

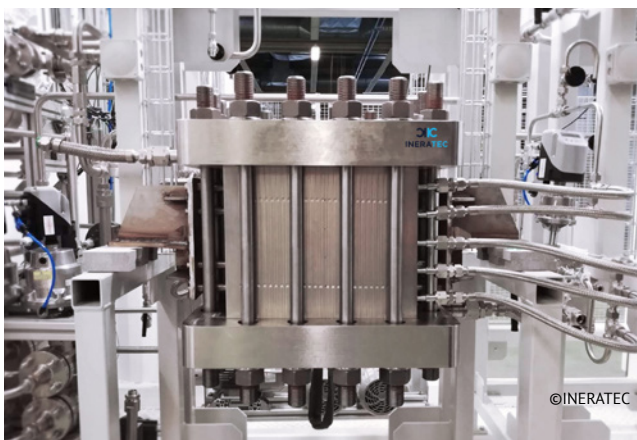


# GAS-TO-LIQUID MODULARITY & SCALE-UP

## INERATEC GmbH

**INERATEC provides modular chemical plants for Power-to-X and Gas-to-Liquid applications and supplies sustainable fuels and products. Hydrogen from renewable electricity and greenhouse gases like CO<sub>2</sub> are converted into e-kerosene, CO<sub>2</sub>-neutral gasoline, clean Diesel or synthetic waxes, methanol or SNG.**

The innovative reactors provide a high load flexibility as well as quick start-up and shut-down times. Therefore, the reactors are perfectly suitable for fluctuating renewable energy applications, e.g. wind or solar. With this reactor concept a cost-efficient, modular numbering-up becomes possible, meaning that standardized units are multiplied to reach higher capacities instead of a traditional scale-up.



FT-reactor (125kWh)

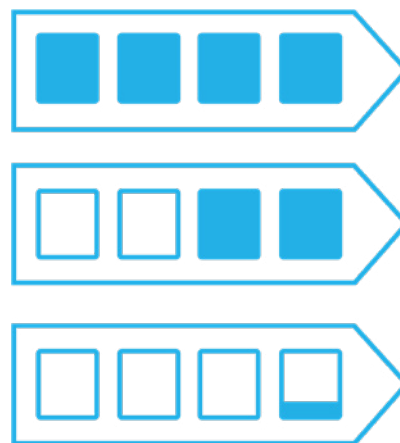
## MODULAR PLANT CONCEPT

### MODULAR PLANT CONCEPT & LOAD FLEXIBILITY

The development of a modular concept for INERATEC's synthesis reactors and plants has been developed in the EU-funded project FLEXCHX. Besides the numbering-up approach, the modular character of the units also enables flexible operation.

- > Partially reducing/increasing the load of one or more reactors or
- > Pausing of individual units
- > Goal: Following the changing loads of the electric grid

**INERATEC's modular technology provides the potential of partial load operation within a range of 10 to 100% of nominal load.**



Visualization of load flexibility concept

## PLANT SCALE-UP AND NUMBERING-UP

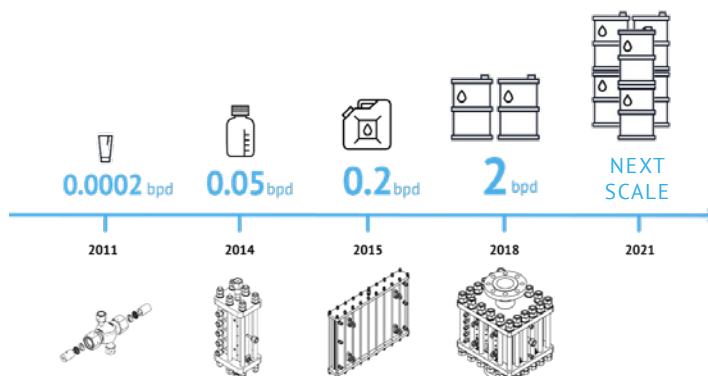
**INERATEC scales-up on two levels:  
The reactors and the synthesis units.**

### REACTOR SCALE-UP

INERATEC has scaled-up the Fischer-Tropsch (FT) reactor from the first lab-scale microstructured FT-reactor with 0.0002 bpd capacity to an industrial 2 bpd reactor in 2018.

