



**19th CONFERENCE -  
FUELS OF THE FUTURE 2022  
REVIEW OF THE CONFERENCE**



## 19th CONFERENCE - FUELS OF THE FUTURE 2022

At the 19th Conference on Renewable Mobility, from 24<sup>th</sup> to 28<sup>th</sup> of January 2022, everything revolved around new trends and possible applications for renewable fuels. Under the motto "Navigator for sustainable mobility!", this year's conference started as an online stream for the second time due to corona. In 15 sessions over five days, more than 60 experts from science, politics and research presented innovative developments around the climate-friendly and everyday mobility of the future.

According to the German government's climate targets, the transport sector should emit 40 percent less CO<sub>2</sub> in 2030 than in 2020. Such an ambitious reduction cannot be achieved with electric mobility alone. "It is therefore important to consistently use renewable fuels for immediately effective climate mitigation in transport. Because sustainable biofuels can already demonstrate a track record here today, which must be further expanded in the future," emphasized Artur Auernhammer, Chairman of the German Bioenergy Association (BBE) in the opening session.

In 2020, sustainable biofuels saved a record value of more than 13 million tonnes of CO<sub>2</sub>. This is almost 4 million tonnes more than the year before, for which the greenhouse gas reduction quota, which was raised from 4 percent in 2019 to 6 percent in 2020, was primarily responsible. The greenhouse gas efficiency competition worked well, Auernhammer said. "Sustainable biofuels are and will therefore remain an indispensable contribution to effective climate mitigation in transport," concluded the BBE chairman. During the conference, experts gave 20-minute presentations on which advanced technologies are already being used or are still in the pipeline. More than 500 participants from more than 31 nations participated in the five-day international congress to find out about the possibilities for climate-friendly transport solutions.

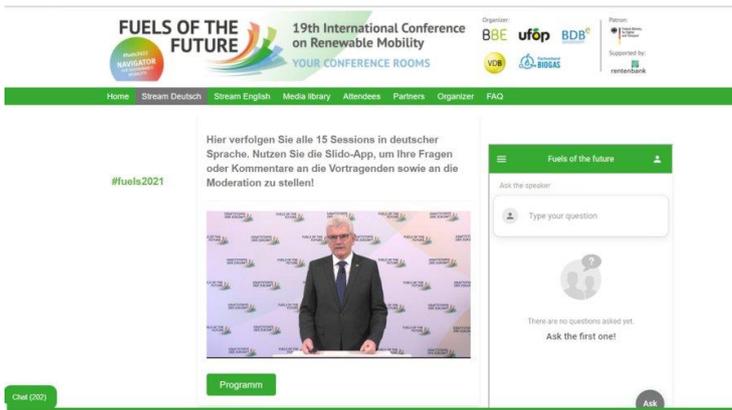
The conference team would like to thank all participants for their participation and hope you enjoy reading the conference review. We look forward to welcoming you to our 20<sup>th</sup> anniversary in Berlin from 23 to 24 January 2023.

Your „Fuels of the Future“ Conference Team

# Session 1 „Fit for 55“ and the contribution of renewable fuels in achieving European climate protection targets

Facilitator:

Stefan Arens, Union for the Promotion of Oil and Protein Plants (UFOP) and Chairman at BBE



Artur Auernhammer, Chair of the BBE Board, opened the 19<sup>th</sup> Conference on 24<sup>th</sup> January. Besides coping with the pandemic, measures against climate change are an omnipresent and urgent topic, he said. "Sustainable biofuels are and remain an indispensable contribution to effective climate mitigation in transport," Auernhammer emphasized.

Daniela Kluckert, Parliamentary State Secretary at the Federal Ministry of Digital Affairs and Transport, described the target of greenhouse gas neutrality as a Herculean task in her presentation on the EU's "Fit for 55" package and its implications for climate protection in the transport sector. "To achieve it, we need all alternative propulsion technologies and the whole range of alternative fuels."



Prof. Dr. Christian Küchen, Chief Executive of En2x, followed with his contribution "'Fit for 55 Package" - What does the implementation mean for the transport sector and for alternative fuels at European and national level?". The Fit for 55 package contains good approaches, he said. "If CO<sub>2</sub>-neutral fuels are taxed much lower than fossil fuels, we will create real supply incentives for green energy."



Jens Gieseke, Member of the European Parliament and rapporteur of the EPP Group as well as transport policy spokesperson of the CDU and CSU Group, pleaded in his contribution for technology neutrality in climate protection in transport in view of the current negotiations in Brussels on the "Fit for 55" package. The "all-electric" approach could endanger more than 100,000 jobs in the EU, he warned. A technology window is needed to enable competition, Gieseke said.





Dr. Stephan Meeder, Vice-President of ePure, called for more ambitious climate protection targets. The greenhouse gas reduction quota of 13 percent could be raised to 16 percent. Because in his opinion "Ethanol is ready to deliver". He stressed that ethanol is already making an important contribution to minimizing greenhouse gas emissions in road transport.

