SolarPower Europe recommendations

to deliver 45% renewable energy by 2030

Key Recommendations

on the Review of Directive 2018/2001/EU on the promotion of the use of energy from renewable sources

1. Increase the share of renewable energy in final energy demand to at least 45% by 2030 (Article 3).
2. Enhance the framework for Commercial & Industrial renewable energy self-consumption (Articles 4 and 21).
3. Improve the Guarantees of Origin framework and increase its transparency (Article 19).
4. Support renewable hydrogen through a robust certification system and dedicated quotas in hard-to-abate end-use sectors, while massively deploying new renewable electricity capacity.
5. Strengthen provisions on administrative procedures and improve their implementation (Article 15).
6. Set minimum requirements for the generation of renewable energy on buildings (Article 15).

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Key messages

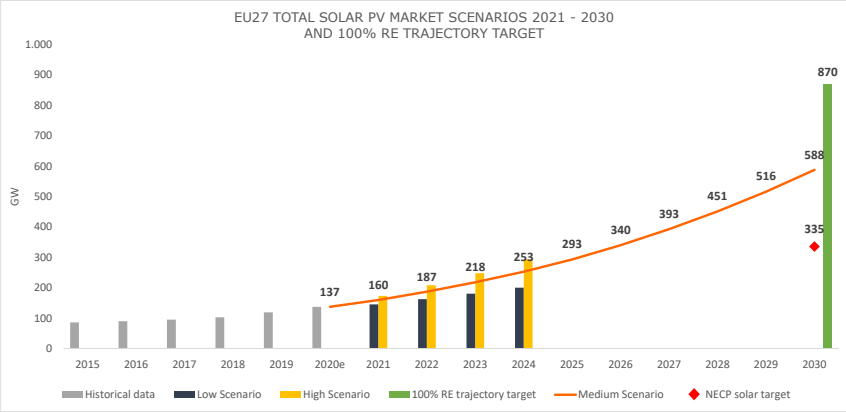
The review of Directive 2018/2001/EU on the promotion of the use of energy from renewable sources (REDII) is a significant opportunity to improve the existing framework, support the reduction in greenhouse gas emissions by 55% by 2030, and put the EU on a cost-effective trajectory to achieving climate neutrality by 2050.

1. By 2030 the share of renewable energy in final energy demand should be at least 45%.

Aligning Europe's 2030 climate and energy targets with the ambition to achieve climate-neutrality by 2050 is an absolute necessity. In particular, the EU's renewable energy goal should be increased to deliver a **45% share of renewables in final energy demand by 2030** (Article 3)**.** This target is in line with a cost-effective trajectory towards climate neutrality by 2050 and consistent with a 1.5 C Paris Agreement scenario[1]. It should be **binding both at the EU level and at national level**.

Driven by the increasing cost-competitiveness of the technology, the EU is likely to overachieve its current solar ambitions, as defined in Member State's NECPs. **SolarPower Europe's Medium Scenario[2] projects that 588 GW of solar capacity will be deployed by 2030**, which is 75% higher than the current solar capacity foreseen in Member States' NECPs for 2030 (335 GW).

Reaching 45% of renewables in the EU's final energy demand, corresponding to 870GW by 2030, is within reach and would put the EU on track to deliver on the 1.5 Paris Agreement scenario. This target can be met through the implementation of an appropriate policy frameworks, reflecting the ambitions of the European Green Deal to drive further additional renewable installations by removing key bottlenecks in grid access, financing, or permitting.



[1] SolarPower Europe and LUT University (2020): 100% Renewable Europe: How To Make Europe's Energy System Climate-Neutral Before 2050. https://www.solarpowereurope.org/100-renewable-europe/

[2] SolarPower Europe (2020): EU Market Outlook for Solar Power 2020-2024. https://www.solarpowereurope.org/european-market-outlook-for-solar-power-2020-2024/

2. Enhance the framework for Commercial & Industrial renewable energy self-consumption.

The future could look bright for Commercial and Industrial (C&I) prosumers. Although forecasts show that installed solar PV capacity in Europe may reach around 245 GW in the commercial sector and 300 GW in the industrial sector by 2030[3], this potential remains largely untapped.

