BRIEFING

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Changes to the Renewable Energy Directive revision and ReFuel EU proposals: Greenhouse gas savings and costs in 2030

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Under the European Climate Law, the European Union (EU) has a legally binding commitment to reach net zero greenhouse gas (GHG) emissions by 2050.[1] This includes a requirement to reduce emissions by 55% relative to 1990 levels by 2030. To achieve this goal, in July 2021, the European Commission released a package of proposals called "Fit for 55." Several proposals include support for renewable fuels to help reduce GHG emissions from the transportation sector, one of the hardest to decarbonize. In a recent ICCT consultant report, Christensen models how two of these proposals, in their current form and with possible changes, would incentivize the use of various alternative fuels and renewable electricity in the transport sector in the EU in 2030.[2] Here we summarize the main findings of that study, including its estimates of the GHG and cost impacts of the European Commission's proposal.

The results in Christensen indicate that the climate benefits of the proposed revision of the Renewable Energy Directive (REDII) would actually increase if the 13% GHG reduction target for transport energy is reduced. This is because the higher target incentivizes the production of greater amounts of high-GHG food and feed-based fuels, even with the current 7% cap on food-based fuels. At the same time, the study concludes that a GHG intensity target results in greater GHG savings and a lower cost of carbon abatement compared to a renewable energy target.

This briefing provides policy recommendations that could assist the European Council and Parliament as they negotiate the final legislation for the Fit for 55 package. Our recommendations follow the findings in Christensen regarding how changes to the policy proposals can achieve greater GHG savings at a lower cost. The analysis also highlights sustainability risks associated with food-based fuels, including intermediate crops.

1 European Commission, European Climate Law, (2021), https://ec.europa.eu/clima/policies/eu-climate-action/law_en

2 Adam Christensen. *Transportation carbon intensity targets for the European Union: Road and aviation sectors.* (Washington, DC: ICCT, 2021), https://theicct.org/publications/transport-carbon-intensity-targets-eu-aug2021

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POLICY CONTEXT

One proposal in the Fit for 55 package is a revision of the Renewable Energy Directive (RED II), which replaces the 14% target for renewable energy in transport in 2030 with a 13% GHG intensity reduction target for fuels, compared to a liquid fossil fuel baseline GHG intensity.[3] This change increases the ambition level of the transport target and fundamentally changes how the policy will function. Under the 2018 RED II, all fuels were required to meet a GHG reduction threshold to be considered eligible, e.g. 50%–65% for biofuels. However, all fuels were considered equal on an energy basis when contributing to the 14% energy target, except for when multipliers were applied. Under the proposed revision, fuels that achieve higher GHG savings make a larger contribution towards the policy target and so are more highly incentivized.

Even though the proposed GHG target is nominally lower than the previous renewable energy target, its ambition level is actually much higher. A greater amount of renewable fuel is needed to achieve a 1% GHG reduction than 1% of energy. Importantly, the proposed RED II revision removes multipliers toward the target, except for the maritime and aviation sectors. The RED II revision proposal also increases the advanced biofuel energy mandate in 2030 from 1.75% (when double counting is considered) to 2.2% of transport energy. In addition, it includes a new 2.6% energy mandate for renewable fuels of non-biological origin (RFNBOs), which include renewable electrolysis hydrogen and electrofuels, also known as power-to-liquids.

While the RED II GHG target includes fuels used in aviation and maritime, the Fit for 55 package also includes separate, legally binding regulations for the maritime and aviation sectors. The ReFuel EU regulation, which includes sustainable aviation fuel (SAF) mandates for several years up to 2050, requires 5% SAF in 2030, with a 0.7% sub-mandate for RFNBOs in aviation. Food-based biofuels are ineligible for these mandates. The Commission also proposed a FuelEU Maritime regulation that includes GHG intensity reduction requirements, including a 6% GHG intensity reduction target for 2030, but the maritime sector is outside the scope of the analysis in Christensen. Christensen assesses the effect the proposed RED II revision and ReFuel EU could have on the mix of fuels supplied to the road and aviation sectors in Europe in 2030.

