

SYNTHETIC FUELS AND CHEMICALS TECHNOLOGY CENTER

Prof. Dr. Hasan Can OKUTAN

R&D Center Project Coordinator

okutan@itu.edu.tr



Prof. Dr. Alper SARIOĞLAN

Chairman of Chemical Eng. Department

asarioglan@itu.edu.tr

- *Founded in 1773. Turkey's first*
- *One of the World's oldest technical university*
- **38 609** students - **2378** academicians
- *110 undergraduate programs*
- *190 graduate programs*

Faculty of Chemical and Metallurgical Engineering

- *Chemical Eng. Department*
- *Metallurgical and Materials Eng. Department*
- *Food Eng. Department*
- *Bioengineering Program*

Undergraduate Programs are accredited by ABET (EAC)



5 Campuses in Istanbul



- ❑ *ITU ranked in the Top 50 for 5 Sustainable Development Goals (SDG) and in the Top 100 for 8 SDGs*
- ❑ *ITU ranked 3rd in the World for SDG 4 Quality Education in THE Impact 2025*
- ❑ *ITU is the World's 38th Most Sustainable Campus*
- ❑ *QS World University Ranking*
 - *Ranked #298 globally- a jump of 28 places from last year*
 - *Globally ranked 79th in Engineering and Technology*
 - *Top in Turkey for Engineering*
- ❑ *ITU founded in 1773 is recognised as the world's third-oldest technical university dedicated specifically to engineering and natural sciences*



- İTÜ-SENTEK is a research center for the production of synthetic fuels and chemicals from sustainable resources, primarily strong on thermal/thermochemical processes.
- Founded on the İTÜ Ayazağa Campus on an area of 800 m² with 8 separate laboratories, enabling successful R&D Projects.
- Financially supported of Turkish Republic Strategy and Budget Presidency under investment plan.
 - 8.000.000 USD
 - 750.000 USD for 2026.
- An important hub for training innovative and creative scientists and engineers specialized in the fields of clean coal technologies, production of energy and chemicals from biomass and waste.