The RED II adopted in 2018 establishes a pioneering enabling framework for self-consumption installations below 30kw. However, it does not tackle the need to remove barriers and facilitate **mid-sized self-consumption installations between 30 kW and 1 MW in size, which are typically covering Europe's C&I segment**. Specifically, Article 4 should exempt solar installations under 1MW from tendering schemes which are not appropriate for small and medium corporate self-consumers. Furthermore, stronger safeguards are needed to ensure the robust implementation of provisions in Article 21, particularly those related to the removal of restrictions on third party ownership of on-site renewable installations, the possibility for C&I self-consumers to contract with multiple energy suppliers, and self-supply their facilities through a direct line.

3. Improve the Guarantees of Origin framework and increase their transparency.

The framework regulating Guarantees of Origin (GOs), defined in Article 19 of the REDII, should be strengthened to **ensure Member States issue GOs to all renewable electricity producers**, irrespective of whether the renewable energy projects are installed behind-the-meter or whether they receive state support. GOs are meant to trace green electricity in the power system and are therefore critical to demonstrating the use of renewable electricity. The impossibility of receiving GO's when contracting with supported renewable installations is a critical barrier to corporate renewable PPA's in key markets such as France, or Germany, despite clear provisions to avoid over-compensation in the REDII (defined in Article 19.2. of the REDII). Furthermore, **the transparency of GOs should be improved. GOs should contain additional information**. Information on the time of generation should be provided at a more granular level to encourage matching of supply and demand. Finally, **rules to guarantee the traceability and ensure issuance of GOs to all renewable electricity producers should follow a standardised approach across all Members States**.

[3] RE-Source (2020) On-site renewable electricity and storage for corporates: business models & policy framework. https://resource-platform.eu/wp-content/uploads/202011-Re-Source-Force_On-Site-Generation-and-Storage_Challenges-and-Barriers-web-3.pdf

4. Support the uptake of renewable hydrogen.

The **revision of the REDII should introduce a robust certification and traceability system for renewable hydrogen**. It should develop dedicated market pull instruments to support the cost-competitive production of renewable hydrogen (contracts for difference, premiums) and to generate lead-markets at end-use level (CAPEX and OPEX support). Such measures should not cover low-carbon hydrogen sources (mostly non-renewable and fossil-based) and include ambitious provisions, promoting the production of renewable hydrogen from additional renewables that are added or curtailed from the grid. It should support business models with a strong linkage to new or repowered renewable energy installations (PPAs, on-site), or curtailed renewable electricity. Supporting the uptake of renewable hydrogen also requires removing barriers to the deployment of new renewable electricity projects, such as grid access and permitting.

5. Strengthen provisions removing administrative barriers for renewable projects.

Administrative procedures remain a clear challenge to the development of renewable energy projects across the EU, and the implementation of the Clean Energy Package provisions will be critical. **The Revision of the RED II should seek to further reduce regulatory burdens, including administrative burdens through a non-regulatory guidance and a targeted revision of articles 15 and 16.**

Specifically, **the revised REDII should require the development of permitting guidelines for renewable energy projects**. They should highlight best practices, using the results of the RES Simplify project, and define a series of Key Performance Indicators (KPIS), such as standard approval time or approval rate of the permits, or the number of staff requires to assess permits in relevant administrations. Such KPIs would allow continuous monitoring of the administrative procedures related to renewable development and allow for monitoring of the implementation of the related provisions of the CEP. Thereby the circulation of best practices would be facilitated, and future challenges could be anticipated, based on lessons learnt.

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6. Set minimum requirements for generation of renewable energy on buildings.

The ambition of the Renovation Wave to decarbonise the EU building stock calls for a further improvement of administrative procedures for distributed solar installations. The revision of Article 15 should foster the deployment of on-site solar rooftops by introducing, **municipal level targets for buildings to generate renewable energy and provide demand-side flexibility in both new and existing buildings, as part of the Member States building codes.**

As a minimum, the generation targets should seek to meet the technical potential for solar rooftops as calculated by the JRC[4]. In addition to fostering distributed renewable energy, targets foster the deployment of distributed energy storage and flexibility solutions, aiming to meet the 160 GW demand response potential expected in 2030[5]..

In addition to the mandatory requirements, the simple notification procedure currently in place for the authorisation of decentralised devices (article 15.1.d) should be extended to the permitting stage.