ANALYSIS AND IMPLICATIONS OF POLICY SCENARIOS

Christensen utilizes a partial equilibrium model to simulate decisions made by fuel blenders, suppliers, and vehicle consumers complying with either a GHG intensity target or a renewable energy target, mandates, and caps in several policy scenarios. In addition to assessing the impact of the original proposals on the transport sector in 2030, the study includes nine additional scenarios assessing other policy options. The model covers the aviation and road sectors, including both cars and trucks, but not the maritime sector.

The model simulates a market where fuel suppliers may trade and use GHG reduction credits generated from the use of renewable fuel to achieve compliance with the policy targets. Fuel GHG intensity reduction policies generally award GHG credits on the basis of GHG saved per unit of fuel supplied, and those credits can be traded or used for compliance in a credit market. The first scenario, called “RED II revision proposal,” is an assessment of the RED II revision and ReFuel EU initiatives as proposed, and the remaining nine scenarios, characterized in Table 1, assess possible changes that could be introduced during the trilogue discussion between the European Parliament and Council in autumn 2021.

3 Stephanie Searle, *Policy update: alternative transport fuels elements of the European Union’s “Fit for 55” package.* (Washington, DC: ICCT, 2021), https://theicct.org/publications/alternative-fuels-fit-for-55-eu-sept21.

These scenarios assess the impact of 1) the overall transport target as a GHG reduction target, as it is in the RED II revision proposal, compared to a renewable energy target, as it is in the current RED II (the **RED II revision proposal and the renewable energy target scenarios**); 2) reducing the GHG intensity target (**lower GHG intensity target scenario**); 3) changing the volume of the renewable energy target (**high renewable energy target scenario**); 4) the eligibility of food and feed-based fuels counting towards the target, including intermediate crops (**no food-based biofuels; no food-based or intermediate crops; no intermediate crops; and energy target, no food-based or intermediate scenarios**); 5) changing the advanced biofuel target level and RFNBO target for aviation (**higher subtargets scenario**); and 6) the electric vehicle (EV) penetration rate (**low EV growth scenario**).

Table 1. Description of policy scenarios and their greenhouse gas reductions and costs relative to baseline, based on Table 9.1 in Christensen.

Scenario	Scenario name	Fuel greenhouse gas (GHG) intensity reduction target	Renewable energy mandate	Food and feed-based cap	Cover crops allowed outside cap?	Advanced biofuel mandate	Aviation e-fuels mandate	High (Climate Target Plan) or low electric vehicle uptake	Renewable share
1	**Red II revision proposal**	13%	-	7%	Y	2.2%	0.7%	H	15.6%
2	**Lower GHG intensity target**	11%	-	7%	Y	2.2%	0.7%	H	12.6%
3	**No food-based biofuels**	9%	-	0%	Y	2.2%	0.7%	H	10.5%
4	**No food-based or intermediate crops**	8%	-	0%	N	2.2%	0.7%	H	8%
5	**No intermediate crops**	13%	-	7%	N	2.2%	0.7%	H	14.2%
6	**Higher subtargets**	13%	-	7%	Y	2.75%	2.5%	H	15.3%
7	**Low EV growth**	13%	-	7%	Y	2.2%	0.7%	L	17%
8	**Renewable energy target***	-	26%	7%	Y	2.2%	0.7%	H	15.6%
9	**High renewable energy target***	-	29.5%	7%	Y	2.2%	0.7%	H	18.9%
10	**Energy target, no food-based or intermediate***	-	19%	0%	N	2.2%	0.7%	H	8.8%

*All renewable energy target scenarios include current RED II multipliers (2x for Annex 9 fuels, 4x for electricity used in EV's, and 1.2x for aviation fuels in the mandate level, fourth column, but not in the renewable energy share reported in the final column).

Unless noted otherwise, all current definitions in the RED II, phase outs, and caps apply in the model. In the renewable energy target scenarios, the model applies the multipliers in the 2018 RED II—2x for advanced biofuels, 1.2x for maritime and aviation fuel, and 4x for renewable electricity use in electric vehicles. The GHG intensity target scenarios only maintain the 1.2x multiplier for aviation and maritime sectors (applied to energy consumption, not to GHG reductions), in line with the RED II revision proposal.

