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PRESS RELEASE

New Report: Alternative Naphtha – Technologies and Market, Status and Outlook

For the defossilisation of the chemical industry it is crucial to replace fossil-based naphtha by alternative naphtha in refineries and crackers

Hürth, 16 July 2024: For the defossilisation of the chemical industry it is crucial to find alternatives to fossil-based naphtha. The “alternative naphtha” concept makes use of existing refinery, steam cracking and chemical industry infrastructure where a proportion of fossil-based feedstocks – crude oil or fossil-based naphthas can be replaced by renewable carbon alternatives derived from the three sources of renewable carbon: CO₂, biomass and recycling.

This new report by nova-Institute presents an analysis of the routes, associated technologies, market players and volumes by which renewable carbon can be introduced to refinery and steam cracking operations as replacement for fossil-based feedstocks.

With 188 pages, 22 tables and illustrated by 48 graphics the report provides a comprehensive view on the growth in capacity for these alternative sources of naphtha as chemical industry feedstock, production routes and the need for “upgrading”, key companies and partnerships and the regulatory environment.

The need for “alternative naphtha”

Base chemicals – aromatics and olefins are the essential start point for some of the largest volume fossil-based chemical polymers and products used today, such as polyethylene (PE), polypropylene (PP), polyester (PET), polystyrene (PS), polyamide (PA) and others. Light naphtha is a key feedstock for steam cracking processes to produce olefins and polymers such as PE, PP in Europe and Asia. Fossil-based refinery naphthas are converted to reformat for the production of aromatics and polymers such as PS and PA. This means that there is an important and urgent need to find renewable carbon-based replacements to meet net-zero goals.

Renewable products and “alternative naphtha”

The “alternative naphtha” concept makes use of existing refinery, steam cracking and chemical industry infrastructure where crude oil or fossil-based naphthas can be replaced by renewable carbon alternatives derived from the three sources of renewable carbon: CO₂, biomass and recycling and the renewable carbon input is attributed to one or more output chemicals.

Refined vegetable oil for bionaphtha

World capacity for hydrotreated or hydrogenated vegetable oil (HVO) / hydrogenated esters and fatty acids (HEFA) output was estimated at 18.2 million tonnes worldwide in 2023 with planned projects to take annual capacity to close to 40 million tonnes by 2026.

The process known as HVO or HEFA, has been developed primarily to produce bio-based diesel and/or SAF (synthetic aviation fuel) from vegetable oils and waste oils with bio-based naphtha as a co-product.

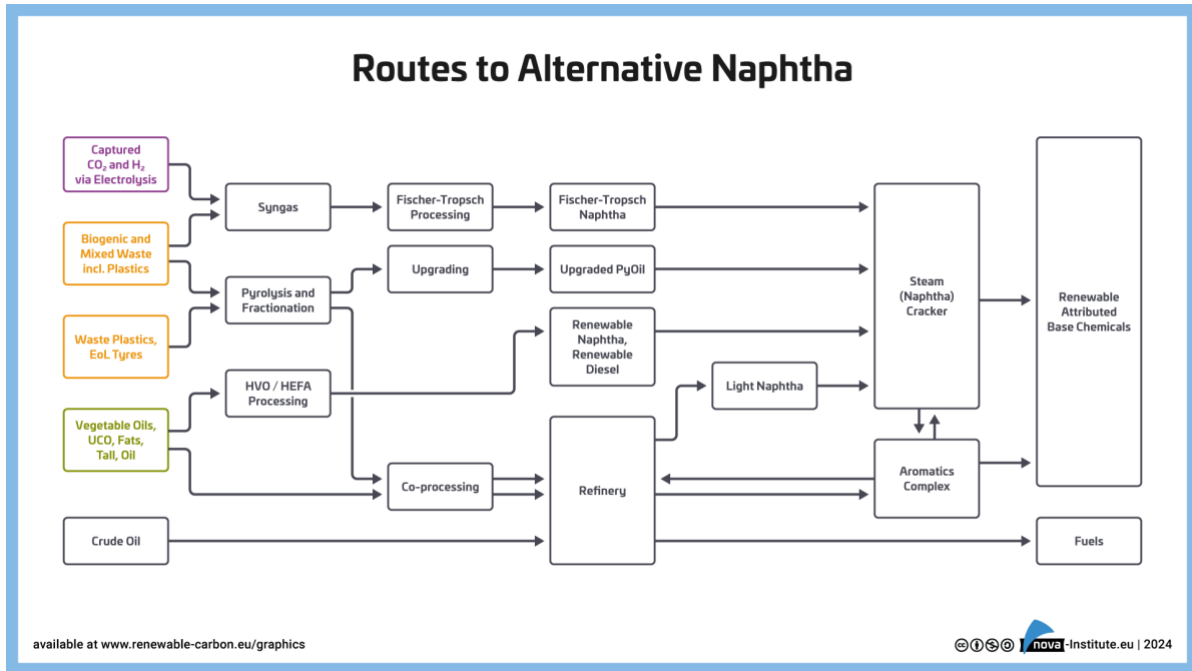


Figure 1: Key Routes for Introduction of Renewable Feedstocks to Refinery & Petrochemical Operations – “Alternative Naphtha”

The bio-based naphtha component, and dependent on the configuration of the steam cracker, the renewable (bio-based) diesel component from the HVO/HEFA process can replace fossil-based light naphtha as a steam cracker feedstock.