[4] JRC (2019) A high-resolution geospatial assessment of the rooftop solar photovoltaic potential in the European Union. https://ec.europa.eu/jrc/en/publication/high-resolution-geospatial-assessment-rooftop-solar-photovoltaic-potential-european-union

[5] European Commission (2016). Impact Assessment Electricity Market Design Regulation and Directive. https://ec.europa.eu/energy/sites/ener/files/documents/mdi_impact_assessment_main_report_for_publication.pdf

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Table of contents

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Revision of existing RED II articles

Article 3 - Binding overall Union target for 2030

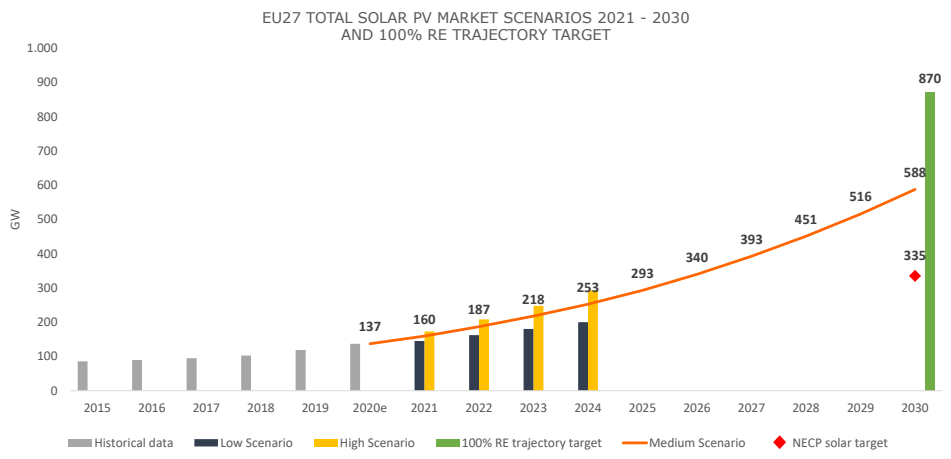
Establish an EU renewable energy target of at least 45% RE by 2030

To achieve climate-neutrality before 2050, **the EU 2030 target for renewable energy must be increased** beyond the range indicated in the 2030 Climate Target Plan. SolarPower Europe's analysis for a 100% Renewable Europe shows that to be on a cost-effective trajectory towards climate neutrality by 2050 consistent with a 1.5 C Paris Agreement scenario, **the share of renewables in final energy demand should be at least 45% by 2030. This target should be binding both at the EU level and at national level.**

Reaching this target will require a **significant increase in the deployment of utility-scale solar plants** (above 1 MW) **and solar rooftop systems** (under 1 MW).

Driven by the increasing cost-competitiveness of the technology, most EU markets are likely to overachieve their current solar ambitions, as defined in their 2030 National Energy and Climate Plans (NECPs). SolarPower Europe's Medium Scenario[6] projects 588 GW of solar capacity by 2030, 75% higher than the 335 GW solar capacity currently foreseen in Member States' NECPs for 2030.

According to SolarPower Europe and LUTs modelling, a cost-effective pathway to reach climate neutrality by 2050 will require the deployment of **870 GW of solar by 2030 in the EU**[7]. A 45% renewable energy target would provide the policy and investor confidence to drive the needed increase in the deployment of additional capacity.



Promote renewable energy storage.

Higher shares of renewable energy capacity will require the deployment of additional storage capacity.

[6] SolarPower Europe (2020): EU Market Outlook for Solar Power 2020-2024. https://www.solarpowereurope.org/european-market-outlook-for-solar-power-2020-2024/

[7] Capacity estimate currently under review. SolarPower Europe and LUT University (2020): 100% Renewable Europe: How To Make Europe's Energy System Climate-Neutral Before 2050. https://www.solarpowereurope.org/100-renewable-europe/

According to the European Commission, **meeting current climate targets would require 97 GW of electricity storage**[8]. We estimate that at least 150 GW of energy storage, not only electricity storage, will be necessary by 2030 to meet the increased climate targets as well as the goals outlined in the EU Hydrogen Strategy.

Reaching this level of storage capacity will require a deep acceleration of the deployment rate of both utility-scale and small-scale storage in Europe.