Figure 1 shows the total greenhouse gas savings and average carbon abatement cost (in euros per metric ton of CO_2e) for the ten different policy scenarios. The savings are calculated compared to a baseline scenario in which there is no renewable fuel policy incentives. The average cost of carbon abatement is calculated as the difference in consumer costs when compared to the baseline, divided by the GHG savings.

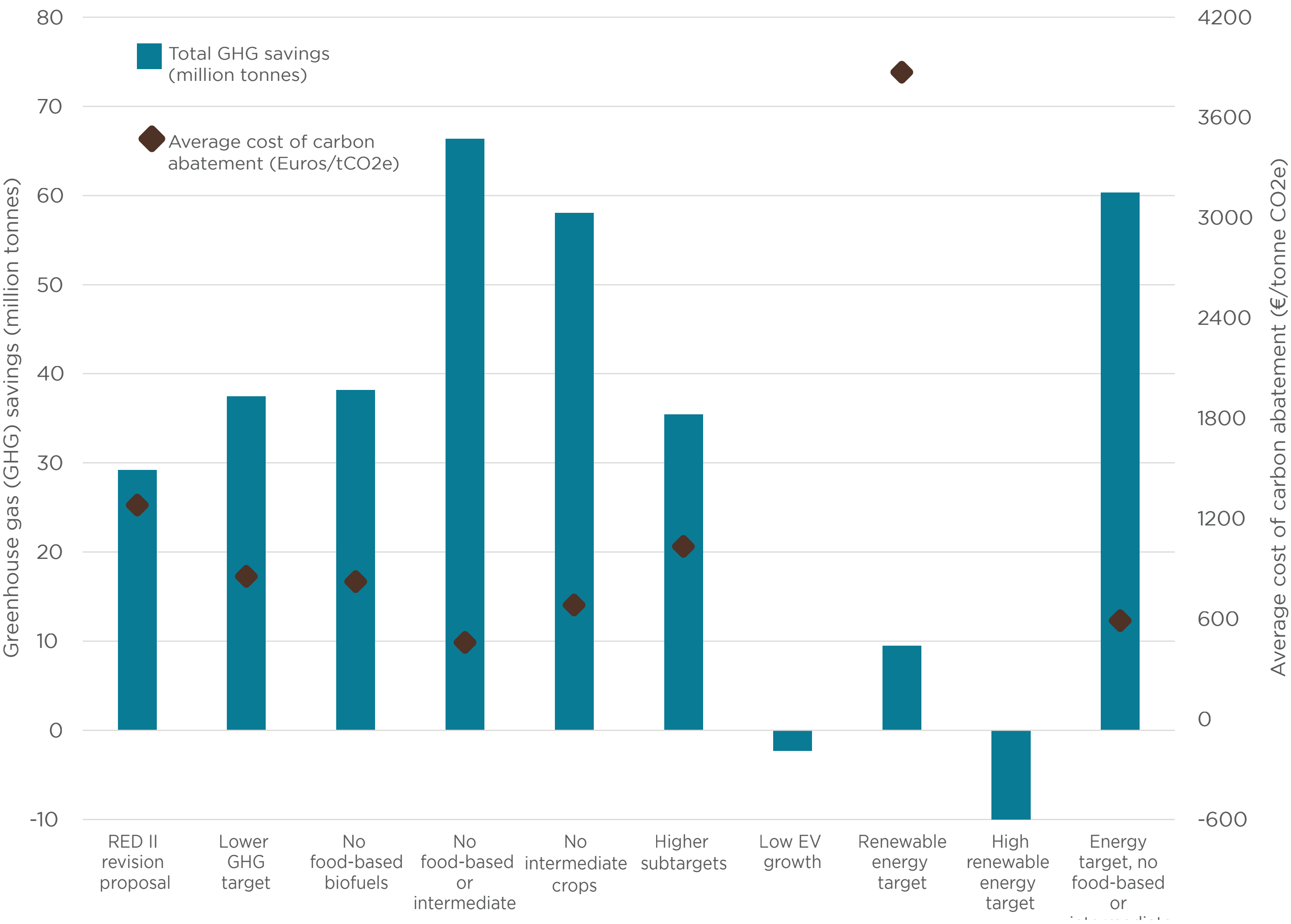

Figure 1. Total greenhouse savings relative to baseline (left axis, million tonnes CO_2e) and average cost of carbon abatement (right axis, euros per tonne CO_2e) for each policy scenario

