

# ReCaLI – Recycling catalysts for use in oil refineries in Vietnam

## Client II – International partnerships for sustainable innovation

Increasing global demand for basic chemicals such as propane is forcing developing and producing countries in particular to find innovative approaches to ensuring their supply. Propane is an essential and versatile building block for the production of everyday objects such as automobile fittings made of polypropylene (PP) or polyacrylic textile fibres (PAN). Since propene is not produced to a sufficient extent in standard oil-refining processes and tonnes of spent catalysts are produced daily, countries with limited access to high-quality crude oil, such as Vietnam, face special challenges. For these countries, local production of propane and a switch to biogenic input materials is therefore essential. Against this backdrop, the German-Vietnamese project “ReCaLI” develops modified technical fluid catalytic cracking (FCC) catalysts based on the shared use of spent catalyst material.

### Recycling spent catalysts

One of the most important refining processes in the production of fuels and chemical products from crude oil is fluid catalytic cracking (FCC). A catalyst is used to improve the process. Catalysts act, among other things, by collecting deposits of environmentally hazardous and unhealthy hydrocarbons and metals such as nickel, iron, and vanadium. Every day, several tonnes of spent catalyst are created at every oil refinery around the world. In many countries, the catalysts are disposed of in landfills or building materials without any form of prior treatment, thus representing a great risk to humans and the environment.



Accumulated spent catalyst filled in big packs.

Spent FCC catalysts still contain important raw materials such as metals, rare earth elements, or silicon and aluminum compounds. However, little work has been done to date to establish a process for the recovery of these resources. The “ReCaLI” project, therefore, aims to recycle spent FCC catalysts. In the course of the project, the recovered components are converted into new industrial catalysts and other commercially exploitable products. This will be done in the country where they are produced using locally available resources.

For PetroVietnam, the operator of a refinery in Dung Quat, Vietnam, meeting the growing demand for propene is a major challenge. On top of this, with the generation of up to 18 tons of spent FCC catalyst per day, the company is also faced with a landfill and recycling problem.

### Producing selective catalysts from residues

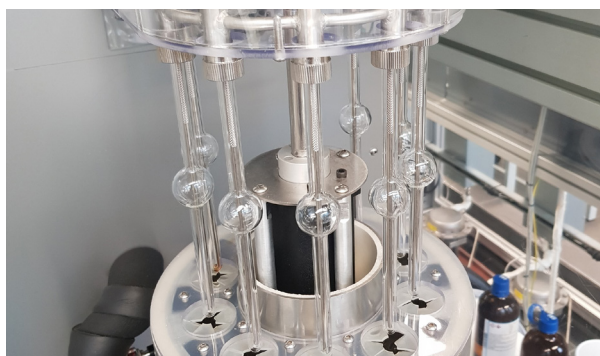
The increasing demand for propene also requires the adaptation of product selectivity in the FCC process and can be realized using catalyst additives. In the “ReCaLI” project, various aluminosilicates are used as the main catalyst components and additives. “ReCaLI” is committed to researching specific seed crystals to implement synthetic solutions with low-quality defects under the prevailing technical conditions in Vietnam.

In general, the use of catalyst additives leads to an improvement in selectivity and higher raw material efficiency of the catalysts used. However, at the same time, it also leads to a deterioration in regeneration and lifetime. This problem results in the need for innovative catalysts or catalyst additives. The catalysts developed as part of “ReCaLI” will be designed to meet the challenges of the FCC process, the increasing need for propene and the change in resources to lighter fossil and biogenic raw materials, including in technical applications.

The “ReCaLI” project can combine and expand on experience gained from previous research projects to create a sustainable, industry-oriented overall concept. The project covers a range of topics, from catalyst recycling and design to the development of technical catalysts for converting fossil and biogenic raw materials.

### Sustainability in the refinery

In Vietnam, catalyst research, catalyst recycling, and the subsequent exploitation of the project's results for catalyst development and use at the Dung Quat refinery are of great economic and local political interest with regard to the public image of the oil industry. Cooperation with Vietnamese research institutions and companies with international partners is therefore supported by the Vietnamese Ministry of Science and Technology.



Catalyst testing equipment for investigating recycled materials.

By adding biogenic raw materials and residues to lower-quality crude oil in order to produce basic chemicals and fuels, "ReCaLI" aims to help establish a bioeconomic and socially acceptable supply of resources in Vietnam.

The recycling of spent catalysts serves to close the material cycle for a more environmentally friendly catalyst production. This is relevant for the transition to clean energy and sustainable raw material use, especially before widespread electromobility is achieved and in emerging markets in particular in the short and medium-term. It may also be possible to use the methods developed by "ReCaLI" in other countries.

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