## Session 2 Panel discussion: Green Deal and "Fit for 55" - The role of alternative fuels for the internal combustion engine of the future

Facilitator:

Sonja van Renssen,

Editor-in-chief of Energy Motor

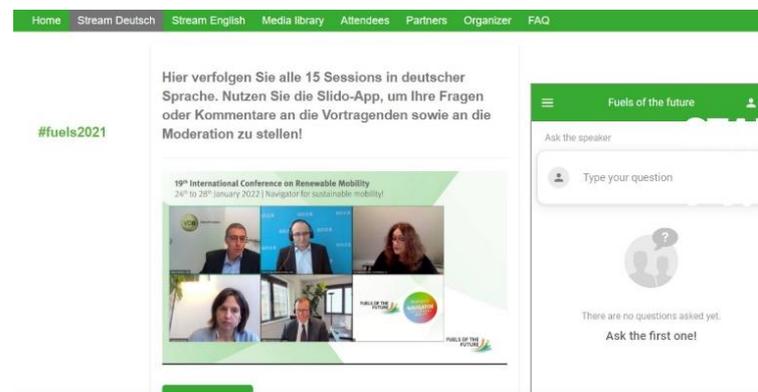


The first session was followed by a one-and-a-half-hour panel discussion to debate the role of alternative fuels for the internal combustion engine of the future. The panelists were Pekka Pesonen, Secretary General of COPA-COGECA, Stefan Schreiber, President of the German Biofuels Industry Association (VDB), Dr. Monika Griefahn from the eFuel Alliance and Prof. Dr.-Ing. Christian Küchen from en2x - Fuels and Energy Trade Association.

The European Union has a global responsibility to find technical solutions to reduce CO<sub>2</sub> emissions, Pekka Pesonen said. According to Pesonen, focusing only on electrification is very far from reality and from the market. He raised the question of how third countries are supposed to achieve electrification when not even Europe is making progress in implementing the targets. By growing sustainably certified raw materials for biofuels, he said, agriculture is helping to diversify the supply of fuels. E-mobility is part of the solution, but different consumer demands for mobility should be taken into account.

The high ambitions of the "Fit for 55" package are good, especially in transport, Stefan Schreiber stressed. However, if the political arena is allowed to decide instead of the market, there is a risk of losing one of the most important factors for CO<sub>2</sub> reduction. Plant-based fuels are an essential backbone for climate protection in transport. However, many questions would still arise from the European package. In addition, an adjustment is necessary, such as a linear increase in greenhouse gas reduction targets until 2030. A sudden implementation from 2029 to 2030 would be difficult to implement.

Synthetic fuels are an important part of the solution, expressed Dr. Monika Griefahn. Only large-scale production of renewable energies would be able at lower prices.



She is convinced, that e-fuels must therefore also play an important role internationally. Hydrogen could be produced in other countries with a lot of solar and wind energy, for example in Chile or Saudi Arabia, or e-fuels could also be imported directly. Worldwide, there are already 1.4 billion vehicles, and these numbers are set to rise. Relying solely on e-mobility is therefore problematic, according to Griefahn's assessment. Moreover, resources such as copper are not sufficiently available.

According to Prof. Dr.-Ing. Christian Küchen, there should be a stable framework for companies that want to invest. The key issue is also the ramp-up of advanced biofuels or green hydrogen. A gradual increase of the CO<sub>2</sub> price as well as an additional taxation would be good steps to reach the desired share in 2045.

There was a general consensus that the energy targets for achieving the climate goals by 2025 had to be more ambitious. Long-term planning security beyond 2030 would also be necessary. All sustainably available resources would have to be used in the future in order to fulfil the climate targets. Existing capacities could be used if there were investment security.

# Session 3 Impact of European climate mitigation legislation on the transport sector

Facilitator:

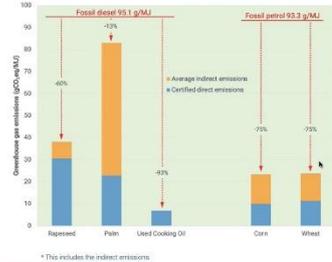
Torsten Weidemann, German  
Bioethanol Industry Association (BDBe)



## 19th International Conference on Renewable Mobility 24th to 28th January 2022 | Navigator for sustainable mobility!

Germany 2019  
3.3 million tonne of renewable fuel saved 7.3 million tonne CO<sub>2</sub> emissions\*

- More than 90% of total volume of renewable fuels used in Germany is biodiesel and bioethanol from only five feedstocks
- Each of these five fuels cause less emissions than fossil fuels, even when taking into account the potential indirect impacts
- As a result, on average, in Germany, 1 tonne of biofuel avoids about 2.2 tonne of CO<sub>2</sub> emissions when replacing fossil fuel
- in case rapeseed and used cooking oil were used instead of palm oil, then the avoided emissions would be about 2.6 tonne CO<sub>2</sub> per tonne of biofuel, reaching 8.6 million tonne total avoided CO<sub>2</sub> emissions



CARLO HAMELINCK



Carlo Hamelink from studio Gear Up presented the results of the study "Greenhouse gas savings through biofuels in Germany". More than 90 percent of the total volume of renewable fuels used in Germany from biodiesel and bioethanol are produced from just five raw materials. These include rapeseed, palm oil, used cooking oil, maize and wheat. On average, 1 tonne of biofuel saves 2.2 tonnes of CO<sub>2</sub>.

Dr. Anne Held from the Fraunhofer Institute for Systems and Innovation Research spoke in her contribution about how important the overall policy package is for e-mobility. The purchase costs of e-cars are higher at the beginning and the investment depends on the individual living situation and lifestyle. The expected decline in unit prices for batteries as well as the further increase in CO<sub>2</sub> prices will improve the future competitiveness of e-mobility, she expected.

Dr. Franziska Müller-Langer from the German Biomass Research Centre (DBFZ) asked for a transparent monitoring process for achieving the climate targets in the transport sector. In order to achieve the goals in the transport sector, it is envisaged that, among other things, the GHG quota will be raised to 25 percent by 2030. She also said that, in some cases, mobility would have to be abandoned. She pleaded for using all possible options to reduce emissions in the future.

