

SkyNRG – Moving Toward a Sustainable Future for Aviation

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Flying is essential for individuals and businesses globally, but the carbon footprint of aviation is significant and growing rapidly. Sustainable aviation fuel (SAF) is the only known way to significantly reduce the dependency on fossil jet fuel in the near term and thereby create a sustainable future for aviation. By building a new industry for SAF, all stakeholders in the aviation industry can work together to create a sustainable future for aviation.

SKYNRG MILESTONES AND ACHIEVEMENTS

SkyNRG is global market leader in sustainable aviation fuel solutions, having supplied over 30 airlines on all continents. The company's mission is to make SAF the new global standard. SkyNRG sources, blends and distributes SAF, while guaranteeing sustainability throughout the supply chain. It also helps to co-fund the price gap over conventional jet fuel and is involved in the commercialization of new conversion pathways.

The SAF industry has made impressive advancements since its inception in 2009 and SkyNRG has been at the forefront of these developments. What started out as SkyNRG supplying a few barrels of SAF for the world's first biofuel flight in 2011, has led to the company currently supplying large volumes of SAF directly into airport tank farms. SkyNRG has a long term off-take with World Energy and a partnership with Shell Aviation. In 2018 and 2019 the company supplied SAF to Air Canada, ANA, Bombardier, JAL, KLM, the Royal Netherlands Air Force, SAS, Singapore Airlines, and Swedavia.

In order to secure significant SAF volumes for the future, SkyNRG also focuses on developing regional SAF supply chains -e.g., DSL-01, that offer a real sustainable and affordable alternative to fossil fuels. Project DSL-01, which was announced by the company in the first half of 2019, will be the first European dedicated production plant for sustainable aviation fuels and is part of this new path forward.

NEXT STEPS TOWARD SAF

Now that the industry has moved beyond the demonstration phase to a stage where SAF is produced commercially and used on a daily basis, the next challenge is to scale-up. For project DSL-01, and future DSL's, there are some key enablers that are essential to create an investable business case. These essentials are key priorities guiding the company's and the industry's activities going forward:

- 1. Bridge the price gap to create a market.** Involve the different stakeholders, including governments and end-users, to create demand for SAF.
- 2. Continue to ensure sustainability.** Sustainability is a precondition for doing business; SkyNRG's Sustainability Board goes above and beyond regulation.
- 3. Build self-sustaining networks of regional supply chains (DSLs).** Enabled by the demand, and within the sustainability framework, SkyNRG is developing SAF supply chains (DSLs) using commercially available technology.

4. Quality assurance and efficient downstream operations. To optimize logistics, the company further integrates SAF supply with existing jet fuel supply chains.

5. Innovate to diversify SAF production pathways. New feedstock and technology combinations are needed for future production facilities; SkyNRG is involved in commercialization tracks.

Together with its partners, SkyNRG is working to overcome current challenges and grow the market for SAF in pursuit of aviation's climate mitigation goals. The following sections explain how this can be achieved.