The study shows that the **renewable energy target scenario** produces carbon abatement costs that are three times higher and greenhouse gas savings that are three times lower than **the RED II revision proposal**. Generally, a GHG intensity target provides greater GHG savings at lower cost. This is because a GHG intensity target can provide an incentive to further decarbonize fuel production beyond an energy target because it rewards additional efficiency and production improvements. For example, an ethanol producer that implements carbon capture and storage (CCS) can reduce emissions and generate more credits per unit of fuel supplied than an ethanol producer without CCS.

The results of this study suggest that introducing higher ambition for the transport sector in the RED II revision proposal does not necessarily result in genuinely higher GHG savings. The RED II does not include indirect land use change (ILUC) in the GHG calculation of different fuel pathways and food-based biofuels are some of the lowest cost alternative fuels available. There is an incentive to use these fuels to meet the target although they may provide very little climate mitigation and, in some cases, are worse than fossil fuels. Christensen follows the RED II in excluding ILUC emissions in simulating compliance with the policy targets, but does include ILUC emissions when calculating the overall GHG impacts to more accurately portray the climate change

4 Hugo Valin, Daan Peters, Maarten van den Berg, Stefan Frank, Petr Havlik, Nicklas Forsell, & Carlo Hamelinck, *The land use change impact of biofuels consumed in the EU: Quantification of area and greenhouse gas impacts,* (Ecofys: Utrect, 2015) (Ecofys: Utrect, 2015) https://ec.europa.eu/energy/sites/ener/files/documents/Final%20Report_GLOBIOM_publication.pdf

mitigation potential of the policy options. Including ILUC in the overall GHG savings calculation explains why the average carbon abatement cost is higher when food- and feed-based biofuels are allowed to help meet the amended RED II mandate compared to when they are not.

Intermediate crops are not included in the 7% cap, though they likely have ILUC emissions as high as their food-and-feed based counterparts. Intermediate crops are those planted before or after the main crop and can include food-based crops, such as winter corn and soybean. They are excluded from the cap in Article 2, paragraph 40 of the current RED II, which defines "food and feed crops" as "starch-rich crops, sugar crops or oil crops produced on agricultural land as a main crop excluding residues, waste or ligno-cellulosic material and intermediate crops, such as catch crops and cover crops, provided that the use of such intermediate crops does not trigger demand for additional land."

While the RED II states that intermediate crops should "not trigger demand for additional land," the European Commission has not issued guidance on how voluntary schemes should interpret this clause. It is possible that a certification body would only ensure that crops grown during the winter or off-season qualify as intermediate. Globally, most intermediate crops are cash crops grown for purely economic reasons, and are generally used for food and feed. For example, the FAO projects that one-third of the increase in soybean harvested area over the coming decade will be from winter cropping.[5] Further, in 2020, production of winter corn in Brazil reached 77 million tons, representing two-thirds of all maize produced there.[6] In addition, a previous ICCT study highlighted the links between soybean cultivation and conversion of forests and savannahs in Brazil to agriculture.[7] Intermediate crop biofuel will generally be associated with same kind of land use change emissions as its corresponding food-based biofuel, since the use of these crops for EU biofuels would displace them from their existing uses in food and feed. For this reason, Christensen applies the same ILUC factors to intermediate crops as for their corresponding food and feed biofuels.

Figure 2 shows the volumes of various renewable fuel types that are produced in response to the different policy scenarios. Here we see that increasing the overall target mainly results in production of more intermediate crop biofuels associated with significant land use change, which increases GHG emissions compared to a lower target. A high renewable energy target leads to a doubling of intermediate crop soy biofuel production compared to the lower renewable energy target scenario. Due to the amount of soy biofuel counting towards the target, the high renewable energy target scenario achieves no GHG savings. Similarly, the only difference between the lower GHG intensity target scenario and the RED II revision proposal is an 11% versus 13% GHG intensity target, and we see a 60% reduction in the amount of intermediate crops at the lower target.