Karsten Schulze, Technical President at the General German Automobile Club ADAC, stressed that mobility should not be income-dependent from the consumer's point of view. CO<sub>2</sub> pricing could only be justified if alternatives were offered. For acceptance, he added, it was also important to create solutions for the existing vehicle fleet and to ensure technology neutrality.

# Session 4 E-Fuels | Examples of R&D on the way into practice

Facilitator:

Dr. Franziska Müller-Langer

German Biomass Research Centre



The screenshot shows the 'FUELS OF THE FUTURE' website interface. It features a navigation bar with options like 'Home', 'Stream Deutsch', and 'Stream English'. The main content area displays a live video feed of Dr. Ulrike Junghans, with her name and title 'DR. ULRIKE JUNGHANS' visible below. To the right, there is a 'Fuels of the future' chat window with a 'Type your question' input field and a 'Ask the first one!' button. The top of the page includes logos for 'FUELS OF THE FUTURE', '19th International Conference on Renewable Mobility', and various partners like 'uföf' and 'BDB'.

Dr. Ulrike Junghans from the Fraunhofer Centre for Chemical-Biotechnological Processes presented the project "SynLink - Synthetic electricity-based fuels as an important instrument for sector coupling", which deals with the further development of methanol synthesis. Methanol is a very important building block for renewable mobility. Produced in a renewable way, one tonne of methanol would avoid 1.5 tonnes of CO<sub>2</sub> emissions.

Karl Dums from Porsche and Marion Wurzel from ExxonMobil presented the joint cooperation project "Haru Oni" in China. The pilot project is to produce 130,000 litres of synthetic fuels from 2022 - with a gradual increase. A CO<sub>2</sub> saving of 85 per cent compared to fossil fuels is possible. ExxonMobil developed the methanol-to-gasoline technology and provided the necessary know-how on liquid catalytic cracking (FCC) plants. Porsche is pursuing the goal of being CO<sub>2</sub>-neutral by 2030.

This screenshot shows a video conference from the '19th International Conference on Renewable Mobility'. It features three participants in a grid layout: Karl Dums (left), Marion Wurzel (top right), and Dr. Ulrike Junghans (bottom right). The background includes the conference title and dates: '19th International Conference on Renewable Mobility 24th to 28th January 2022 | Navigator for sustainable mobility!'. A logo for 'FUELS OF THE FUTURE' is visible in the bottom right corner.

## 19th International Conference on Renewable Mobility 24th to 28th January 2022 | Navigator for sustainable mobility!

The 'Global Projects' map highlights several key initiatives in synthetic fuel production:

- CE Pilot Plant**: 200 t/y, built 2025
- Norway Commercial DAC Plant**: 1-2 Mt/y, Conceptual design underway
- UK Commercial DAC Plant**: 1-2 Mt/y, Operations expected 2028
- Project AtmosFUEL**: Up to 200M t/y, Feasibility study
- Canada AIR TO FUELS™ Plant**: 1 to 2 100M t/y, Operations expected 2028
- US Commercial DAC Plant**: 1 Mt/y when complete, Operations expected 2024
- CE Innovation Centre**: 2000 t/y, Currently commissioning

The map also includes a small video feed of Dr. Amy Ruddock.

Dr. Amy Ruddock from Carbon Engineering presented the Direct Air Capture (DAC) process, in which a filter removes CO<sub>2</sub> from the air. The largest plant of these "artificial trees" will be put into operation in the USA in 2024 and is to filter 1 million tonnes of CO<sub>2</sub> from the air annually. Further use of the CO<sub>2</sub> thus extracted as fuel is possible. Geological storage is also doable, which would make it realizable to achieve negative emissions.

Dr. Mark Misselhorn of Capheniatec demanded: "The transformation of fuels must pick up speed." Every contribution counts, he said, even if 100% CO<sub>2</sub>-neutral fuels are not used initially. A power-and-biogas-to-liquid process could produce synthetic fuels from biomethane or CO<sub>2</sub>, he said. Biomethane scores: the energy input would be 7.6 times less than with water electrolysis.

The slide compares the energy efficiency of two hydrogen production methods:

Feedstock	Energy consumption for the production of 1 mol H <sub>2</sub>
CH <sub>4</sub>	37.5 kJ/mol (Methane pyrolysis)
H <sub>2</sub> O	286 kJ/mol (Water electrolysis)

Conclusion: Methane pyrolysis is 7.6 times more efficient than water electrolysis.

The slide also features a schematic diagram of the methanol pyrolysis process and a video feed of Dr. Mark Misselhorn.

# Session 5 Green hydrogen

Facilitator:

Werner Diwald, German

Hydrogen and Fuel Cell Association (DWW)



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**ALSTOM (BetHy)**  
Development, validation and approval of a fuel cell electric train. First fleets to start operation in 2022/23



**SIEMENS & DB (X-EMU & H2GoesRail)**  
Development, validation & approval of a hydrogen EMU as well as development, testing and optimization of the necessary hydrogen infrastructure.



ELENA HOF



Elena Hof from the federally owned National Organisation Hydrogen and Fuel Cell Technology (NOW GmbH) presented in her contribution, among other things, the hydrogen interconnection project #H2goesRail. Diesel multiple units are to be replaced by hydrogen trains in regional transport. New types of hydrogen fast-filling stations provide the appropriate infrastructure. Heavy goods transport also brings innovations: A battery-electric chassis with a hydrogen fuel cell is being tested, she explained.