To deliver on these objectives, SolarPower Europe recommends the following:

1. **The RED II must complement the existing policy framework to provide additional support mechanisms for the storage of renewable energy**. Concretely, support measures could include direct and indirect financial incentives for end-customers simultaneously deploying renewable energy and purchasing battery storage. The measures could strengthen tax exemptions to renewable energy self-consumption and storage, and integrate flexibility requirements in hybrid renewable auctions.
2. **To promote the deployment of storage, the RED II should establish a European target for storage of renewable energy**. This target should act as a guiding objective for member states to estimate their needs for storage as part of their National Energy and Climate Plans (NECPs), and to incentivise the development of market-based mechanisms.

Article 4 – Support schemes for energy from renewable sources

Exempt solar installations below 1 MW from tendering schemes

Tendering schemes can constitute disproportionate complexity and uncertainty for consumer-driven Commercial and Industrial (C&I) projects. In France, support to on-site self-consumption for solar installations above 100 kW was granted through a tendering scheme, which resulted into an under subscription of the scheme and led the government to increase the tendering threshold to 500 kW.

Exempting solar installations under 1 MW from competitive bidding processes would promote growth in the mid-to large-size on-site solar market segments, which currently represent about half of the total installed capacity in the EU[9].

Modernise the support scheme framework to include dedicated tender segments

As land is scarce in Europe, new concepts optimising the dual use of land should be incentivised. For this reason, it is necessary to design dedicated tender segments reserved for Agrisolar[10] (meaning the combination of agricultural and solar PV projects), floating PV (the deployment of solar PV on water

[8] European Commission (2020), Study on energy storage – Contribution to the security of the electricity supply in Europe. https://op.europa.eu/en/publication-detail/-/publication/a6eba083-932e-11ea-aac4-01aa75ed71a1

[9] SolarPower Europe (2020) European Market Outlook for Solar 2020-2024. https://www.solarpowereurope.org/european-market-outlook-for-solar-power-2020-2024/

[10] SolarPower Europe (2021). Agrisolar Best Practices Guidelines version 1.0. https://www.solarpowereurope.org/agrisolar-best-practice-guidelines

bodies), rooftop PV, solar expansion on infrastructures, or that allow for the introduction of specific tender criteria.

Article 9 – Joint projects between Member States

Regional cooperation in deploying renewable electricity will be critical for an efficient decarbonisation of Europe, as it optimises the continent's energy resources and supports the investment environment by strengthening a renewables Single Market. To maximise its benefits and take advantage of all renewable technologies, regional cooperation should not be limited to renewable projects that are established physically between two countries. Instead, it should encourage cooperation across European countries and regions.

Successful regional cooperation in deploying renewable energy capacities requires a robust regulatory framework that:

- **Ensures fair competition in regional auctions**: a minimum alignment between Member States' regulatory conditions which impact Levelised Cost Of Energy ("LCOE"), such as financing conditions, permitting or grid connection fees should be required. If there is no alignment, Member States entering joint projects should make up for additional costs incurred from regulatory divergences.
- **Properly accounts the costs stemming from a project developed by country A in country B**, for instance, grid connection costs, in the statistical transfers of country B to country A.

To increase the success of these recommendations, it is important to first account for regulatory framework differences in regional auctions or draw lessons from the experience of cross-border support schemes.

Article 15 - Administrative procedures, regulations, and codes

Strengthen provisions on administrative procedures and improve their implementation

Despite the supportive provisions put forward by the Clean Energy Package (CEP), administrative procedures still hinder the development of renewable energy projects across the EU. The Revision of the RED II should seek to further reduce regulatory burdens, including administrative burdens such as:

- **Lengthy and complex procedures and the multiplicity of contact points** create a barrier for project developers. These barriers mean there is a higher risk of project delays and additional project development costs occuring. In addition, COVID-19 has shown that the absence of digitalised procedures has resulted in project delays.
- **Heavy procedures, such as the requirement of construction permits**, can slow down the deployment of rooftop PV installations. This is not in line with the ambition set by the Renovation Wave initiative to be presented by the European Commission.
- **Member States have largely ignored the requirement to remove barriers to corporate renewable PPAs** (Article 15.8). Moreover, specific administrative barriers exist around the retention and retirement of GOs, which create unnecessary barriers to renewable energy purchasing by private companies.

