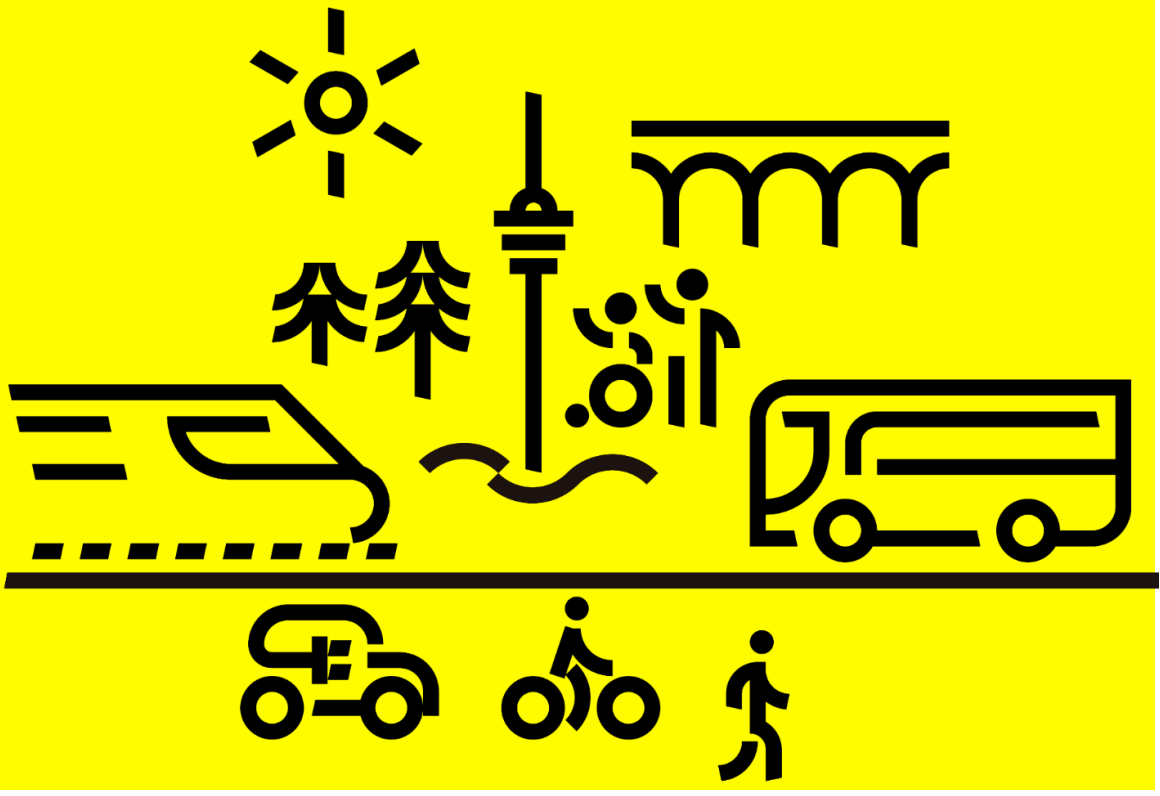
Baden-Württemberg

reFuels Action Plan

Necessary steps for the industrialization of PtL fuels



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reFuels Action Plan – Necessary steps for the industrialization of PtL fuels

Renewable fuels are indispensable for the defossilization of those areas of the transport sector where alternative technologies cannot be used or are difficult to use. Without these fuels, it will not be possible to achieve net greenhouse gas neutrality by 2040 at the state level, by 2045 at the federal level, or by 2050 at the European level. Both electricity-based and biogenic fuels will play an important complementary role in the future. However, both technologies currently face significant challenges that need to be addressed politically in the near term.

In the following, we focus on the specific challenges of power-to-liquid (PtL) fuels. While the technological principles for producing PtL fuels are well known, many processes still need to be further developed and scaled up for large-scale industrial application. However, industrial scaling — and thus the market ramp-up of PtL fuels — faces significant challenges. Under the current regulatory framework, ramping up production within the European Union is hardly feasible. Instead, technologies and production capacities are being developed outside the EU. At the same time, the existing regulatory requirements are geared towards European production, creating uncertainty in many non-EU countries as to whether production in line with EU standards is feasible at all. This further complicates urgently needed imports, which are essential for ensuring resilience. In order to create a suitable framework for competitive PtL production in the EU and to fully unlock the potential of importing PtL fuels and other hydrogen derivatives, the EU must take swift action as outlined and explained in the following action plan.