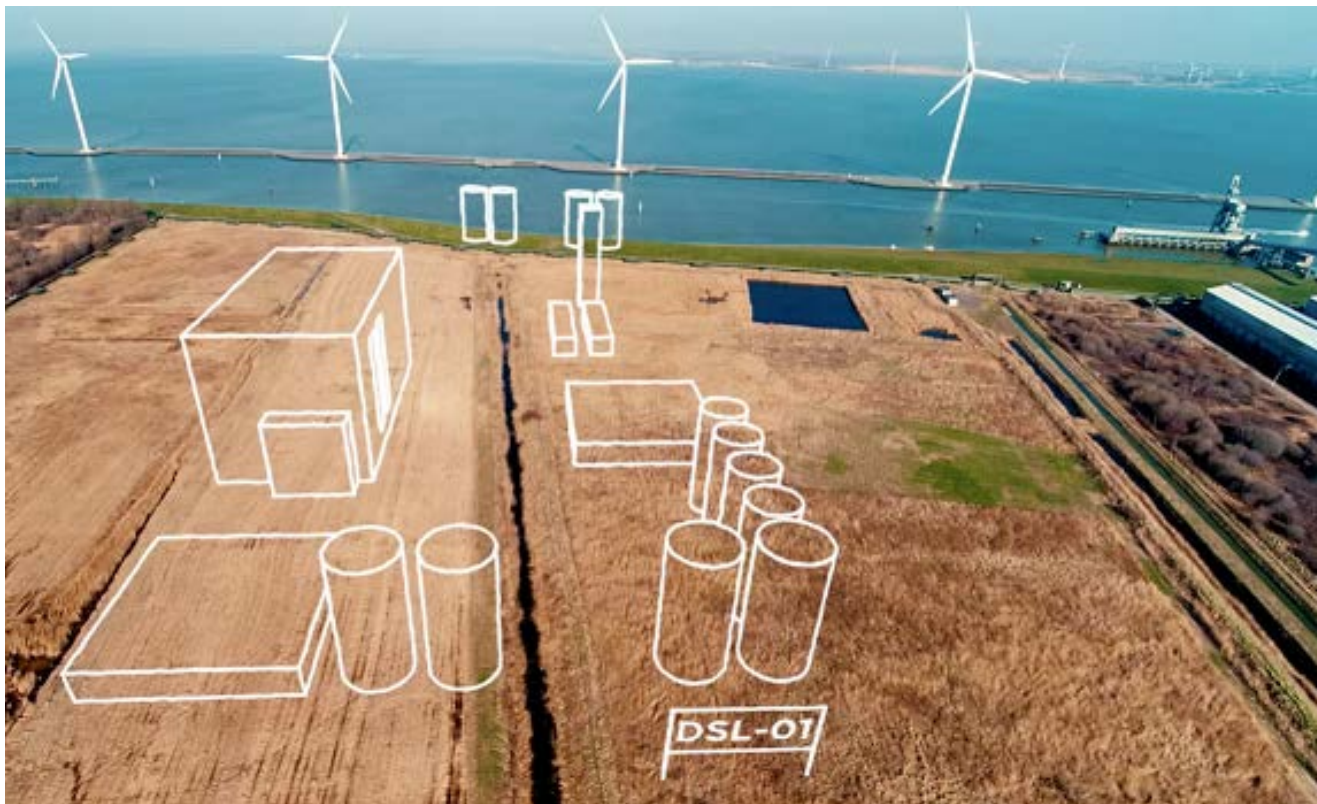
1. CLOSING THE PRICE GAP

Although prices have dropped significantly in the past decade, sustainable aviation fuels are still more expensive than conventional jet fuels. At present, SAF is approximately two to three times more expensive, depending on the feedstock, technology and set-up of the supply chain. The price premium, the price gap between

SAF and fossil jet fuels, has been the biggest challenge limiting large-scale uptake of SAF to date.

To compete with fossil fuels and build this new industry, government involvement is crucial. A level playing field needs to be created with the road transport sector through the drafting and implementation of stable and effective policies. As seen by recent project announcements, one of the most impactful measures to lower the price premium and increase supply, are government incentives. It is essential that governments worldwide realize that they can and must play an important role in providing the right instruments for the aviation sector.

Currently, SkyNRG covers part of the premium with innovative co-funding mechanisms where it collaborates with airlines, airports and companies. Over the past decade, SkyNRG has initiated a variety of customer programs (e.g., KLM Corporate BioFuel Programme, Fly Green Fund). These types of programs enable, companies, individual travelers, governments, and NGO's to fly on sustainable aviation fuels, thereby reducing their travel emissions and supporting the growth of an industry that provides a sustainable alternative to fossil fuels.





Organizations from around the world are stepping up by choosing to fly on SAF through such programs. With their commitment they do not only reduce carbon within the aviation sector, rather than compensate elsewhere through existing offset programs. They also stimulate development of new production capacity, bring down the price premium and spur technology development that is needed for the energy transition in aviation.