Administrative procedures remain a critical barrier to an ambitious and fast deployment of solar capacities in Europe. We therefore suggest a targeted revision of Article 15 of the RED II to further strengthen its provisions, and in particular:

- **Introduce better safeguards for the development of explicit measures to simplify administrative procedures for distributed and large-scale solar installations**, through a better monitoring of the CEP implementation. This could be realised through a structured dialogue as part of the CEP implementation body, or through an ad hoc notification mechanism by the industry to the Commission.
- **Complement the current simple notification procedure (Article 15.1.d) for authorisation of decentralised devices with an explicit exemption from construction permits for rooftop.** Such a measure could boost the market for rooftop PV, could harvest the huge potential for clean electricity generation (680 TWh of electricity production annually according to the JRC[11]) and could accelerate job creation in the many SMEs active in this sector.
- **Require Member States to ensure building regulations and codes require the use of solar in all buildings with suitable conditions**. Belgium, Luxembourg and Spain introduced targets in their NECPs for the deployment of rooftop PV on their public building stock.

In addition to this, we call for the development of permitting guidelines to provide guidance to Member States on the implementation of Articles 15 and 16 of the RED II. The guidelines should highlight best practices, using the results of the RES Simplify project, mapping the administrative procedures for renewables across Europe. **They should establish Key Performance Indicators (KPIs),** such as the standard approval time or approval rate of permits, or the number of staff required to assess permits in relevant administrations. Such KPIs should be used by Member States to assess their own performance regarding administrative processes and should be included in the NECPs reporting exercise. This would allow for a continuous monitoring of administrative procedures related to renewable development and of the implementation of the related provisions of the CEP, facilitating the circulation of best practices, and anticipate future challenges based on lessons learnt.

Strengthen provisions to facilitate and enable Power Purchase Agreements across all Member States

Private renewable energy procurement and renewable sourcing is important for achieving the climate-neutrality target. Many corporate energy consumers have set ambitious targets for sourcing clean energy and for prioritising the deployment of new renewable projects that would not have been developed otherwise. Therefore, **voluntary renewable energy procurement enables Member States to achieve their renewable energy targets**. Furthermore, the private capital investments into renewable energy projects complements Member States' revenue stabilisation mechanisms, minimising the costs for society.

However, the good provisions in Article 15.8 to remove barriers to corporate PPAs, have been largely ignored by Member States. At present, several barriers remain across Europe, including:

[11] JRC (2019) A high-resolution geospatial assessment of the rooftop solar photovoltaic potential in the European Union. https://www.sciencedirect.com/science/article/pii/S1364032119305179

- **Renewable energy corporate buyers contributing to build new and unsubsidized renewable energy installations do not benefit from partial exemptions from national renewable energy levies**. This means that buyers signing corporate renewable PPAs are still asked to pay the full cost of renewable energy levies despite financing new projects.

- **Requirements regarding the retention and retirement of GOs create unnecessary burdens** to renewable energy purchasing for private companies. GOs are meant to trace green electricity in the power system and therefore are critical to demonstrating the use of renewable electricity. In countries like Poland, Spain, and Italy, GOs cannot be assigned for self-consumption or behind-the-meter projects, but can only be signed for the electricity that it is injected into the grid and then exported. Another issue is that Spain, France, Ireland, and Germany retain GOs from renewable energy projects benefiting from state aid.

With increased 2030 renewable targets, **further action is needed to remove regulatory and administrative barriers to private renewable energy PPAs**. To this end, provisions in Article 15.8 of the Renewable Energy Directive must be strengthened to ensure the roll-out of ambitious frameworks for corporate renewable PPAs in the NECPs:

- **The European Commission should share best practices** from more ambitious Members States which have undertaken concrete measures to promote corporate renewable PPAs as part of their National Energy and Climate policies. These best practices include:
    - **Setting a trajectory or target for PPAs**, resembling those in Italy, Spain, and Ireland, e.g. define a percentage of renewable electricity coming from corporate PPAs in the national renewable energy goals.
    - **Setting dedicated procurement procedures for PPAs** like in Italy for Green Public Procurements.
    - **Establishing PPA model contracts** like in Spain.
    - **Setting up financing or de-risking facilities** like in Luxembourg.

- **Require that Member States set up a dedicated financing measure to further promote the use of private PPAs, especially for SMEs facing higher costs of capital.** This could take the form of state backed credit risk guarantees for corporates and industries that sign PPAs. For example, to boost demand for such deals, the Spanish government has approved a state financial support scheme for PPAs among energy intensive companies.