In the future, "power fuels" such as hydrogen or e-kerosene can be used in heavy goods, air or shipping transport. This was pointed out by Hannes Salomon and Friederike Altgelt from the German Energy Agency (dena), who reported on the dena study "E-Fuels - The potential of electricity based fuels for low emission transport in the EU". According to the study, power fuels could cover 28 per cent of the global final energy demand in 2050. In addition to expanding domestic production capacities, the new German government should also expand the import infrastructure for renewable energies by 2030, according to the speakers. This is because despite an increase in domestic production, the expected total demand for 2030 could not be met.

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**FUELS OF THE FUTURE** 19th International Conference on Renewable Mobility  
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#fuels2022

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DR. JÖRG DEHMELE

Ask the speaker

Type your question

There are no questions asked yet. Ask the first one!

New era: Shell wants to become a net-zero emissions energy company by 2050. New perspectives for the energy transition are provided by the refinery in the Rhineland. At the sustainable energy and chemical site, green hydrogen is produced with the help of the largest Proton Exchange Membrane (PEM) hydrogen electrolysis. In PEM electrolysis, positive hydrogen ions migrate through a membrane to the cathode, where they are reduced to molecular hydrogen. Waste from the wood industry could also be used as synthetic crude oil in the future in the aviation sector, among others, according to Dr. Jörg Dehmel from Shell Energy and Chemicals Park Rheinland.

Dr. Andy Gradel from BtX energy GmbH presented a new technology: Hydrogen from biogas through steam reforming. The production costs per kilogram of hydrogen could be lower compared to electrolysis. The complete solution in container format is also space-saving and can be used decentrally, he emphasized the advantages.

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DR. ANDY GRADEL

Ask the speaker

Type your question

There are no questions asked yet. Ask the first one!

# Session 6 Biodiesel research - boosting the potential for higher blending levels now!

Facilitator:

Prof. Dr. Jürgen Krahl, President, University of Applied Sciences East Westphalia-Lippe



The screenshot shows the 'Fuels of the Future' conference interface. At the top, there are logos for 'FUELS OF THE FUTURE', '19th International Conference on Renewable Mobility', and various sponsors like BBE, ufop, BDB, VDB, and reinterbank. Below the navigation bar, there is a text prompt: 'Hier verfolgen Sie alle 15 Sessions in deutscher Sprache. Nutzen Sie die Slido-App, um Ihre Fragen oder Kommentare an die Vortragenden sowie an die Moderation zu stellen!'. A video feed shows a speaker. To the right, there is a 'Fuels of the future' chat window with a 'Type your question' input field and a message: 'There are no questions asked yet. Ask the first one!'.

For the increased use of rapeseed oil methyl ester (RME), it is important to monitor the ageing process. Prof. Dr. Markus Jakob from Coburg University of Applied Sciences is developing an on-board sensor system for this purpose in order to be able to detect deposits in biodiesel-containing fuels at an early stage. The system can also be used to analyse the composition of unknown RME fuels. The sensor technology could be used, for example, to enable a higher proportion of RME in motor transport.

The viscosity of pure vegetable oils can be problematic. However, this can be reduced by adding a small amount of furan, according to Florian Kerke from the University of Regensburg. The cloud point would also decrease through the use of furan. Synthetically produced antioxidants could be replaced by natural, hydrophilic antioxidants in biofuels.

This screenshot is similar to the previous one but features a different speaker. The video feed shows a man wearing a headset, identified as 'FLORIAN KERKE'. The rest of the interface, including the navigation bar, text prompts, and chat window, remains the same.

This screenshot shows another speaker in the video feed. The interface layout is consistent with the previous screenshots, featuring the same navigation bar, text prompts, and chat window.

Whether B10 or B30: When using biodiesel or biodiesel blends, no deposits occur in the low-temperature range, stated Dr. Richard Wicht of the Association Quality Management Biodiesel e.V.. B100 can also be used so that greenhouse gas emissions in the transport sector can be reduced, says Dr. Wicht in his article "Technical aspects for the use of higher biodiesel-diesel fuel blends".



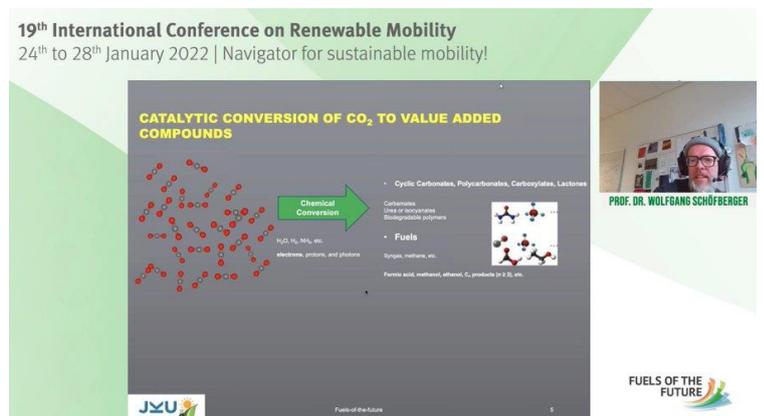
Dariusz Zdanuk from Ekobenz presented the production of liquid hydrocarbons from biomass or waste that can be added to fuels without restrictions. By means of ETD technology (ethanol to gasoline), the properties of ethanol/bioethanol are improved. In this way, biokerosene, for example, can be produced as a fuel.