In order to make these programs successful, SkyNRG needs the help of both governments and ICAO for alignment on the measurement and accounting of aviation-related CO₂ emissions. On national and international levels, the carbon reduced by the use of sustainable aviation fuel is measured inconsistently, using different standards for different targets. ICAO needs to be aware of the different ways that the carbon reductions from SAF usage are measured by different countries on various continents. The accounting procedures of CORSIA need to be aligned with the accounting procedures which are already in place. Another concrete way to support these programs and the industry at large, is of course by countries and organizations voluntarily committing to fly on SAF.

2. GUARANTEEING SUSTAINABILITY THROUGHOUT THE SUPPLY CHAIN

SkyNRG believes that the impact of bioenergy on social and environmental issues varies depending on local conditions and the design and implementation of a project. In order to make sure that every feedstock used and fuel delivered is truly sustainable, the company has established three measures that exceed the sustainability criteria set out by the European Union's latest Renewable Energy Directive (RED II).

RSB Certification

All SkyNRG operations and products are certified by the Roundtable on Sustainable Biomaterials (RSB). The RSB is a multi-stakeholder organization that has established the most encompassing certification scheme to guarantee social-and environmental sustainability.

Independent Sustainability Board

Every time SkyNRG considers a new feedstock, or when it needs advice on the true GHG-performance of a certain feedstock-technology combination, it consults the members of its Sustainability Board to share their knowledge and opinions. That Board, which includes representatives from WWF International, European Climate Foundation, Solidaridad Network, and the Energy Research Centre in the Netherlands

Non-Governmental Organization (NGO) Network

The last measure entails SkyNRG's ongoing dialogue with its extensive NGO network. The company is involved in projects all over the world and is well aware that different regions face different sustainability challenges. Constant dialogue with local NGO's is essential to make sure that important information is not overlooked. These organizations keep SkyNRG abreast of the current challenges, opportunities, and the latest developments in the various regions.

Through these measures, it is the intent of SkyNRG to step up its game and lead by example. Sustainability is constantly evolving, and merely relying on policies and standards often means that one is not up to date with the latest developments. Being on top of sustainability also means the development and implementation of strict policies when it comes to feedstocks. For example, SkyNRG primarily uses waste and residue streams to produce its fuels. Crops which can be used for feed or food are not used. Displacement emissions are avoided, and indirect displacement effects are carefully considered. SkyNRG has not and will not use palm, soy, or any of their derivatives as feedstocks for its fuels. There is not enough sustainable palm (or palm residue) products on the market to satisfy the enormous demand for palm (or PFAD). Therefore, the company believes that buying these products, even if certified, will result in increased usage of uncertified and untraceable products in other markets. This will cause further deforestation and pollution. For that reason, these feedstocks will not be used for its fuels.



3. DIRECT SUPPLY LINES

SkyNRG has set out to build a self-sustaining network of regional supply chains, known as Direct Supply Lines (DSL's). A DSL is a supply chain for sustainable aviation fuel that consists of local feedstock, a commercial fuel production plant, and long-term offtake partners.

Supported by EIT Climate-KIC, SkyNRG has installed 'Team DSL', a dedicated team of experienced professionals who will analyse, finance, and develop a network of DSL's throughout Europe. Team DSL focuses on selecting a location, feedstock and technology for DSLs and ensuring that they are developed as replicable and profitable business models. To capture all environmental and socio-economic benefits of the selected DSLs, the team is advised by SkyNRG's Sustainability Board and adheres to the company stringent sustainability standards. DSL-01

The first of these Direct Supply Lines, DSL-01, is currently being developed in Delfzijl, The Netherlands. Partners to this project include KLM Royal Dutch Airlines, SHV Energy, Schiphol Airport, and many others.

The feedstocks used for production will be waste and residue streams, such as used cooking oil, coming predominantly from regional industries. The facility will run on sustainable hydrogen, which is produced using water and wind energy. DSL-01 is expected to start production in 2022.