5 "Latin America and the Carribean will account for 25% of global agricultural and fisheries exports by 2028," FAO/OECD, 2021, http://www.fao.org/americas/noticias/ver/en/c/1200912/

6 Michael Cordonnier, "Conab- 2020/21 Brazilian Soy Production up 7.1%, Corn up 2.6%," *Soybean and Corn Advisors,* October 9, 2020, http://www.soybeansandcorn.com/news/Oct9_20-Conab-202021-Brazilian-Soy-Production-up-7_1-Corn-up-2_6

7 Stephanie Searle and Jacopo Giuntoli, *Analysis of high and low indirect land use change definitions in European Union renewable fuel policy* (Washington, DC: ICCT, 2018), https://theicct.org/publications/analysis-high-and-low-iluc-definitions-eu

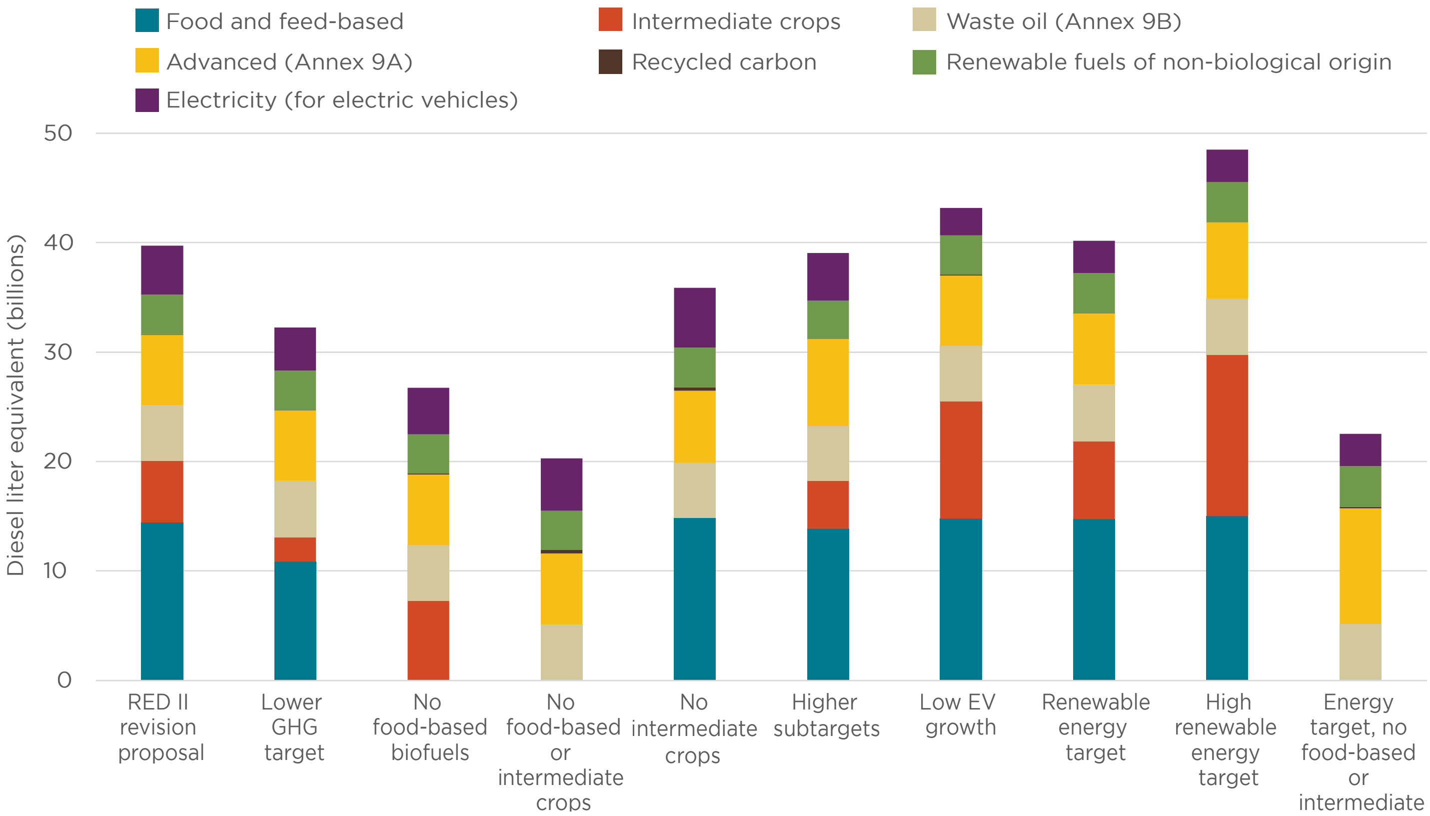

Figure 2. Renewable fuel consumption and electricity use in vehicles in each policy scenario (billion diesel liters equivalent)

The high contribution of intermediate crops to the fuel mix in these scenarios is because these pathways comprise the least expensive pathway for complying with the overall transport fuel GHG intensity target (or renewable energy mandate) that is not subject to a subtarget or a cap. In other words, once the food-based and waste-based biofuel caps are filled, the submandates are met, and the demand for renewable electricity in vehicles is counted, Christensen finds that any remaining demand for renewable fuel to meet the overall transport target is met primarily by intermediate crops. The largest increase is in soy renewable diesel because there are no blending constraints for this drop-in pathway. The higher the overall transport target is raised above the sum of submandates and caps, the greater the draw for intermediate crops. Reducing the overall transport target to a level close to the sum of submandates and caps, plus expected renewable electricity, such as in the lower GHG intensity target scenario, thus minimizes the demand for intermediate crop biofuel.

Scenarios with no food and feed-based biofuels increases GHG emission savings compared to the RED II revision proposal. This is because when ILUC is included in the GHG savings calculation, food-based fuels provide little climate mitigation, and some, particularly soybean oil, are actually worse than using fossil fuel. Figure 1 shows that while the RED II revision