Simon Eiden from TEC4FUELS GmbH presented on the material compatibility of petrol substitute fuels with alcohol contents above 15 percent. The storage and usability of liquid fuels as well as the operational safety and service life of components and systems could be optimized by the higher alcohol content and the associated reduced tensile strength of the fuels.



Prof. Dr. Christian Beidl from the Technical University of Darmstadt emphasized in his lecture that the combustion engine would continue to embody an important energy system in the future. Sustainability and functionality of CO<sub>2</sub>-neutral fuels are the top goals that should be pursued, because these could also be used in efficient petrol engines.

In his lecture, Prof. Dr. Wolfgang Schöfberger from the Johannes Kepler University Linz presented a catalyst that is responsible for the electrochemical reduction of CO<sub>2</sub>. The electrical reduction of CO<sub>2</sub> represents a scientific and technical challenge, but under ideal conditions CO<sub>2</sub> can be converted into methanol.



# Session 8 Biomethane in the international context

Facilitator:

Dr. Claudius da Costa Gomez,  
German Biogas Association



Lasse Kari from Accenture DACH underlined that the competitiveness of alternative fuels depends on fuel as well as CO<sub>2</sub> taxes. Low-carbon fuels with a low cost premium could be an advantage for future B2B customers.

Arjan Coenradie from Stirling Cryogenics B.V. presented a special refrigeration cycle system that enables the production of bio-LNG at low pressure through a liquefaction technology. The storage and transport of large quantities of LNG still encounter problems that could be solved with a modular design with small units, he estimated.



Best practice project from China: Lars von Lehmden (EnviTecBiogas) showed a biogas plant that is operated with poultry manure. The biogas produced is compressed into Bio-CNG (Compressed Natural Gas) in a second step and can be marketed directly on site. Every year, 200,000 tonnes of CO<sub>2</sub> can be saved in this way.

Kevin Günther from Chemical plant engineering Chemnitz GmbH presented power-to-gas technologies that can produce synthetic natural gas (SNG) and transport it via existing pipeline networks. Only one conversion step is necessary to convert methanol to hydrocarbons.



# Session 9 International biofuel trade

Facilitator:

Torsten Weidemann,

German Bioethanol Industry Association (BDBe)



The screenshot shows the conference website interface. The main content area displays a slide with the following text: "German fuel suppliers likely to pay higher premium for Annex IX-A biofuels than Swedish". Below the slide, there is a table with columns for 'Country', 'Premium', and 'Notes'. The table lists data for Germany and Sweden. To the right of the slide, there is a 'Fuels of the future' sidebar with a search bar and a 'Type your question' input field. Below the input field, it says 'There are no questions asked yet. Ask the first one!'.

Cornelius Claeys of Stratas Advisors showed how the use of biofuels from used cooking oil (UCO) has increased. In 2021, around 6.9 million tonnes were used globally, accounting for 5 per cent of biofuels. Almost one-fifth of all European biofuels are now produced from UCO. Supply depends on dietary habits and urbanisation rates, among other factors, he said. In his opinion, alternative biofuels such as pyrolysis oil, biomethane or ethanol from cellulose should be expanded.

Dr. Wolter Elbersen from Wageningen University presented "Flex-Crops", which could be used as food/feed, fuel or industrial material depending on demand and availability. By using them, food security could be increased. Agricultural efficiency and yield could also be increased.

The screenshot shows the conference website interface. The main content area displays a slide titled "Example: USA" with a line graph showing a price increase over time. The graph has a y-axis labeled 'Price' and an x-axis labeled 'Year'. The price starts at a low level and rises sharply towards the end of the period. To the right of the slide, there is a 'Fuels of the future' sidebar with a search bar and a 'Type your question' input field. Below the input field, it says 'There are no questions asked yet. Ask the first one!'.

The screenshot shows the conference website interface. The main content area displays a slide titled "Supply and demand drivers of bioisophtal utilization in transportation fuels and petrochemicals applications". The slide includes a photograph of a large industrial facility. To the right of the slide, there is a 'Fuels of the future' sidebar with a search bar and a 'Type your question' input field. Below the input field, it says 'There are no questions asked yet. Ask the first one!'.

Evriddiki Dimitriadou from S&P Global reported on bionaphtha, which can be produced from organic materials such as cellulose residues, vegetable oil waste or used cooking oil, or as a by-product of the production of second-generation biofuels.

Sébastien Haye from E4tech presented assessments of biofuel feedstocks that could be included in Annex IX of RED II. These raw materials would partly represent new potentials for the production of advanced biofuels.

The screenshot shows the conference website interface. The main content area displays a slide with a video feed of a speaker. The speaker is a man wearing a headset and a dark jacket, sitting at a desk. To the right of the slide, there is a 'Fuels of the future' sidebar with a search bar and a 'Type your question' input field. Below the input field, it says 'There are no questions asked yet. Ask the first one!'.

# Session 10 Biofuels from waste and residues

Facilitator:

Detlef Evers,

Waste-based Fuels Association



Fabien Hillairet from Greenea predicted in his presentation for 2030 that the truck market could become the main market for hydrogenated vegetable oils thanks to HVO100. Diesel-powered cars would hardly exist, so that fatty acid methyl esters would have no chance to establish themselves on the market due to the blending limit. On the other hand, he expects an increasing demand for ethanol.

Angel Alberdi from the European Waste-based & Advanced Biofuels Association (EWABA) devoted his presentation "Fit for what? A look at the EU proposals for waste-based biodiesel", he focused on used cooking oils, among other things. These are limited for use as fuel, but household waste and municipal waste offer great potential and could provide higher quantities of fuel, e.g. for air transport.