But our ambition doesn't stop there, if we want to meet the industry's CO₂ emission targets we need to rapidly increase the supply of SAF. That is why SkyNRG has already identified opportunities for further DSL's whereby we can replicate the DSL blueprint. These DSL's might use different types of sustainable feedstocks and different conversion technologies. This technology-agnostic approach allows us to adapt to the regional context and stakeholder preferences.

Each DSL will be a high impact, high visibility project and SkyNRG is continuously looking for strong and reliable strategic partners throughout the supply chain (feedstock suppliers, technology providers, locations & sites, EPC companies, customers, financiers, etc.).

4. QUALITY ASSURANCE AND DOWNSTREAM OPERATIONS

SkyNRG has been responsible for most SAF supplies since the introduction of SAF in 2011 and set up the respective supply chains. SAF supply chains are tailor-made solutions based on customer demand and economic and sustainability criteria. SkyNRG works together with its production, logistics and quality partners to deliver SAF to airports globally in a safe and sound way. Quality assurance is a key element – the company ensures that: neat SAF complies with ASTM D7566 specifications, the SAF is blended with fossil Jet A/A-1, and the blended SAF complies with conventional jet fuel standards ASTM D1655, DEFSTAN 91-091 and EI1530 JIG guidelines.

Early SAF supply chains were characterized by extensive segregated operations to fuel specific aircraft. However, today SAF is integrated into the existing jet fuel infrastructure as much as possible to increase efficiency and reduce costs. As a result, a growing number of airports have received SkyNRG's SAF into their commingled fuel system, including Los Angeles (LAX), San Francisco (SFO), Oslo (OSL), Stockholm (ARN), and Toronto (YYZ).

To assure quality and efficient downstream operations, SkyNRG and Shell Aviation have a long-term strategic partnership to promote and develop the use of SAF in aviation supply chains. The collaboration combines Shell Aviation's technical and commercial expertise, world-class supply chain, and carbon management operations, with SkyNRG's proven track record of supplying SAF, and its in-depth knowledge of this market. The agreement is a multi-year collaboration, with both companies acknowledging that the path to lower carbon emissions in aviation requires long term commitment. The collaboration will focus on joint development and funding of new opportunities to extend the use of existing SAF supply chains and the establishment of more resilient supply chains in the future.

5. INNOVATION

It has been proven that SAF production is feasible on a commercial scale and with high-level CO₂ emissions



reductions. However, to reach large-scale market penetration, there is a need to diversify the feedstock and technology base for SAF production. This is a maturing area of research and many alternative production pathways are being developed. It is widely recognized that there is no one “silver bullet” solution, and that a mix of technologies is needed to reach global aviation’s CO₂ emission reduction targets.

SkyNRG believes that the only way to get insights into the viability of these emerging tracks is to get directly involved with these developments. The company is therefore currently involved in roughly a dozen innovation projects. As such, it works closely in consortia with partners that represent the entire supply chain towards the common goal of finding commercially viable SAF production pathways. This could include such initiatives as the development of a pilot project or a demonstration facility, or an effort towards ASTM certification of the fuel.

Over the past decade this work has yielded valuable knowledge and experience for all potential SAF production pathways. Some initiatives proved not to be viable, but other initiatives were successful and SkyNRG continues to develop these pathways. Through experience, the company knows which pre-conditions are required to have a viable business case for each technology. Eventually, some of these long term development tracks will result in future DSLs. Because SkyNRG is not tied to any particular technology, it has the flexibility to adapt to a specific regional context and it knows that future plants will require different technological solutions than the ones available today.

ALWAYS SEEKING NEW PARTNERS

To meet future demand for SAF, large-scale investment is needed. This will result in the necessary economies of scale required to make the shift from conventional jet fuel to SAF possible. To make the aviation industry a sustainable one, the understanding, support, and investment of governments, entrepreneurs, and pioneers is required.

SkyNRG is continuously looking for new partners to help accomplish its mission to create a sustainable future for aviation. Although the company has many partnerships already in place with airlines, airports, governments, NGO’s, and companies, it is always looking for additional partners.