scenario provides GHG savings of 29.2 million tonnes CO2e relative to the baseline, changing the policy can provide even more GHG savings at lower cost. The **no food or feed-based biofuels** scenario increases GHG savings by 31% compared to the RED II revision proposal and reduces the average cost of carbon abatement by 36%. The no food or feed-based biofuels scenario, however, does not achieve the level of GHG savings of some of the other scenarios because intermediate crops are still allowed to count towards the policy target.

Excluding intermediate crops from the REDII proposal delivers even greater GHG savings than removing food-based biofuels. Comparing the **no intermediate crops** scenario with the RED II revision scenario, one sees that twice as high GHG savings can be achieved when intermediate crops are excluded from the targets (Figure 1). The **no food-based or intermediate crops** scenario has an overall GHG intensity reduction of 13%, like the RED II revision proposal, but due to the exclusion of these fuels, the highest GHG savings and the lowest average carbon abatement cost are achieved of all scenarios. High GHG savings are also achieved in the **energy target, no food-based or intermediate crops** scenario. Thus, the most cost-effective way to increase GHG savings from transport fuels in the REDII proposal is to exclude intermediate crop and food-based biofuels.

In most scenarios, Christensen's model follows EV penetration assumed in the Climate Target Plan, while in the **low EV growth** scenario, the study assumes half that rate of EV penetration in 2030. The Low EV Growth scenario leads to increased GHG emissions compared to the baseline. This is because there is a relatively small amount of renewable electricity counting towards the 13% GHG intensity target, leaving a larger gap between the submandates and the overall target compared to the REDII proposal, and, again, intermediate crop soy biofuel fills the gap to meet the GHG reduction target. The low EV growth scenario delivers almost twice the amount of intermediate crop soy biofuels as in the RED II revision proposal scenario. The high land use change emissions from this large amount of soy biofuel more than offset the GHG savings from the rest of the policy.