The EU has created a regulatory framework to manage a dynamic growth phase in which production capacities for PtL fuels are being massively expanded. The aim is to establish sustainable production in the long term while at the same time advancing the decarbonization of the energy sector. The problem, however, is that this growth phase of PtL production has not yet been reached. At present, the industry is still in an upstream innovation, testing, and scaling phase, in which various technological approaches must be tested and optimized in order to determine the best technology path for future production.

This phase requires different rules and framework conditions than the subsequent growth phase, as innovation and development pose different challenges and risks than large-scale industrial implementation and growth. A strict set of rules may be useful in the later growth phase in order to steer fuel production clearly in the direction of sustainable production. In the current experimental innovation and scaling phase, it provides too little flexibility and slows down progress. In addition, fuel producers in the innovation and scaling phase face the first-mover dilemma, which is associated with high financial risks: plants built later can produce more efficiently and at lower cost, causing early facilities to lose competitiveness quickly. Regulation should therefore initially aim to enable companies to move rapidly through the innovation and scaling phase and then transition swiftly to the growth phase, in which the technology is applied more broadly and production capacities are expanded on a large scale.

After an overview, the following sections set out in detail the measures that should be implemented to enable a rapid technology ramp-up in the EU. In addition, they explain why these steps are critical and time-sensitive in the current innovation and scaling phase.

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reFuels Action Plan – Summary

1. Adjust transitional rules on green electricity criteria for first PtL plants to ensure economic viability: The current requirements for electricity used in the production of renewable fuels of non-biological origin are too restrictive and hinder cost-effective production. To ensure that plants are actually built and production technologies continue to develop, pragmatic transitional arrangements — or at least an extension of the transition periods — are needed.

2. Allow the use of unavoidable and hard-to-abate CO_2 emissions beyond 2040: To secure carbon supply in the coming years and enable the scaling of synthetic fuels, the use of unavoidable and hard-to-abate emissions from industrial point sources must remain permitted beyond 2040 — as they are more readily available and easier to access than biogenic or atmospheric CO_2. Otherwise, corresponding fuel production plants will not be economically viable and therefore will not be built. A prerequisite is a balancing mechanism based on geological storage or long-term carbon sequestration from 2040 onwards.

3. Simplify rules for co-processing and allow flexible allocation of renewable shares to products: The joint processing of renewable and fossil feedstock is one of the few economically viable approaches for producing renewable fuels at competitive prices and promoting the market ramp-up. To unlock its full potential, clear and practicable rules are needed, along with flexible and consistent attribution of renewable shares and their recognition in relevant regulations such as the EU Emissions Trading System (EU ETS), ReFuelEU Aviation, and FuelEU Maritime.

4. Enable imports of PtL fuels and intermediates produced with industrial CO_2 from non-EU countries: In the long term, the EU will depend on imports of synthetic fuels from different regions in order to ensure a crisis-proof and resilient supply. In practice, however, current requirements exclude many potential production countries. To foster international scale-up and ensure security of supply, flexible and pragmatic rules are needed that also allow fuel imports from countries without an "effective carbon pricing system" — without lowering climate and sustainability standards.

5. Provide long-term planning certainty — establish a binding EU-level pathway to climate neutrality by 2050 with clear rules for residual emissions, quotas, and sector-specific strategies: Companies and investors need long-term planning certainty for investments in climate-neutral technologies, but current regulations leave key questions unanswered. The EU should present a consistent and coherent roadmap to climate neutrality across all sectors, including clear quotas, a strategy for the existing passenger car fleet, and rules for handling residual emissions, in order to avoid delaying necessary investments. At the same time, flexibility for future developments should be allowed for.

6. Guarantee regulatory grandfathering for first PtL plants: Without certainty that synthetic fuels produced under today's requirements will continue to be counted as renewable in the future, there is a risk that they will lose their value under regulatory changes. This would undermine the necessary investment security and prevent plants from being built. A reliable grandfathering provision must therefore be ensured over the entire depreciation period.