Solketal as a drop-in capable fuel? "Yes!" said Julian Türck from the University of Leuphana in Lüneburg. The waste- and glycerine-based biofuel shows no significant influence on the ageing of fuels in the multi-component system. Solketal is considered a sustainable, advanced fuel component. However, further research steps are still necessary.

Stefan Eder from the Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT presented the thermo-catalytic reforming process, in which residual biomass can be converted into synthesis gas, carbonisate or liquid bio-crude oil. One project example is in Bavaria, where the raw material consists of sewage sludge.

# Session 11 Biofuels in shipping

Facilitator:

Prof. Dr. Bert Buchholz,

University of Rostock, CIMAC Germany



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### Motivation

IDEALFUEL aims to develop methods to convert lignin – the polymer found in the structural materials of plants and trees – from dry plant matter (otherwise known as lignocellulosic biomass) into renewable marine fuels.

### Facts & Figures

Project full name  
Lignin as a feedstock for renewable marine fuels

Acronym  
IDEALFUEL

Duration:	48 months	Partners:	11
Start date:	1 May 2020	Countries:	4
Total budget:	4,77 M€	GA Number:	883753
EC Funding:	4,77 M€		



CHANDRA KANTH KOSURU

Chandra Kanth Kosuru from TEC4FUELS GmbH presented on lignin-based biofuels for the shipping industry. Lignin can be extracted from wood in the form of raw lignin oil, for example. What remains is cellulose material that can be used in the paper industry or converted into ethanol. The drop-in compatibility is still being investigated, and a detailed analysis of the fuel behaviour during long-term runs is already available, he said.

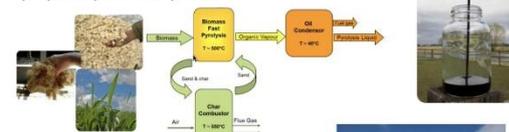


Dr. Rainer Janssen from WIP Renewable Energies addressed the topic "Market introduction support for intermediate bioenergy sources - production of marine biofuels from pyrolysis oil". With the help of the pyrolysis process, fuel for the marine sector can be produced from low-grade raw materials such as wood waste & agricultural residues. The use requires scale-up measures, among other things.

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### PYROLYSIS OIL – A PROMISING ENERGY CARRIER

#### Pyrolysis oil production process



- Efficient, sustainable process using non-food biomass
- Proven technology: three 24.000 t/year plants have been implemented, further plants under negotiation

The Empyro Pyrolysis plant in Hengelo (est. 2015)

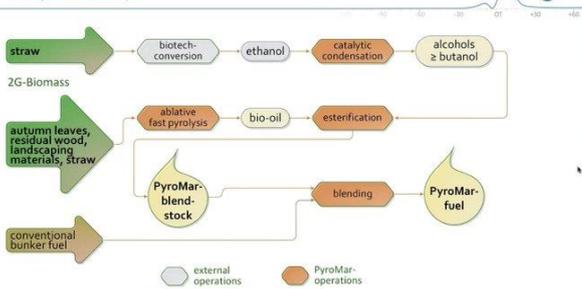


DR. RAINER JANSSEN



## 19th International Conference on Renewable Mobility 24th to 28th January 2022 | Navigator for sustainable mobility!

### The PyroMar concept



DR. FANNY LANGSCHWAGER

Dr. Fanny Langschwager from the University of Rostock presented the "PyroMar" project, which enables the production of blend components from straw or leaves. By testing the mixing ratios with marine fuels, the existing tank infrastructure could be maintained. This process could save about 9 million tonnes of CO<sub>2</sub> equivalents annually, she estimated.

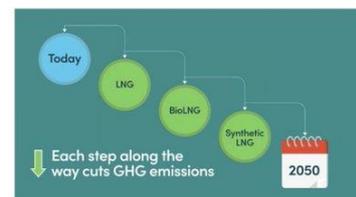


Bio-LNG is already sufficiently available today and is already being used in Western Europe, according to Steve Esau of SEA-LNG. Global use is also possible because of existing supply infrastructures and LNG-fuelled ships can be used without problems, said Esau in his presentation "SEA-LNG - a global advocacy group for accelerating the introduction of LNG as a marine fuel".

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### LNG: an incremental pathway for decarbonization SEA-LNG Utilizing existing assets and infrastructure

- Longer term – IMO and EU 2050 targets in reach through use of bioLNG & renewable synthetic LNG
- BioLNG – a lower risk pathway
  - Enables incremental decarbonization
  - Uses existing LNG-fuelled ships and supply infrastructure
  - No blending issues



STEVE ESAU





# Session 12 Climate-friendly flying? Biofuels in aviation

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ALFONSO BERROCAL

### Why Argus care so much about SAF

- Excited about an emerging market crucial for **decarbonising aviation**
- Critical with pricing which allows market to clear/trade based on SAF's own **specific supply/demand fundamentals**
- We publish **daily pricing** of European SAF incl. Asian SAF netbacks & US SAF. Closely follows everyday the **physical SAF**
- Argus reporters speak everyday to **airlines, suppliers and producers**

### Why sustainable aviation fuel?

- Aviation accounts for around 3pc of global GHG emissions
- Electrification not a solution
- Airlines can use efficient aircraft, carbon offsets, SAF
- European mandates and incentives in the US, can support building new-technology plants.

