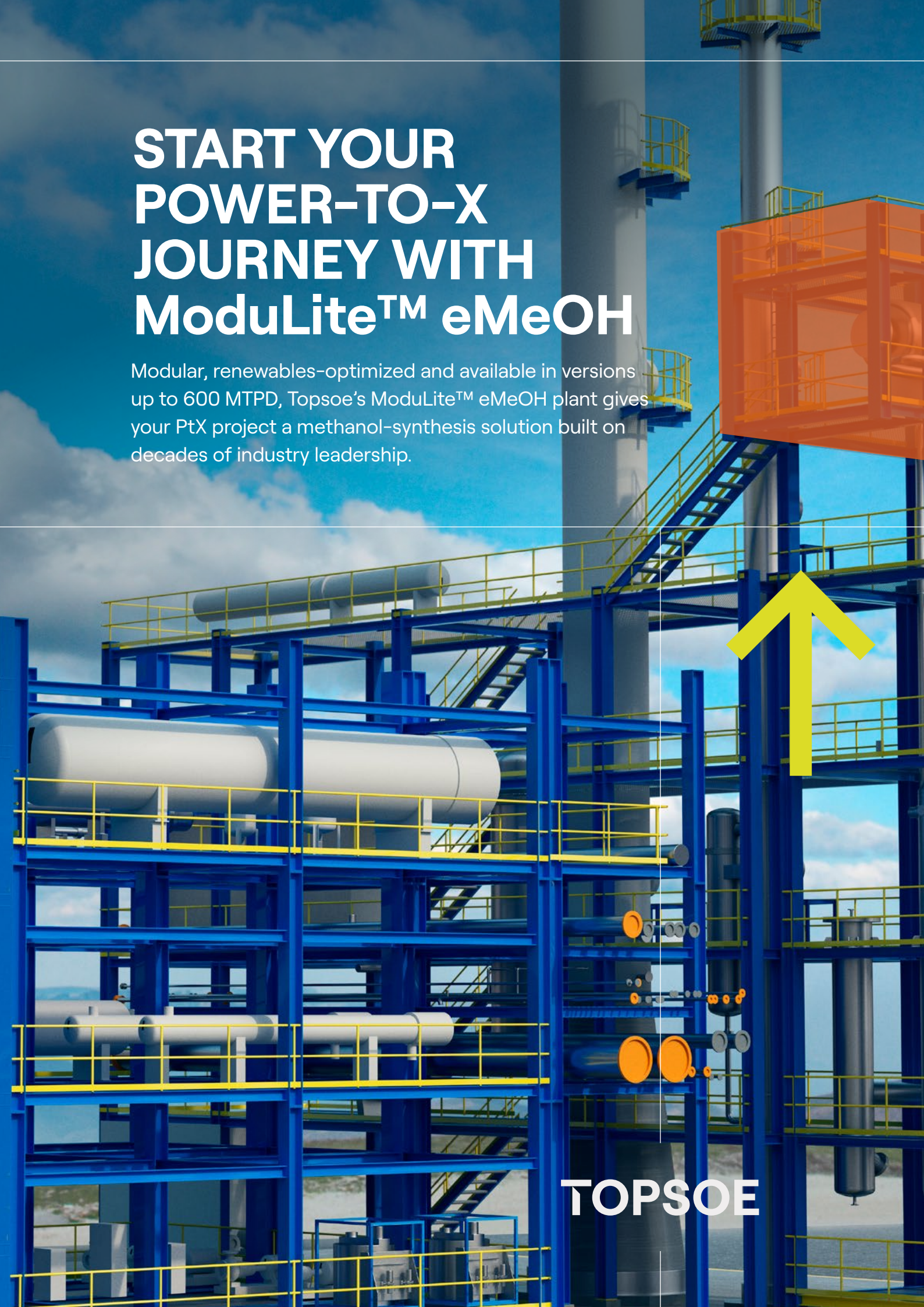


START YOUR POWER-TO-X JOURNEY WITH ModuLite™ eMeOH

Modular, renewables-optimized and available in versions up to 600 MTPD, Topsoe's ModuLite™ eMeOH plant gives your PtX project a methanol-synthesis solution built on decades of industry leadership.