The concept for the next scale reactor with a capacity of 8 bpd has already been elaborated. The reactor scale-up has been part of the Horizon 2020 project COMSYN.

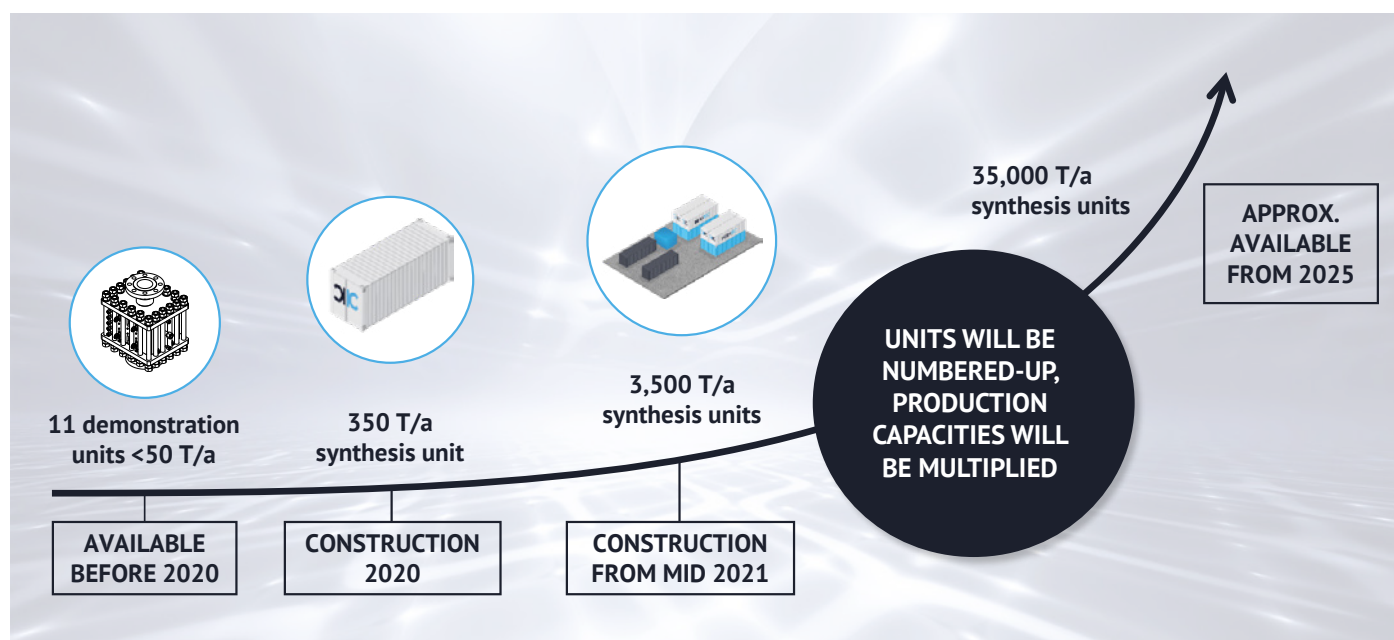
Further reactor scale-ups are under development. In each synthesis unit, several reactors are installed.



### NUMBERING-UP

In the FLEXCHX project, INERATEC has worked on industrial size synthesis units. They are equipped with the scaled-up FT-reactors. By multiplying the number of FT-reactors, the capacity of one synthesis unit is increased. The concept is called "numbering-up". In the next step, by multiplying the number of synthesis units, the chemical plant's capacity is increased. This enables a more flexible, step-by-step scale-up which is cost-efficient, low-risk and especially holds potential for renewable applications.

11 demonstration units with production capacities <50 T/a have already been installed before 2020. The first industrial-scale synthesis unit contains eight FT-reactors and was manufactured in 2020. This synthesis unit will be multiplied to reach even higher production capacities.



**Scale-up of the plant capacity by numbering-up reactors and synthesis units.**

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### PROJECTWEBSITES

<https://www.comsynproject.eu/>  
<http://www.flexchx.eu/>

### COMSYN



### FLEXCHX

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