WASTES
SEWAGE SLUDGE



BIOMASS
RICE STRAW, HAZELNUT SHELL, APRICOT KERNEL

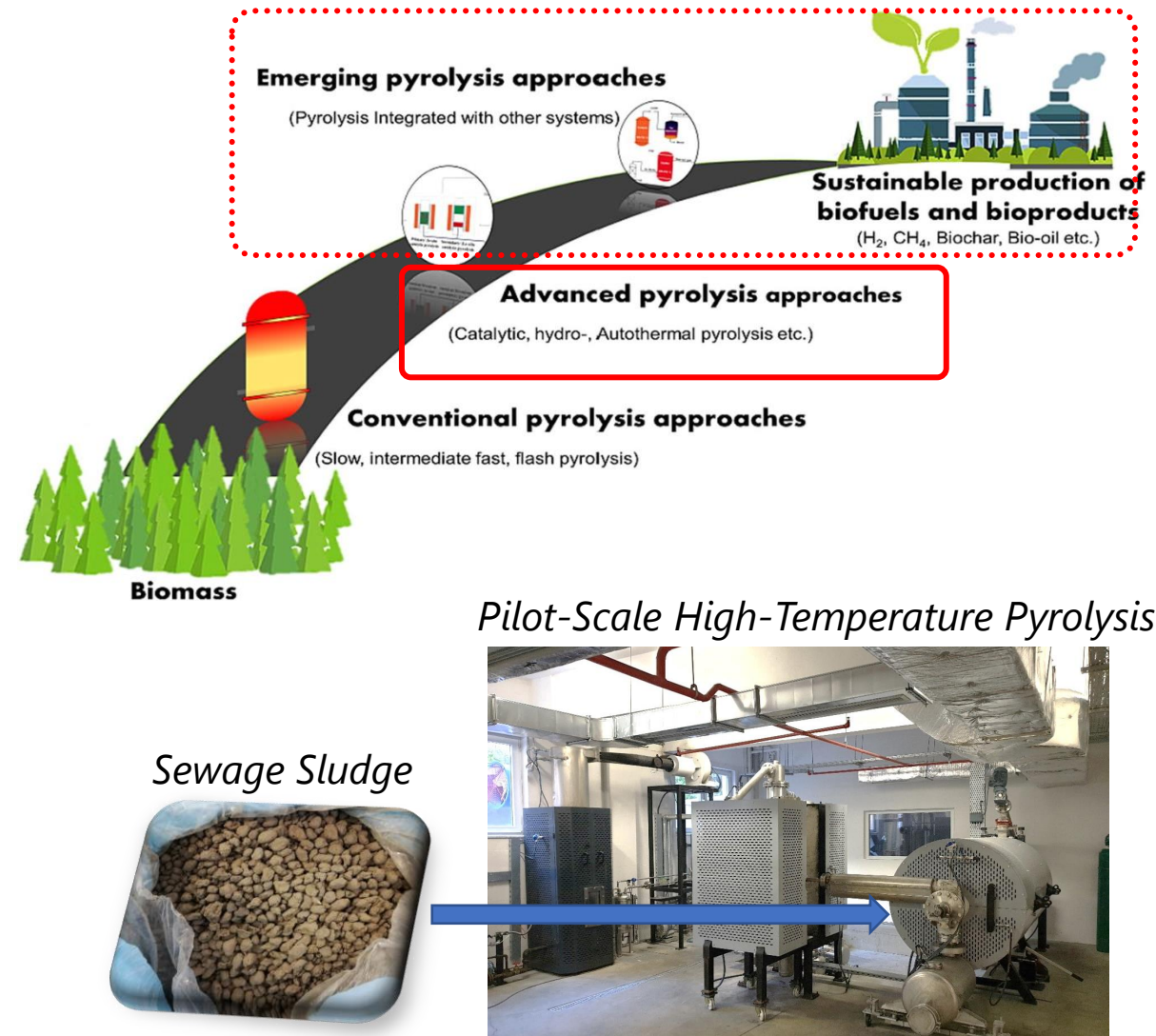


COMPOSITE WASTES
CELLULOSE-PLASTIC

İTÜ-SENTEK Aims to Establish Strategic Collaborations & Develop Partnerships with the Industry

Our applied research and technology development activities include:

- High-Temperature Pyrolysis Technology
- Advanced Fluidized Bed Gasification Technology
- Production of H₂ rich syngas from biomass and waste
- Syngas Conditioning and Gas Clean-up
- Polymeric Membranes For Gas Separation
- Pressure Swing Adsorption
- CO₂ Capture and Utilization Technologies
- Development of Catalyst, Adsorbent and Catalytic Processes
- Production of Sustainable Fuels And Chemicals (Green Methane, Green Methanol, SAF)



Research Laboratories

- Characterization Laboratory
- Thermal Analysis Laboratory
- Membrane Gas Separation Laboratory
- Heterogeneous Catalysis Engineering and Adsorbents Laboratory
- Gasification and Gas Clean-Up Laboratory
- Pyrolysis and Gas Clean-Up Laboratory
- Solid Fuel, Biomass and Waste Pretreatment Laboratory
- CO₂ Capture and Utilization Laboratory

*two-fixed bed pilot scale
Fischer-Tropsch unit*



We Have 5 Research Groups @ İTÜ-SENTEK: Core Technologies Around Thermal Processes

Research Groups @ İTÜ-SENTEK

A. Thermal Processes

Prof. Dr. Hasan Can OKUTAN
Prof. Dr. Ahmet Alper AYDIN
Prof. Dr. Alper SARIOĞLAN
1 Post-Doc, 4 PhD and 3 MSc Students

B. Membrane Gas Separation

Prof. Dr. Ş. Birgül TANTEKİN-ERSOLMAZ
Assist. Prof. Dr. H. Enis KARAHAN
1 Post-Doc, 3 PhD, 2 MSc Students

C. Catalysis & Adsorbents

Prof. Dr. Selim ŞENKAN (UCLA)
Prof. Dr. Hüsnü ATAĞÜL
Prof. Dr. Ahmet SİRKEÇİOĞLU
Prof. Dr. Alper SARIOĞLAN
Prof. Dr. Alireza KHATAEE
1 PostDoc, 4 PhD, 3 MSc students

F. Bioprocess Tech.s – in-progress

G. Carbonization Tech.s – in-progress

D. Process Development & Modelling

Prof. Dr. Devrim Barış KAYMAK
Prof. Dr. Hasan Can OKUTAN
Prof. Dr. Alper SARIOĞLAN
1 MSc Student