TOPSOE

IF YOU'VE GOT THE P, WE HAVE THE X

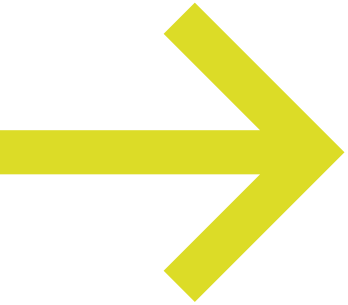
For developers who want to produce eMethanol, choosing the right methanol-synthesis partner is critical.

While electrification is the low-carbon way forward for cars and other light vehicles, decarbonizing hard-to-abate sectors like shipping, aviation, steel and cement will take more.

Specifically, it will take Power-to-X (PtX), a process that uses renewable power to produce hydrogen from water, and then converts the hydrogen into other green chemicals such as eMethanol. The resulting end-products can be used as green alternatives to diesel and other fossil fuels, or to facilitate decarbonization in other applications.

Most Power-to-X pioneers are already experts in renewable power – the 'P' in the PtX equation. The 'X', however, involves processes and technologies used in the chemicals industry and are less familiar to many players in renewable power.

For developers who want to produce eMethanol, the gap between 'P' and 'X' makes choosing the right methanol-synthesis partner critical. And with 50 years of experience in methanol, unmatched insight into plant efficiencies and optimization, and the breakthrough ModuLite™ eMeOH solution, Topsoe has what it takes to guide you on your way.



GREENER PASTURES FOR CHEMICAL PLANTS

Wind and solar project developers aren't the only companies taking a hard look at PtX. Fossil-based chemical plants are also seeing new revenue streams in eFuels and other PtX products. Here, the challenge lies in understanding the intricacies of energy-transition goals, timelines and strategies, as well as the rapidly evolving market for PtX products.

If your plant is ready to take the eMethanol leap, partner with Topsoe. We know chemical plants – most likely even your own. We know Power-to-X. And we are ready and able to guide you into the PtX business with expert advice and proven technologies.

INTRODUCING ModuLite™ eMeOH

To produce eMethanol from green hydrogen and captured CO_2, a methanol-synthesis loop is needed. Not just any loop, but one that meets the needs of eFuel producers, meaning modular, designed for hydrogen + CO_2 feedstock, and available at the right scale.

Designed as a prefabricated, truckable solution, Topsoe's ModuLite™ eMeOH plant meets all these needs and delivers exceptional value.

Modularity and prefabrication mean the solution can be delivered and commissioned much faster than methanol loops built on site, enabling you to start production much sooner. ModuLite™ also ensures easy transport and installation anywhere – including remote off-grid PtX project sites.

The solution includes an industry standard, referenced methanol-synthesis loop and our MK-417 SUSTAIN™ catalyst. This catalyst boasts stability, selectivity and mechanical strength all optimized for producing eMethanol from green hydrogen and CO_2. The plant as a whole is operationally flexible and able to adapt to a variety of variables, such as intermittent power supply.

Combined with availability in four output tiers from 150 to 600 MTPD, these strengths result in a proven solution that accelerates revenue intake and minimizes costs and risk.

Assembled on site from prefabricated, truckable modules

AN eMeOH PLANT FOR EVERY PROJECT

ModuLite™ eMeOH TIER 1

- Nominal capacity: 150 MTPD
- Product quality: Grade AA
- H_2 consumption: 13,300 Nm^3/h
- CO_2 consumption: 4,500 Nm^3/h

ModuLite™ eMeOH TIER 2

- Nominal capacity: 300 MTPD
- Product quality: Grade AA
- H_2 consumption: 26,600 Nm^3/h
- CO_2 consumption: 9,000 Nm^3/h