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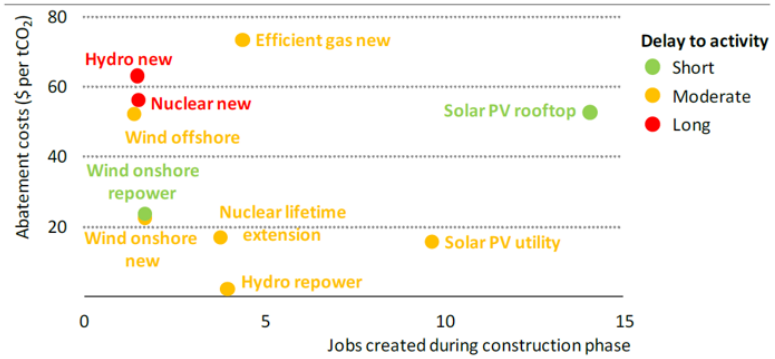
Set municipal targets for the generation of renewable energy on buildings

To reach higher increased renewable targets by 2030, the Fit for 55 Package must accelerate the deployment of decentralised generation and flexibility resources. To enable an efficient and system integrated energy system, the mass deployment of rooftop solar installations must go hand in hand with the roll out of demand-side flexibility resources such as EV charging stations, heat pumps, and battery energy storage systems.

Figure 2.3 ▷ Job creation per million dollars of capital investment in power generation technologies and average CO_2 abatement costs



New solar PV and wind have low abatement costs, as do nuclear lifetime extensions and repowering existing wind and hydro facilities; solar PV provides the largest boost to jobs.

Note: Avoided CO_2 emissions calculated based on displacing coal-fired generation, global averages shown.

IEA (2020) Sustainable Recovery

Accelerating the deployment of on-site solar and storage will have positive effects on job creation, unlocking significant potential for sustainable investments, and support a resilient green recovery. As shown by the IEA graph above, **investments into rooftop solar offer the highest level of jobs created of any power generation technology**[12].

The RED II revision should establish municipal targets for renewable energy generation in buildings. These should apply to both new and existing buildings renovations and would support the creation of smart and renewable urban and municipal communities. In addition to distributed renewable energy, active consumer targets should seek to deploy distributed storage in buildings.

As a minimum, the generation targets should seek to meet the technical potential for solar rooftops as calculated by the JRC[13]. In addition to distributed renewable energy, targets foster the deployment of distributed energy storage and flexibility solutions, aiming to meet the 160 GW demand response

[12] IEA (2020) Sustainable Recovery. https://webstore.iea.org/download/direct/3008

[13] JRC (2019) A high-resolution geospatial assessment of the rooftop solar photovoltaic potential in the European Union. https://ec.europa.eu/jrc/en/publication/high-resolution-geospatial-assessment-rooftop-solar-photovoltaic-potential-european-union

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potential expected in 2030[14]. Setting requirements for buildings to meet minimum levels of on-site renewable energy, wherever technically and economically feasible, would provide incentives to scale up the deployment of rooftop solar installations. **These requirements could be inserted in Member States' building codes.**

A municipal-level approach will drive system integration. Excess generation of individual buildings can be stored or used in flexible appliances or can be used to compensate lacking generation in other buildings. Roofs with only a small potential for generation could still provide valuable additional flexibility, while other buildings could generate a higher share of renewables than the minimum standard to compensate. This approach would untap synergies with the framework for collective self-consumption and renewable energy communities. Local renewable energy requirements could be required within municipal urban planning.

Article 19 - Guarantees of origin for energy from renewable sources

Provide a more transparent framework for Guarantees of Origin

In a more integrated energy system and in a context of increased electrification rates, GOs are critical for ensuring the traceability of renewable electricity, for facilitating transparency in the uptake of corporate renewable consumers, and to ensure the additionality of renewable energy as the economy electrifies. For this reason:

- **Member States should issue GOs to all renewable electricity producers**, irrespective of whether the renewable energy projects are installed behind-the-meter or receive state support. This is crucial for retaining the link between renewable energy producers and consumers, for avoiding green washing practices and for enabling corporates to justify the use of renewable electricity as part of their corporate sustainability requirements. Moreover, Article 19 already states that the price of the GOs needs to be factored into the level of support schemes, to avoid any double compensation.