E. Sustainability & Life Cycle Assessment

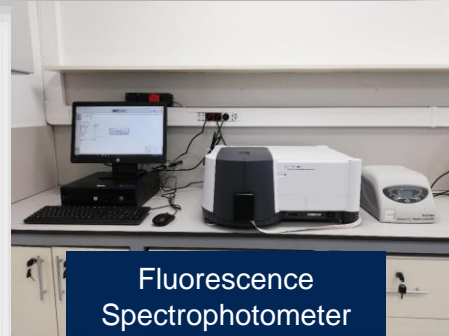
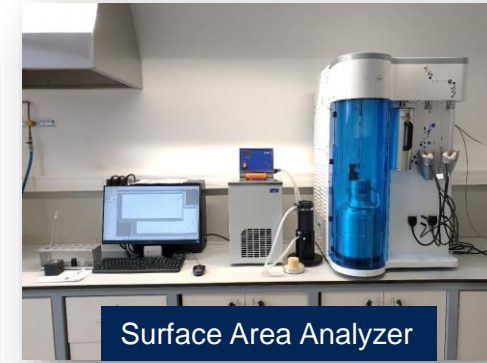
Prof. Dr. Nilgün CILIZ KIRAN (Boğaziçi University)
Prof. Dr. Hasan Can OKUTAN
Prof. Dr. Alper SARIOĞLAN
1 MSc Student

**12 Academic
staff with
12 PhD, 13
MSc, and 1
technician**

**National
Roadmap
Working Group
Leadership:
Green
Technologies
Chemical
Sector**

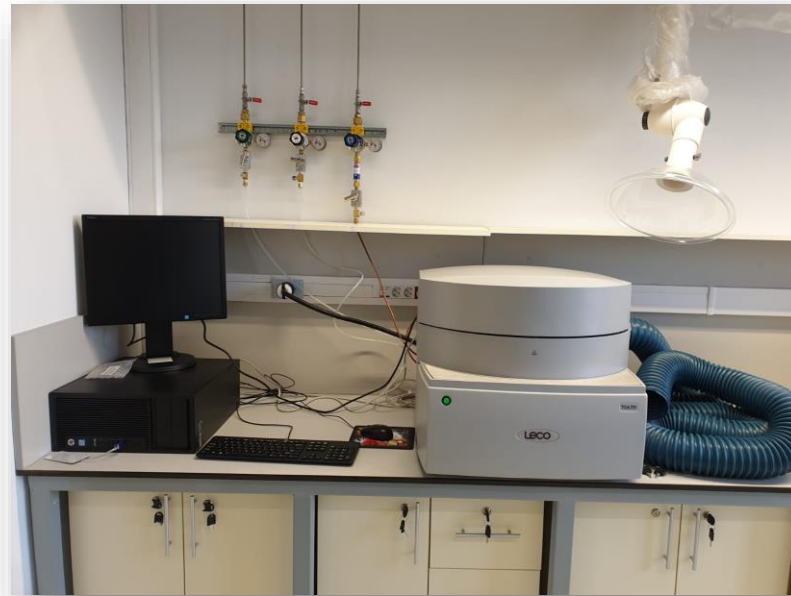
**>30 Projects
in last 5 years:
2 Internationally
Funded (EU,
Scotland),
>20 National,
>10 Industrial**

**Hydrogen
Europe
Research
Association
(HER)**

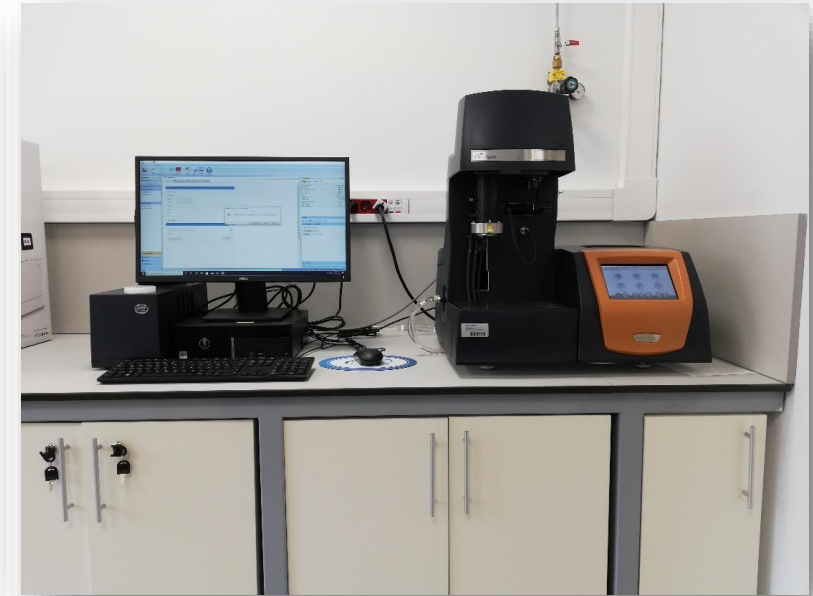




High-Pressure TGA MS



Macro TGA (Proximate Analysis)



Atmospheric TGA

Membrane Gas Separation Laboratory of ITU SENTEK has lab scale equipments to produce hollow fiber membrane and prototype membrane moduls at technology readiness level 4 (TRL4).