ModuLite™ eMeOH TIER 3

- Nominal capacity: 450 MTPD
- Product quality: Grade AA
- H_2 consumption: 39,900 Nm^3/h
- CO_2 consumption: 13,500 Nm^3/h

ModuLite™ eMeOH TIER 4

- Nominal capacity: 600 MTPD
- Product quality: Grade AA
- H_2 consumption: 53,200 Nm^3/h
- CO_2 consumption: 18,000 Nm^3/h

PtX BASICS

Power-to-X is a process whereby electricity from renewable sources, biogenic CO_2 and other feedstocks are combined to produce eFuels and other PtX products needed by shipping, aviation, steel, cement and other heavy industries to abate their carbon emissions.

In many countries, helping such industries decarbonize is critical for meeting carbon-reduction goals. In Europe, for example, the EU has made a legally binding commitment to achieve climate neutrality (zero net emissions) by 2050, with a 55% reduction by 2030 established as an interim target.

Most PtX projects combine a wind or solar farm with a hydrogen electrolyzer and downstream plants that use hydrogen to produce desired end-products like eMethanol. Today, shipping companies operating dual-fuel vessels are the major off-takers for eMethanol, which is used as green fuel.

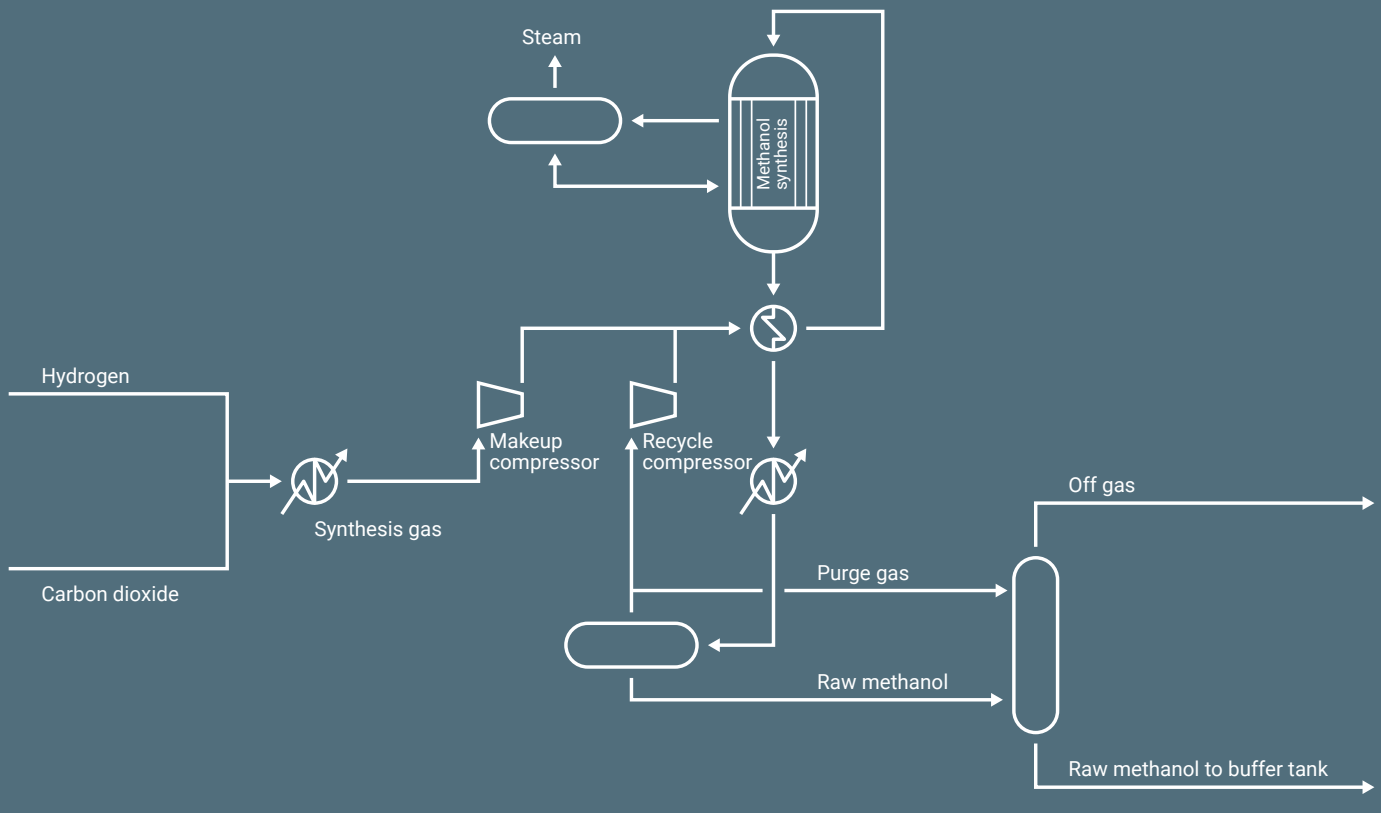
Due to its importance in global decarbonization, PtX presents huge growth potential for energy-project developers and chemical plants. Because we are entering a low-carbon age, where green energy will no longer be a luxury but a license to operate, PtX is a strategic opportunity that few can afford to ignore.