- **GOs should contain more information** to support both those consumers seeking to obtain more detail on the origin of their electricity and to also empower renewable energy producers to market their electricity.

- **Information related to the time of generation of the GO should be provided at a more granular level** than simply annually, to support corporate consumers willing to attest to the matching of supply and demand, i.e. GOs should be required to "time-stamp". Therefore, SolarPower Europe calls on all Member States to "time-stamp" the GOs issued to producers to show the precise time at which the underlying unit of energy was produced.

- **Rules to guarantee the traceability and ensure issuance of GOs to all renewable electricity producers should follow a standardised approach across all Members States**. Arbitrary rules for

[14] European Commission (2016). Impact Assessment Electricity Market Design Regulation and Directive. https://ec.europa.eu/energy/sites/ener/files/documents/mdi_impact_assessment_main_report_for_publication.pdf

the retirements of GOs, such as requirements that only allow suppliers to retire GOs, or that GOs must be retired within the same month as they are generated, should be eliminated.

Article 21 – Renewable self-consumers

Enhance the framework for medium-sized on-site renewable energy installations to promote self-consumption.

Medium-sized installations fall under a regulatory "grey area" in the current European framework, which defines specific provisions for installations <30 KW and >1 MW, but do not address the characteristics of C&I self-consumption installations, which are commonly medium-sized. Such installations would benefit from stable and predictable support:

- **Support innovative business models for C&I self-consumption:** Member States should i) remove restrictions on third party ownership of on-site renewable installations, ii) allow for project developers that are different from the energy supplier, and iii) allow C&I self-consumers to self-supply their facilities through a direct line.

- **Remove disproportionate administrative procedures for C&I self-consumers**. Despite the provisions highlighted in Article 21.3 of the RED II, several Members States still apply disproportionate administrative procedures for C&I self-consumers. For this reason, it is crucial to ensure solar installations under 1 MW are exempt from tendering schemes (as argued above in relation to Article 4).

Article 23 – Mainstreaming renewable energy in heating and cooling.

SolarPower Europe's 100% Renewable Europe study shows that **the share of renewable energy in heating and cooling could reach about 60% by 2030**. Given that the current share of renewable energy in the heating and cooling sector is around 20%, reaching a share of 60% renewable energy in heating and cooling would require an increase of renewable energy shares in the heating and cooling sector of at least 5% per year, on average.

The sector remains dominated by fossil fuels and therefore dependent on imports. **The pathway to electrify heating and cooling with renewable energy, means deploying efficient appliances for heating and cooling in combination with the expansion of renewable electricity capacities, both at utility-scale and distributed-scale renewable generation, for example on rooftop solar PV buildings and industry.**

The current RED II framework and indicative target do not incentivise the cost-optimal deployment of renewables for heating, cooling, and hot water use. SolarPower Europe supports an increase of the annual average target to a more ambitious level than that indicated in the Climate Target Plan. Nevertheless, any increase in the target should be preceded by an impact assessment of the availability and sustainability of renewable electricity and fuels which count towards renewable heating target.

Dedicated measures to support the renewable-based electrification of the EU's heat sector remain the most appropriate policy for supporting the strong uptake of renewables in the heating sector. This will increase energy efficiency, driven by the deployment of highly efficient heat pumps which could meet up to 50% of heat generation by 2030**.** Until then, the deployment of renewable-based electric heating

systems in buildings and some parts of industry should be prioritised. After 2030 the availability of abundant and affordable renewable electricity will enable the decarbonisation of industrial high temperature heat through the production of renewable hydrogen.

The **list of measures included in Article 23, paragraph 4 of the Directive should be more detailed,** to specify the promotion of renewable-based direct electrification of heating and cooling. Additional detail should include:

- Under sub-paragraph (a) that renewable electricity should be incorporated in the energy supply for heating and cooling
- Under sub-paragraph (b) further specify that direct mitigation measures should include the deployment of on-site renewable electricity generation capacity to power heating and cooling systems in buildings and industry. Under sub-paragraph (d) further specify that additional efforts are needed to ensure a level playing field between renewable electricity and other energy carriers, in addition to ensuring that energy taxation frameworks create fair and incentivising taxation frameworks to promote the penetration of highly efficient renewable-based electricity in the heat sector.