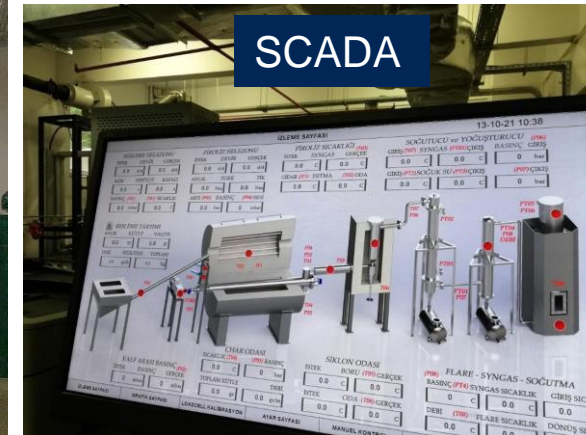


(a) Hollow fiber preparation unit



(b) Gas permeability measurement unit

- Gasification, Pyrolysis and Gas Clean-up Technologies Laboratories of ITU-SENTEK have semi-pilot and pilot scale test units to perform technology demonstration and validation studies at technology readiness level 4-6 (TRL 4-6).

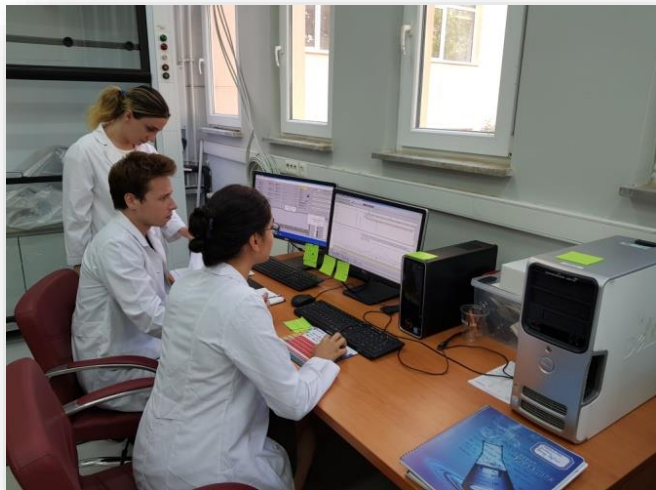


Semi Pilot Gasification and Gas Clean-Up
Continuous fluidized bed gasification unit with 5 kg/h feed and flare system

Pilot Scale Pyrolysis and Gas Clean-Up
High temperature continuous pyrolysis unit with 15-20 kg/h feed



- ITU-SENTEK Catalysis Laboratory is the only catalysis lab in Turkey that owns a high-throughput catalyst screening test system used in catalyst development for heterogeneous catalysis processes.