THE VENERABLE TOPSOE LOOP

Topsoe has been supplying methanol loops and carrying out converter revamps for over 40 years, with more than 50 references worldwide. Our loops enable the most straightforward and effective processes possible. They operate at the lowest cost, leave the lowest environmental footprint, and ensure a very fast time to market.

One advantage with Topsoe loops is that we also supply customer-optimized catalysts, and have delivered hundreds of charges of methanol-synthesis catalyst over the years. The loop in a Topsoe ModuLite™ eMeOH plant uses Topsoe's MK-417 SUSTAIN™ catalyst, developed especially for the demanding work of synthesizing methanol from green hydrogen and biogenic CO_2.

A further optimization for eMethanol production is that the loop is dynamic, consuming hydrogen directly as the electrolyzer produces it. This ability to adapt to fluctuations in hydrogen production eliminates the need for costly hydrogen storage.



ABOUT ModuLite™

Intended for use in PtX applications, Topsoe's ModuLite™ systems are complete plants built from prefabricated, truckable modules. The benefits of a ModuLite™ plant include rapid deployment, a plug-and-play architecture, and less work on site – all of which gets production and revenue flowing sooner, while reducing risk and maximizing profits.

ModuLite™ plants are modular solutions in the sense that each plant comprises a number of prefabricated modules, plus a few "stick built" components. Each plant is designed to meet specific production volume requirments, and most plant types, such as the ModuLite™ eMeOH plant, are availalble in a range of output capacities.

ModuLite™ plants are particularly well suited for Power-to-X applications, but Topsoe has been working with and perfecting modular plant concepts for decades. Innovation meets certainty with every ModuLite™ system.

PtX BEYOND METHANOL

When you partner with Topsoe for your eMethanol synthesis solution, you partner with a storied industry leader that is wholly committed to the energy transition and to innovating solutions that will enable it. Alongside our ModuLite™ eMeOH plant, we are developing a ModuLite™ ammonia synthesis plant and a solution for producing green jet fuel, with other processes to follow.

Upstream, our SOEC electrolyzer for producing green hydrogen is a revolutionary technology with industry-leading efficiency and the ability to produce more hydrogen for every megawatt of renewable energy used.

Founded in 1940, Topsoe is a global leader in developing solutions for a decarbonized world, supplying technology, catalysts, and services for the worldwide energy transition.

Our mission is to combat climate change by helping our partners and customers achieve their decarbonization and emission-reduction targets, including those in challenging sectors: aviation, shipping, and the production of crucial raw materials. From low-carbon or zero-carbon chemicals, to renewable fuels and plastic upcycling, we are uniquely positioned to aid humanity in realizing a sustainable future.

Topsoe is headquartered in Denmark, with 2,400 employees serving customers all around the globe. To learn more, visit topsoe.com.

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