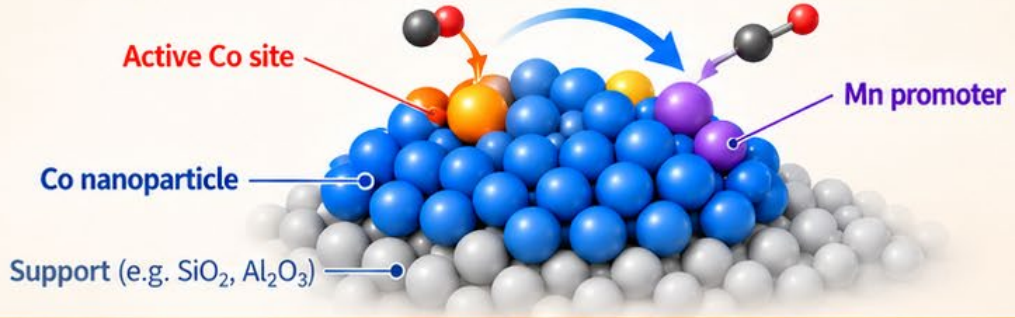


Model systems
(nanoparticles / thin films)

supported Co catalysts under FT conditions

3 Mechanistic understanding of catalyst performance

Reveals how active Co sites, support interactions and Mn promotion govern structure, CO activation and selectivity.



4 Knowledge-driven design of next-generation FT catalysts

Translates fundamental insight into catalyst and reactor design principles for SAF-oriented Fischer–Tropsch processes.



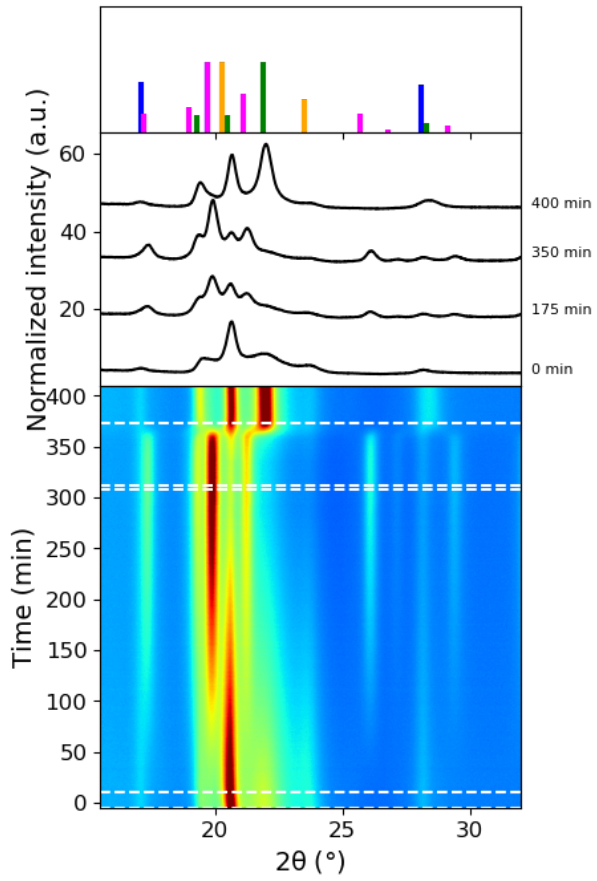
Digital approaches applied to Catalysis Research

Connecting insights with faster technology development

- ***Digital approaches will play an increasing role moving forward in FT catalysis research***
- **Compute and AI Models:** Local data centers and partner for hyperscale
- **Data as a strategic asset:** Meta-analysis of literature and historical data using LLMs and process data
- **Self Driving Labs:** Agentic AI connects prediction, synthesis, characterization, analysis and decisions.
- **Automation of beamlines:** Synchrotron operation and data in the loop

AI can help to shorten innovation cycles through better experiments and faster learning