7. Reduce financial risks — for example through securing long-term supply and off-take agreements: To ensure that production plants for synthetic fuels are built, investment risks must be reduced through targeted government measures. Suitable de-risking instruments should be further developed, and long-term supply and off-take agreements promoted. Mechanisms such as H2Global or auctions under the European Hydrogen Bank should be expanded and reliably financed — for example through revenues from the EU ETS.

8. Establish a reliable chain of custody for SAF-related emission reductions and introduce a book-and-claim system compatible with existing regulation: Currently, standardized documents are missing in the chain of custody from producers to airlines, which prevents SAF-related emission reductions from being accounted for under the EU ETS and removes the financial incentive to use SAF. A reliable chain of custody must therefore be established. In addition, a European book-and-claim system should be introduced that is compatible with existing regulations such as ReFuelEU Aviation and the EU ETS, in order to facilitate SAF trading and reduce logistical and administrative barriers.

Key immediate actions to enable the rapid scale-up of synthetic fuel production

Regulatory measures

1. **Adjust transitional rules on green electricity criteria for first PtL plants to ensure economic viability**: The requirements set out in the RED II delegated act on electricity used in the production of renewable fuels of non-biological origin are extremely strict. They are intended to ensure both the sustainable production of renewable fuels and the continued defossilisation of power generation — even though the latter is already addressed by the European Emissions Trading System (EU ETS). For innovative first-of-a-kind plants producing synthetic fuels, which initially need to gain operational and practical experience, these requirements are too demanding. Technical and economic realities are not sufficiently taken into account: for example, complying with an hourly correlation between power generation and consumption in hydrogen production represents a major challenge. Depending on the electrolysis technology, highly dynamic operation leads to increased wear and tear. In addition, production plants typically depend on continuous operation in order to be cost-efficient. Under the current requirements, however, this is difficult to achieve, driving production costs even higher and further undermining competitiveness. Yet without competitive prices, there will be no customers — and without customers, no plants will be built.

   Economic viability is already crucial in the early phase of the market ramp-up — not only once a mature market has been established. Although technology development is still underway, investment and production costs for electricity-based fuels are so high that even the first plants will only be built if profitable operation is foreseeable. A ramp-up permanently financed by subsidies is neither politically nor fiscally feasible. At the same time, regulatory measures such as quotas or penalties alone are insufficient to reliably trigger investment. Especially in the early phase, there is a risk that companies treat penalties as a calculable cost item and weigh them against purchasing or producing more expensive fuels themselves — particularly when the fossil core business remains significantly more profitable. Such a system is unstable and dependent on political continuity. Once the credibility of regulatory requirements is called into question — for example due to rising prices or political pressure — the basis for reliable investment decisions disappears. Competitiveness is therefore not a secondary condition but the prerequisite for investment and production in the first place.

Accordingly, pragmatic transitional rules for innovative first-of-a-kind plants are essential to move through the innovation and development phase as swiftly as possible. They should be more flexible than the current requirements or at least provide for a longer transition period in order to enable economic production. It is important that these transitional rules are developed in close coordination with fuel producers and other relevant stakeholders. This is the only way to find practical and broadly applicable solutions that do not hinder innovation. Transparent, reliable, and long-term planning is of utmost importance to ensure investment security. This should in no way weaken climate protection standards but is a prerequisite for the production ramp-up that is essential for climate protection. At the same time, it must be ensured that long-term climate targets are achieved.

2. **Allow the use of unavoidable and hard-to-abate CO_2 emissions beyond 2040**: The long-term role of direct air capture (DAC) and biogenic sources for future carbon supply is undisputed. However, DAC technology will not be available at industrial scale for the foreseeable future. Biogenic CO_2 sources do exist, but they are limited and not available in all potential production countries. Moreover, they are unlikely to meet future demand.