While there were an estimated 44 HVO/HEFA producing facilities worldwide in 2023, the number of companies active in providing feedstock for attributed chemicals via steam cracking is very much smaller and dominated by four key companies. Based on currently known projects, production for the chemical industry is expected to rise to approximately 1.6 million tonnes by 2026.

Pyrolysis Oil (PyOil) from plastics and tyres

Pyrolysis of plastics and tyres has grown significantly in interest in the past 2-3 years because it offers circularity for plastic containing wastes which are often difficult to recycle by mechanical means.

Proposed new EU legislation now sets ambitious targets for recycled content in plastic packaging materials. Pyrolysis as a form of recycle offers great advantages in achieving the quality standards that packaging materials in contact sensitive applications have to achieve. Legislation has not officially been introduced into EU law yet but it can be expected that pyrolysis will thus play a significant role in achieving more ambitious recycling targets and strongly support the production of PyOil from plastic wastes.

The industry is characterised by partnerships between developers and operators of pyrolysis technologies and downstream partners who are the refinery and steam cracker operating companies, or traders serving the chemical industry.

The report analyses current projects and estimates capacity for plastics and tyre pyrolysis oil availability. The capacity available to produce PyOil in total could grow to >1.5 million tonnes/year by 2026 if current projects with refinery and chemical industry offtakers continue as planned.

Other routes to “alternative naphtha” can also contribute to renewable attributed content.

Gasification of biogenic wastes or plastic containing wastes to produce syngas (a mixture of carbon dioxide and hydrogen), which is then converted to a mixture of renewable naphtha, diesel and sustainable aviation fuel (SAF) via the Fischer-Tropsch process is a further possible contributor of alternative naphtha. At present 450 ktpa of capacity envisaged for North America and 74 ktpa of capacity for Europe by 2026 from wood waste mainly, expected to be for fuel use only.

Technologies for the combination of **carbon capture**, production of syngas, conversion to synthetic crude oil via Fischer-Tropsch technology and separation of products to required outputs such as SAF, diesel, naphtha, waxes and other chemicals, are being investigated and implemented now in 25 or more projects worldwide. Projects involve multiple technologies, where expertise on the capture of carbon, conversion of CO₂ and H₂ to syngas as well as Fischer-Tropsch technology may be provided by separate companies or organisations.

Most of these projects target fuels production, especially sustainable aviation fuel (SAF), due to the regulatory environment in the EU and incentives for use of CO₂ in the US, though co-product naphtha will also be available for the chemical industry.

Most projects for fuels via carbon capture and the associated production of naphtha are not expected to be realised until after 2026 and are currently foreseen for the period 2026-2030, when the resulting CO₂-based total hydrocarbon capacity (for fuels and chemicals) could increase to close to 800 ktpa worldwide should all the currently active projects go ahead.

A future review on availability of alternative naphtha for the chemical industry may indicate “**alcohol-to-jet**” processes, where alcohols such as methanol, ethanol and isobutanol may be “upgraded” to produce synthetic kerosine (SAF), could be included as a route to alternative naphtha. Technology developers and licensors are active in developing and optimising processes and as the technologies mature and volumes become available to the market, this source of naphtha may warrant increased consideration!

The full version can be found here: <https://renewable-carbon.eu/publications/product/alternative-naphtha-technologies-and-market-status-and-outlook-pdf/>

The short version can be found here: <https://renewable-carbon.eu/publications/product/alternative-naphtha-technologies-and-market-status-and-outlook-pdf-short-version/>

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nova-Institut GmbH has been working in the field of sustainability since the mid-1990s and focuses today primarily on the topic of renewable carbon cycles (recycling, bioeconomy and CO₂ utilisation/CCU).

As an independent research institute, **nova** supports in particular customers in chemical, plastics and materials industries with the transformation from fossil to renewable carbon from biomass, direct CO₂ utilisation and recycling.

Both in the accompanying research of international innovation projects and in individual, scientifically based management consulting, a multidisciplinary team of scientists at **nova** deals with the entire range of topics from renewable raw materials, technologies and markets, economics, political framework conditions, life cycle assessments and sustainability to communication, target groups and strategy development.

50 experts from various disciplines are working together on the defossilisation of the industry and for a climate neutral future. More information at: nova-institute.eu – renewable-carbon.eu

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