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According to Alfonso Berrocal of Argus Media, Sustainable Aviation Fuels (SAFs) made from used cooking oils or animal fats could significantly reduce aviation emissions. Investments in SAF production are likely to change market liquidity, among other things, he predicts. The use of SAFs would be the most effective way to reduce CO<sub>2</sub> emissions in the airspace, the expert said.

Jonathan Wood from Neste appealed in his presentation that global greenhouse gas emissions would have to fall by 7.6 per cent annually over the next ten years in order to effectively counteract global warming. One key element was sustainable aviation fuels: SAFs would not require any additional investment in the infrastructure already in use, as they would be drop-in capable.

Synthetic paraffin can be produced by Fischer-Tropsch synthesis and used as drop-in fuel with 50 percent content. Marcel Dossow from the Technical University of Munich gave a presentation on "Maximising carbon efficiency by electrolysis for an advanced biomass-to-liquid process for the production of sustainable jet fuels", which included biomass-to-liquid and power-and-biomass-to-liquid processes as possible production routes.

Which alternative fuels should be promoted for aviation? Dr. Ralph-Uwe Dietrich from the German Aerospace Centre (DLR) addressed this question and emphasized that technical as well as economic and ecological aspects must be taken into account. The "power-to-liquid" process, for example, is too cost-intensive at 3.68 €/kg.

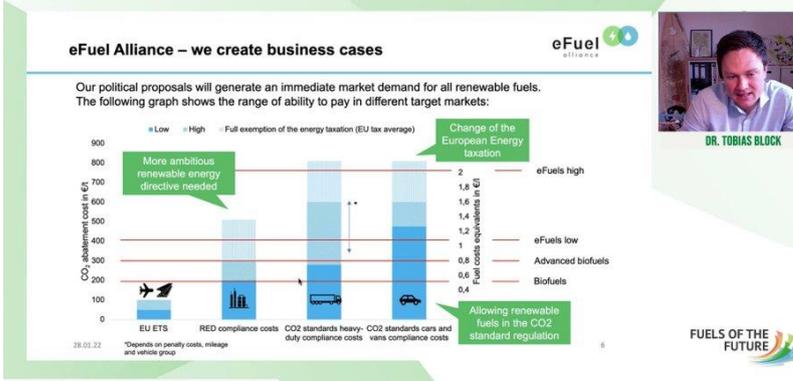
# Session 13 Advanced alternative fuels – The pathway to implementation

Facilitator:

Prof. Dr. Thomas Willner,  
University of Applied Sciences (HAW Hamburg)



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DR. TOBIAS BLOCK

In his presentation, Dr. Tobias Block from the eFuel Alliance dealt with the significance of the "Fit for 55" package for eFuels. In his view, there were contradictions and a need for change. For example, the proposed GHG reduction target of REDIII in the transport sector should be raised from 13 to 20 percent.

Dr. Ulrich Arnold from the Karlsruhe Institute of Technology (KIT) presented, among other things, the NAMOSYN research project. In this project, cost-effective and energy-efficient production processes for synthetic fuels are being researched, such as oxymethylene ether (OME), a synthetic diesel fuel.

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DR. ULRICH ARNOLD

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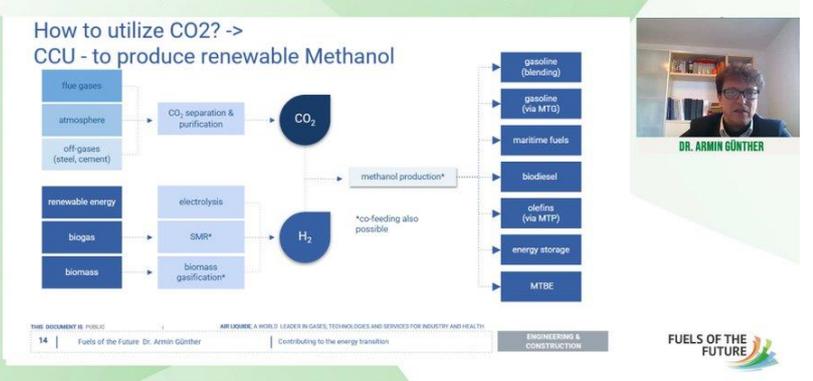


DR. SIMON HAFNER

Dr. Simon Hafner from Thyssenkrupp Industrial Solutions presented "BioTfuel", among other things. The aim: converting lignocellulosic biomass such as straw or wood residues into high-quality advanced biofuels such as renewable diesel or SAF via an indirect thermochemical pathway.

The conversion of CO<sub>2</sub> to methanol is commercially available and easily scalable, said Dr. Armin Günther from Air Liquide Global E&C Solutions Germany GmbH. There are various process technologies that can be used for this purpose, the end products of which can in turn be used in a variety of ways.

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DR. ARMIN GÜNTHER



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### Status LNG in Europe

- 488 LNG fueling stations (01.2022)
- Average consumption of 120 t LNG per month per station = about 700,000 t LNG total
- Several Bio-LNG liquefactions planned

MAXIMILIAN KURTH

FUELS OF THE FUTURE

Maximilian Kurth from bmp greengas GmbH presented, among other things, existing LNG filling stations in Europe. Filling station operators and LNG logistics companies can switch to bio-LNG as a climate-friendly alternative in the future. By 2024, 25,000 trucks could already be running on bio-LNG, he estimated.

Green methane is easy to store and can be transported over longer distances (e.g. from Australia), as Zoltan Elek from Landwärme GmbH explained in his contribution. In addition, it promotes the circular economy and serves to protect the environment and water. However, only 6 out of 27 EU countries use bio-LNG, according to the expert.