   To secure CO_2 supply in the coming years, enable the scaling of synthetic fuel production, and fully exploit the CO_2 mitigation potential, unavoidable and hard-to-abate process-related emissions should therefore also be usable — particularly during the ramp-up phase. Such emissions arise, for example, in the cement and lime industries, in thermal waste treatment, as well as in parts of the chemical industry and at refinery sites. The use of CO_2 from such point sources is currently the only practical and economically viable option at many locations for ensuring a reliable carbon supply. It also offers several advantages: it is more energy-efficient, entails lower investment costs, and requires less land than CO_2 recovery from the atmosphere. It therefore plays a decisive role in the ramp-up of synthetic fuel production.

   However, current regulations make this use considerably more difficult: they only allow these emissions to be used for renewable fuels of non-biogenic origin (RFNBOs) until the end of 2040. This ignores the long investment cycles of industrial plants, which can take up to 20 years to pay for themselves. Since such plants are not profitable under these conditions, they are not being built, and valuable CO_2 savings remain unused. In order to realize this potential and at the same time ensure that climate neutrality is

achieved, the use of such emissions should continue to be possible under certain conditions even after 2040 – the necessary framework conditions for this are presented below.

A blanket ban on the use of unavoidable and difficult-to-avoid CO_2 emissions is not an appropriate approach to reducing these emissions. Both industrial plants and air traffic are already subject to the EU ETS, which creates a strong incentive to avoid and reduce emissions—regardless of whether the CO_2 is used or not. This principle should be maintained.

To enable the use of these emissions for fuel production while at the same time ensuring the long-term climate neutrality of such fuels, the limitation to the year 2040 for unavoidable and hard-to-abate process-related emissions such as those mentioned above should be lifted. Instead, a European accounting system should be introduced to ensure that any use of fossil or process-related CO_2 from these sources beyond 2040 is balanced by geological CO_2 storage (CCS) or by long-term CO_2 utilization (CCU) from biogenic or atmospheric sources.

3. **Simplify rules for co-processing and allow flexible allocation of renewable shares to products**: Co-processing — the joint processing of fossil and renewable feedstock to produce fuels with a renewable share — is currently one of the few economically viable approaches to producing renewable fuels at competitive prices and can make a significant contribution to the market ramp-up. To this end, rules for co-processing should be clear, simple, and practicable, without losing sight of the long-term climate targets. Established models from the chemical industry can serve as a reference. In addition, to maximize climate benefits, co-processing should be enabled for a broad range of renewable and recycled feedstock across all process steps.

   The refining process always produces several products, known as co-products. To give producers greater flexibility and support the market ramp-up, flexible and consistent attribution of renewable shares should be allowed. This makes it possible to allocate the renewable share specifically to those products where it creates the greatest added value — for example, kerosene, which is urgently needed to meet the respective climate targets. Consequently, co-processing products should be eligible for credit in the EU ETS and in regulations such as ReFuelEU Aviation and FuelEU Maritime in line with their allocated renewable share. At the same time, the carbon balance must remain consistent — i.e., the renewable share allocated to products corresponds to that in the

input used. This avoids unnecessary additional costs and accelerates market integration.

4. **Enable imports of PtL fuels and intermediates produced with industrial CO_2 from non-EU countries**: The EU will continue to rely on imports from different regions in the long term in order to ensure a crisis-proof and diversified supply of PtL fuels and other green hydrogen derivatives.

   As already explained in Point 2, the production of renewable fuels currently relies on biogenic and industrial CO_2 sources, as DAC is not yet available on an industrial scale. However, many potential production countries have few biogenic sources — often only cement plants and other industrial CO_2 sources are available there. Importing fuels from industrial CO_2 is currently not possible due to current EU regulatory requirements, meaning that many of these countries are effectively out of the question as suppliers of RFNBOs to the EU.

   The problem is that the current rules for the production of synthetic fuels are primarily geared towards production within the EU. For industrial CO_2 sources, the CO_2 must first be accounted for in an "effective carbon pricing system." In a legally non-binding Q&A document, the European Commission explains the conditions for such a system and cites the EU ETS, the Swiss ETS, and the UK ETS as examples of effective carbon pricing systems. However, it remains unclear which other countries will be recognized.

   This prevents the timely conclusion of off-take agreements with producers outside the EU — a key prerequisite for meeting the established quotas and climate targets. As a result, the fuels in question are either exported to other parts of the world or the production facilities are not built at all.