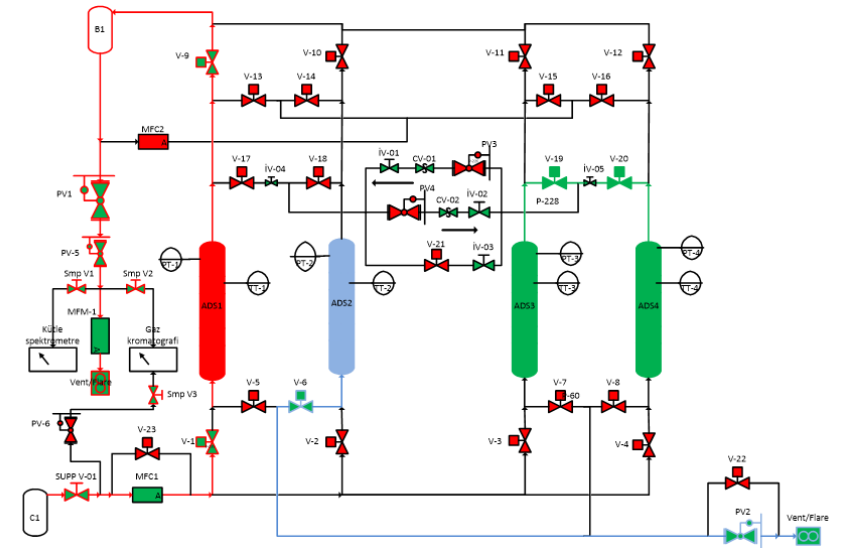


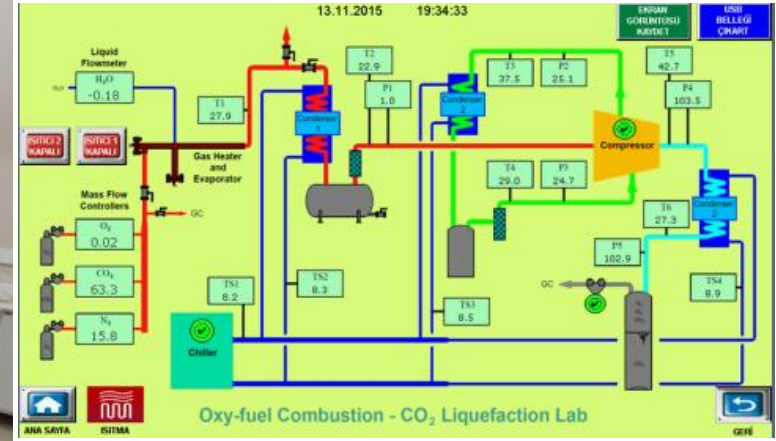


Semi-Pilot Scale FT Reactor Unit



Semi-Pilot Scale PSA Unit

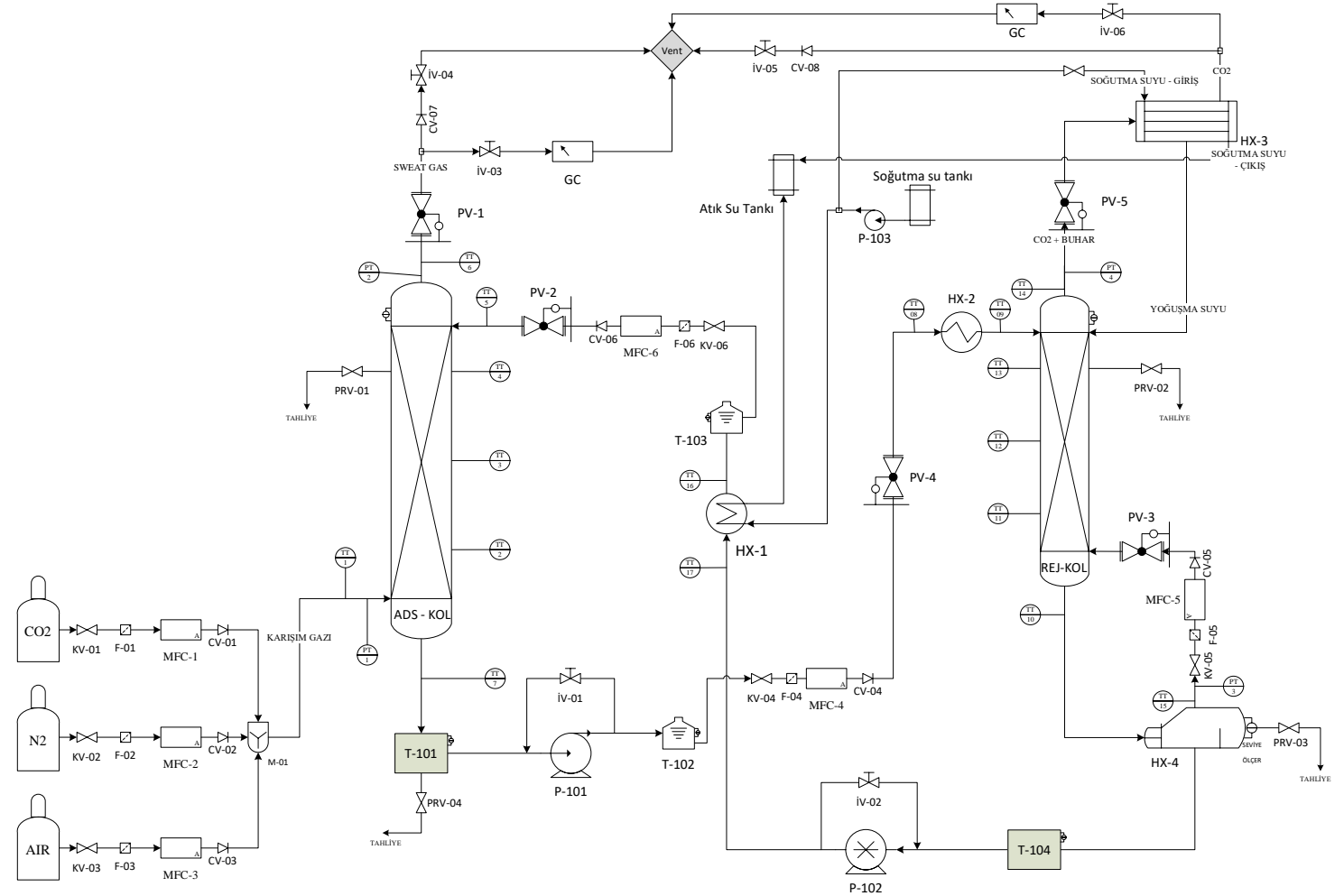




Semi-pilot scale CCS experimental setup

Semi-pilot scale CCS experimental setup

CCS process flow diagram



Semi-pilot Scale CO₂ Separation Test System



We Thank You & All Our Collaborations, & Main Funding Providers



TECHNISCHE UNIVERSITÄT
BERGAKADEMIE FREIBERG
The University of Resources. Since 1765.

TU Freiberg Energy Process Engineering



THE UNIVERSITY
of EDINBURGH



NANYANG
TECHNOLOGICAL
UNIVERSITY
SINGAPORE



Italian National Agency for
New Technologies, Energy and
Sustainable
Economic Development



YONSEI
UNIVERSITY



Shiraz University



Türkiye Bilimler Akademisi
TURKISH ACADEMY OF SCIENCES



REPUBLIC OF TÜRKİYE
MINISTRY OF ENERGY AND
NATURAL RESOURCES



TENMAK



Mohammed VI
Polytechnic University



北京理工大学
BEIJING INSTITUTE OF TECHNOLOGY



A.V. Topchiev Institute of
Petrochemical Synthesis
Russian Academy of
Sciences



GaPP.green

Frimpeks

KIER SCHOOL UST

1. Environmentally Compatible Sustainable Advanced Vehicle Technologies (ILATERA) Platform Project - **Turkish Scientific and Technological Research Council (TUBITAK)**

- Development of Hydrogen-Based Fuel Properties Suitable for PEM Fuel Cells and Internal Combustion Engines
 - Hydrogen Production from Sugar Beet Pulp via Catalytic Gasification

2. Development of a High-Performance Polymer-Based Hollow Fiber Membrane Containing a Selective MXene Nanosheet Layer for Clean Hydrogen and Methane Production from Syngas – **TUBITAK**