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### CURRENT SUPPORT OF RENEWABLES FROM THE RENEWABLE METHANE PERSPECTIVE

NUMBER OF STATES	CURRENT PRACTICE
27	established feed-in-tariffs for renewable electricity
27	established a (bio)fuel quota system
27	allow liquid 1st gen. biofuels to count towards their biofuel quota
27	have CNG filling stations
21	have LNG filling stations
6	accept biomethane or bio-LNG to count towards the (bio)fuel quota
4	have established a biomethane production subsidy scheme
2	grand feed-in-tariff for electricity produced from biomethane
1	allows imported biomethane in their subsidy scheme

ZOLTAN ELEK

FUELS OF THE FUTURE

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UNIVERSITY OF HOHENHEIM  
State Institute of Agricultural Engineering and Biotechnology (IAT40)

probioLNG

### Location of pilot plant

Elena Holl

FUELS OF THE FUTURE

Faster decomposition processes, better quality and variable application possibilities: Elena Holl from the University of Hohenheim presented an experimental plant for biomethane production at the test site "Unterer Lindenhof". Renewable raw materials are being investigated with different conversion techniques in order to find the combination with the best efficiencies. The fermentation of liquid manure or maize produces biogas, which is either fed into the local gas grid or used to generate electricity and heat in a local combined heat and power plant.

Bio-LNG can be distributed through gas grid injection or local fuel production. Securing operations after the expiry of the feed-in tariff could be worthwhile, among other things, through a scrapping premium for trucks, which would lead to an increasing sales market, said Alexey Mozgovoy of Planet Biogastechnik GmbH in his contribution.

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### Wie erfolgt das Inverkehrbringen von Biomethan?

PlanetET

**A. Gasnetzeinspeisung**

- Flexible Vertragsgestaltung,
- Anlagenkomplexität überschaubar,
- Wertschöpfung wird mit Dritten geteilt

**B. Lokale Kraftstoffproduktion**

- Mehr Wertschöpfung vor Ort,
- Mehr Wertschöpfung beim Landwirt,
- Evtl. verminderte Netzkosten

ALEXEY MOZGOVOY

FUELS OF THE FUTURE

# Session 15 Biofuels in agriculture and forestry

Facilitator:

Prof. Dr. Peter Pickel,  
John Deere GmbH & Co. KG



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Farmers have to deal with rising energy prices

National CO<sub>2</sub>-Pricing will lead to higher prices for fossiles (started 2021!)  
Farmers have to check their options, e.g. use of biofuels

Year	CO <sub>2</sub> pricing of fossil diesel (€/t)	Fossil demand (Mtoe)
2021	15	6.3
2022	16	6.5
2023	17	6.8
2024	18	7.2
2025	19	7.8
2026	20	8.5
2027	21	9.5
2028	22	11
2029	22.2	13
2030	22.2	15

Stephan Arens

FUELS OF THE FUTURE

The use of sustainable biofuels in agricultural and forestry machinery could save around 3 million tonnes of CO<sub>2</sub> in the short term, according to Stephan Arens of the Union for the Promotion of Oil and Protein Plants (UFOP e.V.). The conversion to biofuels requires an attractive and, above all, reliable tax framework. An increase in the federal programme to promote energy efficiency and CO<sub>2</sub> savings in agriculture and horticulture is also desirable.

Markus Winkler from Deutz AG presented a hydrogen engine with an output of around 150 kilowatts that could be used in the off-highway sector in the future. It is not the engine itself that causes CO<sub>2</sub>, but the fossil fuels, he summarized the problem. The "Deutz Powertree" could be used as a fast-charging hub at construction sites or airports, for example.

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**DEUTZ TCG 7.8 H<sub>2</sub> - Hydrogen combustion engine**  
An engine with a wide range of applications

- Off-Road applications**
  - Excavators
  - Tractors & agricultural machinery
- Stationary power generation**
  - Generators (Diesels)
  - Block heat and power plants
- Rail applications**
  - Regional trains
  - Special vehicles
- City and intercity buses**
  - Medium range buses, 12m
  - Complement to BEV city centre fleets
- Delivery trucks**
  - 16-18t trucks
  - delivery traffic

Markus Winkler / VE-1A

FUELS OF THE FUTURE

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**Goals**

- Tractor which can be operated with different fuels and fuel mixtures
- Detection of fuel mixture in tank
- Based on series sensors and mathematical models – No additional Sensors
- Adjust engine parameters to fit in an optimal way regarding power, fuel consumption and emissions

Andreas Schröder

FUELS OF THE FUTURE

Andreas Schröder from John Deere gave a presentation on the "MuSt5-Trak" research project on a multifuel tractor. Bio-fuels and conventional diesel fuels can be used in various mixtures. Sensors inform the engine control system so that optimal operation is possible. Hydrogenated vegetable oils (HVO) can also be integrated into the fuel matrix.

Dr. Peter Emberger from the Technology & Support Centre (TFZ) spoke about the advantages of a multifuel engine: Operators can choose the preferred fuel and there are no disadvantages in performance behaviour, among other things, he said. The service life of the sensors, on the other hand, still needs to be researched.

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**Integration of the VLO-M1 and HLB1400 sensors in the tractors**

Emberger + Spiegel  
Folie 20

TFZ

FUELS OF THE FUTURE

## IMAGE REFERENCE

p.2 "orinoco-art", Canva.com  
pp.3 German Bioenergy Association

## CONTACT

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For more information, please visit <https://www.fuels-of-the-future.com/en>.