   To remove this barrier, new, flexible, and pragmatic rules for production in non-EU countries should be developed in collaboration with fuel producers and other relevant stakeholders. These must ensure that renewable fuels can also be imported from countries that do not currently have an "effective carbon pricing system". At the same time, it must be guaranteed that imported fuels are equivalent to those produced in Europe in terms of climate and sustainability standards. Only in this way can the international scale-up of production be promoted, trade in renewable fuels enabled, long-term security of supply in Europe ensured, and international climate targets be met.

5. **Provide long-term planning certainty — establish a binding EU-level pathway to climate neutrality by 2050 with clear rules for residual emissions, quotas, and sector-specific strategies**: Companies and investors need long-term planning certainty to make strategic decisions on major investments in climate-neutral technologies and infrastructure. These decisions often involve planning horizons of several decades — many companies already have to make choices today that will affect their production in the 2040s. The EU must therefore create the necessary policy framework now to ensure that investments are made in time.

   Although the EU is pursuing the goal of climate neutrality by 2050, existing regulations such as ReFuelEU Aviation, FuelEU Maritime, and the Renewable Energy Directive (RED III) do not yet provide for complete decarbonization. While RED III only sets binding targets until 2030, the European Commission's current plans for 2040 remain unclear as to how residual emissions are to be addressed. Against this backdrop — and given that the last allowances in the EU ETS are expected to be auctioned as early as 2038 — concrete regulations beyond 2030 and 2040 are now needed to achieve climate neutrality at EU level by 2050.

   This applies in particular to industries with unavoidable process-related emissions, such as the cement industry. So far, there is no clear strategy for dealing with residual emissions once the EU ETS comes to an end. Open questions include whether only CCS or CCU with long-term carbon storage will be considered as solutions, or what role other CCU approaches compatible with climate targets will play — such as the accounting option proposed under Point 2. The EU should therefore determine in a timely manner which technologies and accounting mechanisms will be recognized as permissible options in the future, in order not to jeopardize investments.

   Furthermore, the EU should establish a clear, consistent, and coherent framework with binding milestones to ensure long-term planning certainty for the implementation of climate neutrality in the transport sector by 2050. This includes, in particular, the long-term setting of quotas and multipliers for renewable fuels in the RED. Long-term quotas help to estimate future demand, prepare strategic decisions, and trigger targeted investments. Multipliers can make the share of renewable energy used appear larger than it actually is. They should therefore be phased out gradually in order to reflect the achievement of targets in a transparent and realistic manner.

In the transport sector, the EU should develop an integrated strategy that takes into account electrification, the use of renewable fuels, and, in particular, the existing vehicle fleet. This strategy must clearly show how net greenhouse gas neutrality can be achieved in the transport sector in a timely manner. A long-term decarbonization and defossilization plan should also be presented for industry.

In doing so, the EU should strike a balance between providing planning certainty for companies on the one hand and offering sufficient flexibility on the other to respond to future technological developments and market changes.

6. **Guarantee regulatory grandfathering for first PtL plants**: The regulatory framework for synthetic fuels is still being developed, and it is both likely and desirable that legal requirements will evolve further in the coming years. However, investments in new plants require certainty for investors that the fuels produced will continue to be recognized as renewable in the future. Without appropriate grandfathering provisions, there is a risk that these products will lose their value under regulatory changes and no longer be in demand. This risk deters investors and off-takers and thus hampers the scale-up of the technology. To enable final investment decisions to be taken today and plants to be built, reliable grandfathering for innovative first-of-a-kind plants should be ensured over the entire depreciation period.

Operational measures

7. **Reduce financial risks — for example through securing long-term supply and off-take agreements**: Since both the future price and demand for synthetic fuels are difficult to predict today, the investment risk of building production plants during the innovation and scaling phase is particularly high. Without government-backed guarantees, innovative first-of-a-kind plants are therefore hardly financeable. To enable final investment decisions, this risk should be reduced through targeted government measures. A range of de-risking instruments is available, which should be selected and applied in close cooperation between the European Commission, producers, and the financial sector.