Synchrotron XRD generates 1000's of spectra in an experiment



HZB/Sasol data, CARE-O-SENE

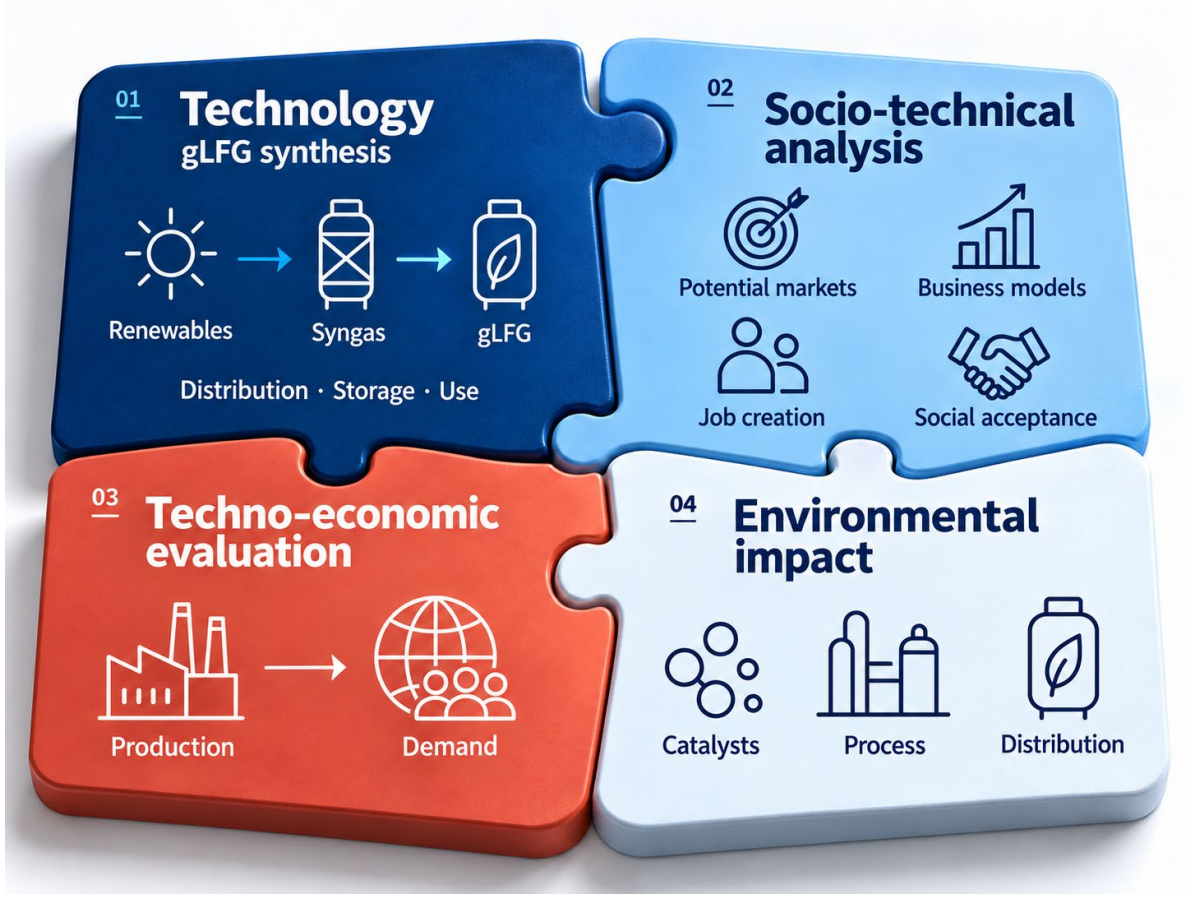
Greening the production and use of liquefied fuel gas in Southern Africa

GreenQUEST
Innovation for clean household fuel

Federal Ministry of Research, Technology and Space

Develop a viable, sustainable green fuel product (gLFG) by combining technological process development with a holistic assessment of the technical, economic, environmental, and social dimensions along the entire gLFG value chain.

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CSIR
JÜLICH Forschungszentrum
HYENA HYDROGEN ENERGY APPLICATIONS
SASSCAL



Industrial Advisory Partners: sasol SHV ENERGY

What drives gLFG market adoption?

Social acceptance study from Cape Town and Kampala

GreenQUEST Innovation for clean household fuel

Federal Ministry of Research, Technology and Space

Household adoption conditions

Affordability
Competitive pricing, flexible quantities

Accessibility
Reliable supply, hybrid distribution

Trust and Safety
Demonstrated safety, consumer confidence

gLFG uptake

Enabling policy and delivery levers

Viable business models
Small cylinders, partial refills and targeted support

Inclusive delivery
Local networks, suppliers and public–private partnerships

de-risk market entry
Safety standards, awareness, real-world trials

Market uptake depends on affordability and delivery models — not technology readiness alone

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FAB-1: First African Beamline

UCT-HZB Joint XAS Laboratory

FAB-1 first african beamline

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catalysis institute

27 February 2026
Inauguration at UCT's Catalysis Institute, Cape Town

Wider Impact

- **Joint laboratory-based hard X-ray absorption spectrometer (XAS)** housed at the Catalysis Institute (UCT)
- **Strengthening the research capacity in Africa**
- **Local capacity building** through HZB training and **support linked to BESSY II**
- Routine local access to **XAS for material science,** combining research with training
- **Access for African researchers** in future through HZB GATE system
- **Strengthens connections between Academia and Industry**

UCT and HZB combine complementary expertise to expand access to advanced X-ray characterization and build lasting research capacity in Africa

HZB–Sasol Industrial Research Fellowship



- **Connects research with scale-up.** Sasol's Fischer–Tropsch expertise informs catalyst research at HZB.
- **Enables reciprocal learning.** Industrial experience meets advanced characterisation at BESSY II.
- **Develops scientific talent.** Mentoring connects early-career researchers with experienced specialists.
- **Broadens the partnership.** Cooperation now extends into digital catalysis, AI and machine learning.



Dr. Denzil Moodley

Senior Scientists at R&T Sasol
Industrial Research Fellow at HZB

Embedding industrial expertise in research strengthens technology transfer beyond projects

Our Teams …



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Catalyst Research for Sustainable Kerosene



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Innovation for clean household fuel

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