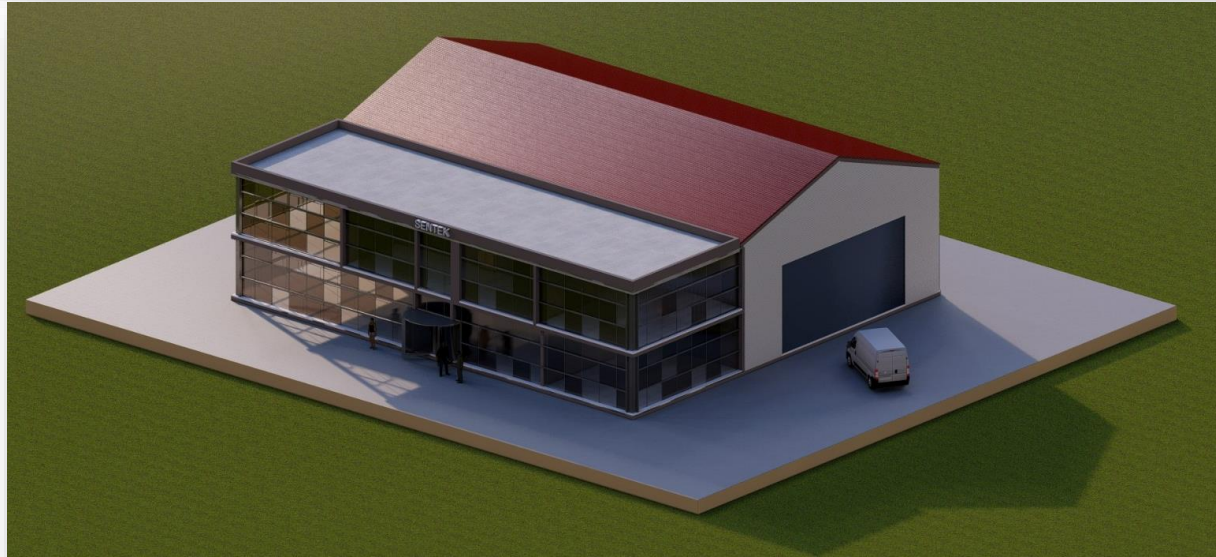
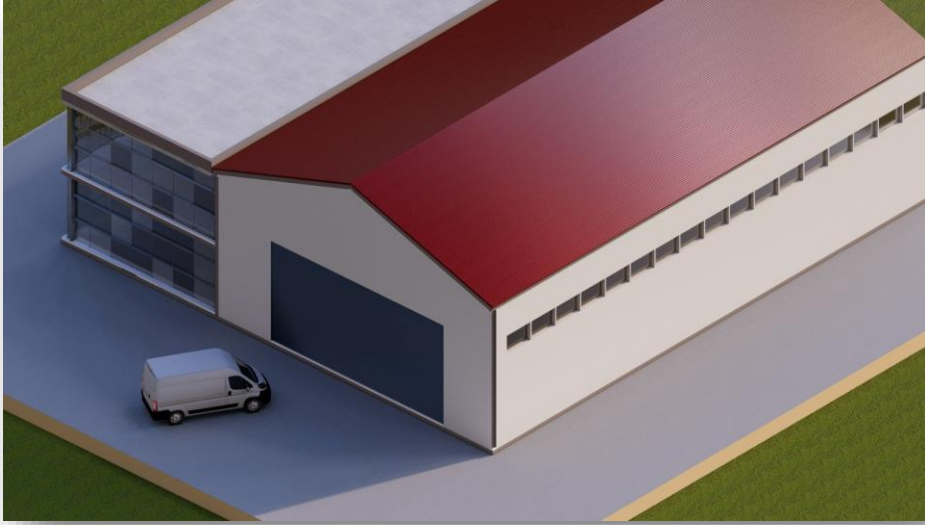
3. Thermochemical Synthesis of Biomass-Derived Carbon- and Metal-Based Nanoparticles for Bioenergy Production and Antimicrobial Applications – **TUBITAK-BIDEB-2232-B**

4. Utilization of Carbon Dioxide Captured from Air via Methanation-**TUBITAK** in cooperation with Morocco

5. Development of an Integrated CO₂ Capture and Slag Mineralization Process for Steel Production- **Turkish Energy, Nuclear and Mineral Research Agency (TENMAK)**

6. High Temperature Pyrolysis of Sewage Sludges- **GaPPGreen**
7. Green Hydrogen and Methane Production From Composite Wastes and Process Development by High Temperature Pyrolysis Technology- **Frimpeks A.Ş.- GaPPGreen**
8. Valorization of Aluminum-Containing Composite Waste through Pyrolysis for the Production of High-Value Products- **GAPPGreen**
9. Production of Activated Carbon and Hydrogen Rich Syngas from Hazelnut Shell and Apricot Kernel Shell by High Temperature Pyrolysis Technology - **CEIBA**
10. Sustainable Aviation Fuels Project- **ALTACA Energy and TÜPRAŞ**
11. High Temperature Pyrolysis of TOGG Car Factory's Waste For the Hydrogen Rich Syngass Production- **TOGG**

New Hall Under Construction (2026)



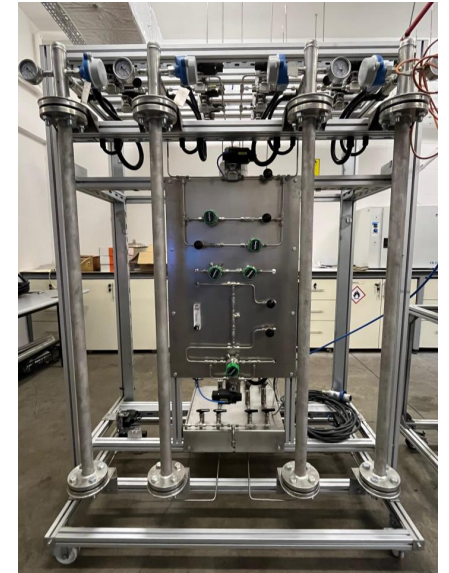
İTÜ-SENTEK, *a Technology Symbiosis Hub for a Sustainable Future*

At ITU, we are building a new research hall to host:

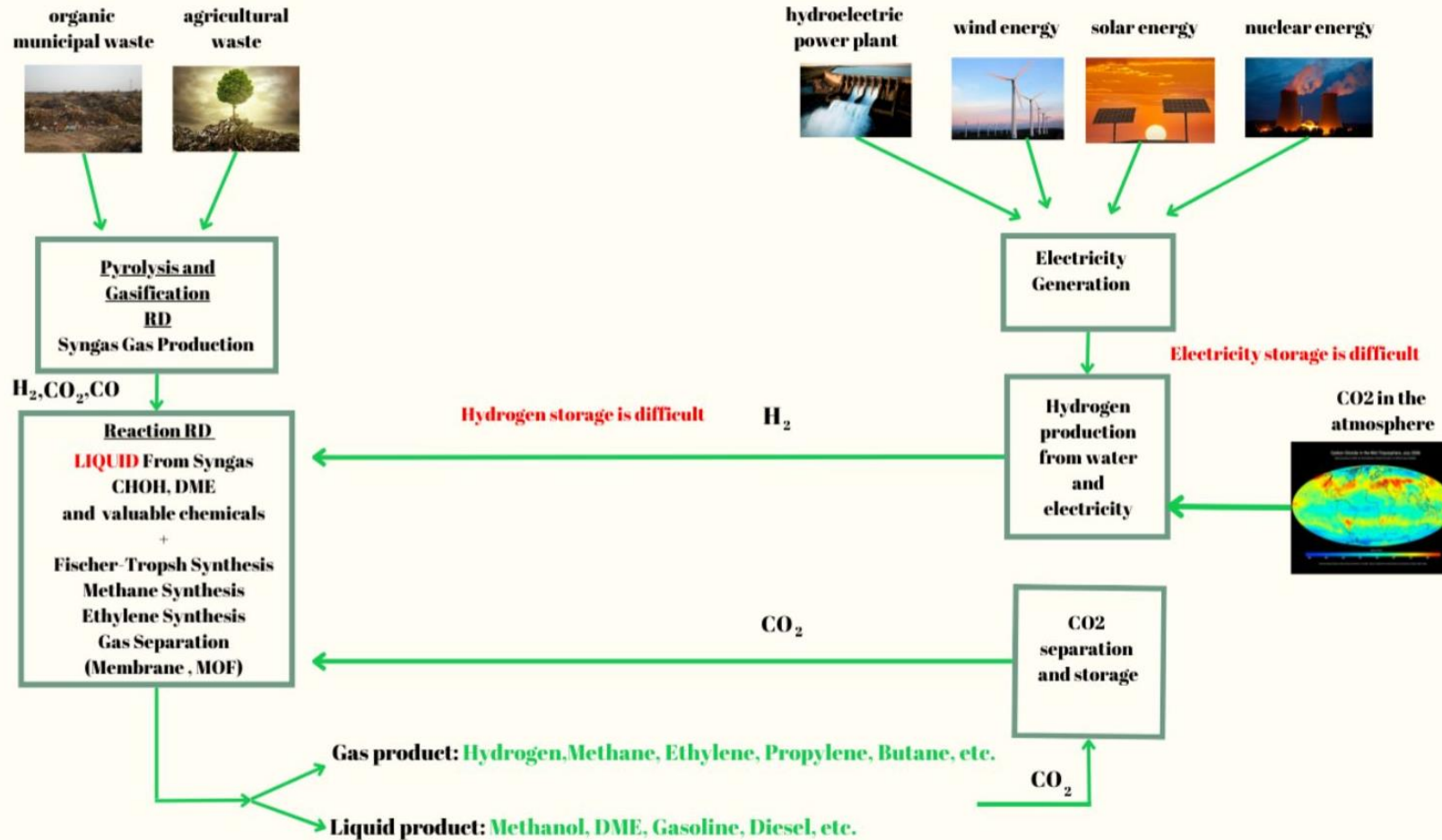
- Bubbling fluidized bed gasifiers
- High temperature pyrolysis units
- CO₂ capture systems (MEA sorption and cryogenic based gas separation units)
- H₂ purification (PSA Unit)
- RWGS + Fischer–Tropsch Synthesis Test Rig

This facility will serve as a technology symbiosis hub, enabling:

- End-to-end demonstration of integrated circular carbon technologies
- Consortium-scale projects bridging academia, industry, and policymakers
- Platform for EU Horizon and EU-COST collaborations



ITU Synthetic Fuels & Chemicals Technology Center (Future Target)



**THANK YOU!
TEŞEKKÜRLER!**