   Long-term off-take agreements, such as those under the H2Global[1] mechanism, play a particularly important role. They are crucial for overcoming the first-mover dilemma by guaranteeing stable revenues over an extended period. It should be examined how such contracts for renewable fuels can be financed and further expanded on a permanent basis — for example, using revenues from the EU ETS, which also covers aviation and maritime sectors.

   As part of the upcoming third auction round of the European Hydrogen Bank, it should be examined to what extent long-term off-take agreements can also be more strongly supported for downstream products based on RFNBO hydrogen, such as renewable fuels and green derivatives. So far, these products have only benefited indirectly from support, since the auctions have focused on hydrogen as the primary product. Dedicated support could help strengthen the entire renewable energy value chain and provide investment certainty for producers and off-takers.

   In addition to instruments such as H2Global and the European Hydrogen Bank, which primarily aim to build production capacities and international supply chains, the demand side should also be taken into account. Contract-for-difference models can play a complementary role here, as they create economic conditions that facilitate investments in the use of PtX products during the early market phases.

[1] The core idea of H2Global is the so-called “double auction model.” It is designed to bridge the gap between the high prices at which hydrogen is currently available on the world market and the lower prices at which it can be resold regionally and used economically.

At the same time, in times of tighter public budgets, it should also be examined how appropriate regulation can help avoid the need for government subsidies.

8. **Establish a reliable chain of custody for SAF-related emission reductions and introduce a book-and-claim system compatible with existing regulation**: Without a reliable chain of custody, there is no basis for the transparent and regulation-compliant use of SAF. However, there are currently no standardized documents to provide legally compliant evidence for the entire supply chain — from production through to airlines. This not only complicates the implementation of ReFuelEU Aviation but also prevents SAF-related emission reductions from being taken into account in the EU ETS, i.e. from leading to a reduction in the number of allowances to be surrendered. Without this possibility, airlines lack a crucial financial incentive to use SAF.

   To ensure compliance and transparency in the SAF supply chain, standardized proofs must be introduced that cover the entire process from production to use. These include, in particular, compliance tickets that fuel suppliers can use to demonstrate fulfilment of the SAF blending mandates under ReFuelEU Aviation, as well as SAF certificates that airlines need to verify their SAF purchases under the EU ETS. As highlighted in the European Commission's report on the feasibility of an EU SAF trading system, such proofs are essential to ensure transparency and meet regulatory requirements. Depending on the technical implementation, these documents could exist either as traditional proof documents or in digital form via a central database (UDB).

   In addition to a reliable chain of evidence, it is equally crucial to ensure the availability of SAF. Even if regulatory barriers are removed through standardized documentation, the physical provision of SAF remains a challenge. Sustainable aviation fuels are produced in a limited number of regions, and physical delivery to each location is often logistically complex, expensive, and leads to additional CO_2-emissions. To prevent the use of SAF from being hindered by these obstacles, the EU must ensure that more flexible mechanisms for SAF trading are established.

   A book-and-claim system offers a solution by decoupling the physical delivery of the fuel from the trading of its sustainability attribute, allowing certificates for the use of renewable fuels to be traded flexibly between suppliers and end-users. This enables SAF to be placed on the market where it is most economically efficient. The EU should therefore expand the flexibility mechanism under ReFuelEU Aviation to include elements of an EU-wide book-and-claim system.

A well-designed book-and-claim system can significantly reduce logistical and administrative requirements, benefiting both producers and end-users. It makes market entry easier, particularly for smaller producers, as they can market their products without complex supply chains. At the same time, ambitious airlines seeking to reduce their carbon footprint gain a practical way to purchase sustainable fuels — regardless of logistical barriers or high transport costs that would otherwise make procurement unattractive.

To fully unlock the potential of a book-and-claim system, it must be closely linked to the chain of custody. The tradable certificates should be directly integrated into existing regulatory mechanisms and recognized as proof within frameworks such as the RED and the EU ETS, as well as programs like ReFuelEU Aviation and CORSIA. In this way, book-and-claim can not only create flexibility in the market but also reduce bureaucratic barriers and promote transparency.

For maritime transport (FuelEU Maritime), an equivalent solution should be developed.

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