New measures should incentivize charging station companies to expand their networks and reduce rates, which should contribute to increased EV use in transport in 2030. The RED II revision proposal requires EU Member States to establish a mechanism so that public charging stations can receive credits when renewable electricity is supplied to electric vehicles. In addition, the Alternative Fuel Infrastructure Regulation proposal mandates EV charging infrastructure. However, it is difficult to project what EV penetration will be in 2030 across all of Europe. The low EV growth scenario highlights the risk of setting the overall transport target too high when future EV growth is uncertain if intermediate crops continue to be exempt from the food- and feed-based biofuel cap.

While the results in Christensen highlight the risks of setting a high overall transport target without improvements in sustainability criteria, they also suggest that the advanced biofuel subtarget in the RED II revision and the aviation e-fuels target in ReFuel EU could be increased. The scenario with **higher subtargets** shows that even when the ambition of the advanced fuel target in the RED II and the RFNBO mandate in ReFuel EU is increased, the average carbon abatement cost is lower and GHG savings are greater than when keeping the subtargets at the level of the current proposals. In particular, the high subtargets scenario shows that the RFNBO target for aviation could be increased from 0.7% to 2.5%, which would also better align with the 2.6% RFNBO target in the RED II revision. In fact, all the scenarios show that the RED II targets incentivize the production of more advanced SAF than the SAF targets themselves. Compared to the target of 5% for 2030 in the proposed ReFuel EU regulation, the share of SAF in total jet fuel is over 6% in 2030 in all scenarios and the share of e-fuels is over 2.7%.

8 European Commission, "Commission staff working document, impact assessment accompanying the document: communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions," (2020), https://ec.europa.eu/clima/sites/clima/files/eu-climate-action/docs/impact_en.pdf

POLICY RECOMMENDATIONS

The European Parliament and European Council will have the opportunity to review and change the RED II revision and ReFuel EU proposals. Based on the analytical findings in Christensen, we make the following recommendations:

- **Exclude all food and feed-based feedstocks, including intermediate crops, from the RED II revision and lower the GHG reduction target accordingly to increase GHG savings and reduce cost. If it is not possible to exclude all food-based feedstocks, remove the exemption for intermediate crops from the food cap.** We find that removing the exemption for intermediate crops is the single most effective measure to increase GHG savings from transport fuels in Fit for 55. This is because setting an ambitious GHG or renewable energy target while continuing to exempt intermediate crops from the food cap will result in large, additional amounts of business-as-usual crop biofuel, mainly from soy oil, with high associated land use change emissions. Including intermediate crops under the food cap would eliminate this significant risk of leakage.

- **If it is not possible to change the eligibility of food or intermediate crops towards the targets, reduce the GHG intensity target level to achieve more GHG savings and lower carbon abatement.** Once submandates for advanced fuels, which provide GHG savings, are met and the demand for renewable electricity in vehicles is counted, any remaining demand for renewable fuel to meet the overall transport target is met primarily by intermediate crops. With a lower overall target, less intermediate crop fuels would be produced.

- **A GHG intensity transport target with submandates, as proposed, provides greater GHG reductions at a lower cost than a renewable energy mandate.** Compared to a comparable renewable energy target, the current GHG intensity target in the RED II revision proposal produces a cost of carbon abatement that is three times lower and greenhouse gas savings that are three times higher. This is because a GHG intensity target rewards efficiency and production improvements more than a renewable energy target.

- **Member states should meet complementary and ambitious EV targets to help meet the transport targets.** Since each member state has different EV targets and each will experience varying success with meeting these targets, it is difficult to predict the aggregated effect of these policies on EV deployment in 2030 across in the entire EU. This analysis shows that lower-than-predicted EV penetration in the transport sector in 2030 has large risks for the transport fuel GHG target, resulting in a significant increase in the production of intermediate crop fuel. This finding reinforces the importance of removing the intermediate crop exemption or lowering the GHG intensity target level.

- **The ReFuelEU aviation e-fuels mandate for 2030 and the revised RED II advanced biofuel subtarget could be increased.** The analysis suggests that the 2030 aviation e-fuels mandate could be 2.5% and the RED II advanced biofuel subtarget could be increased to 2.75% at no additional cost per tonne CO_2e reduction.