Article 25 – Mainstreaming renewable energy in the transport sector

Improve the implementation of the objective of renewable energy used in transport, to better reflect the contribution of renewable electricity.

SolarPower Europe's 2050 study shows renewable-based electrification will drive the bulk of road transport decarbonisation even before 2030, while Renewable Fuels from Non-Biological Origin (RFNBOs) kick in as of 2030 as a key solution for heavy duty transport such as shipping and aviation. In the short term, electrification is now widely acknowledged as the fastest and most efficient way to decarbonise road transport. Electric cars have an energy efficiency of 69% against 26% for cars running on e-fuels and 13% for ICEs[15], and electric cars and vans will be cheaper than any fossil fuels vehicle from 2025 according to a 2021 Bloomberg New Energy Finance analysis[16]. Although electricity will be a key contributor of the integration of renewable energy in the transport sector, **the current renewable target for transport does not drive the electrification of mobility.**

The current target must be achieved through obligations on fuel suppliers. This often translates into blending mandates which require suppliers to include renewable fuels in their fuel mix. As it is not a drop-in fuel that can be blended, **renewable electricity is not properly accounted in RES-T targets**. The current framework is also not adapted to the variety of actors supplying renewable electricity to transport infrastructure, such as charging station operators and electricity suppliers.

This is a missed opportunity. Failing to account for renewable electricity means that the renewable energy target does not contribute to the deployment of the most efficient technologies to decarbonise transport. It also would mean failing to drive private investment where they are needed most, by failing to include the variety of electromobility players, such as charging station operators and electricity

[15] Agora Energiewende, Agora Verkehrswende (2018) The Future Cost of Synthetic Fuels
[16] Bloomberg New Energy Finance (2021) Hitting the EV Inflection Point

suppliers. Therefore, an increase in the renewable energy target for transport should be conditional on a revision of the target's structure and accounting methodology.

To this end, **we call for an obligation for fuel suppliers to demonstrate that they fulfill their obligations through fuel-neutral credit trading mechanisms.** Fuel-neutral credit trading mechanisms require obligated parties to meet their renewable energy obligations by means of fuel-neutral credits, accounted for in energy equivalent units (kWh, KJ, Gcal or other). In parallel, fuel-neutral credits are allocated by a public authority to defined parties for each energy unit of renewable fuel used in transport. As for electricity, various possibilities exist concerning the party entitled to receive credits (charging station operator, electricity supplier, and more). Subsequently, obligated parties can either acquire fuel-neutral credits by increasing blending in their fuel supply or by procuring credits from third parties through a dedicated platform. Such schemes have already been introduced in the Netherlands, in Germany, in California and in France, and are being elaborated in Canada.

Electricity credit mechanisms can be considered 'low hanging fruit' to adequately value the contribution of renewable-based electromobility in decarbonising transport. Importantly, electricity credit mechanisms would also generate resources for the diversity of players in the electromobility sector, including utilities, automakers, and network charging operators, without weighing on state budgets. For instance, credit revenues could support charging point operators in improving the business case for charging infrastructure and could accelerate the roll-out of the millions of chargers needed to charge the millions of EVs that will be on EU roads by 2030.

Article 27 – Delegated act to establish a Union methodology setting out detailed rules on electricity used when liquid and gaseous transport fuels of non-biological origin can be considered fully renewable

Develop an additionality approach that leads to a quick upscaling of the renewable-based hydrogen market

To mainstream the use of renewable energy in the transport sector and meet the EU climate neutrality goal, Member States should guarantee that by 2030 14% of the final energy consumption in the transport sector is from renewables. To successfully achieve this goal, electricity used to produce renewable liquid and gaseous RFNBOs must be generated by renewable energy sources. Renewable hydrogen from non-biological sources like solar is a type of RFNBO and it is expected to play a key strategic role in the decarbonisation of the transport sector as well as other sectors of the EU's economy which cannot be fully electrified.

Today, renewable electricity is a scarce resource in Europe. This is not due to the availability of wind and solar resources, which are abundant across the continent, but due to concrete bottlenecks hampering the deployment of new renewable projects such as permitting, financing or grid access. On the other hand, producing renewable hydrogen requires a lot of renewable electricity and "loses" 30% of this electricity compared to the direct use.

To enable a truly renewable hydrogen economy we must remove bottlenecks to renewable energy deployment for good or establish incentives to quickly deploy renewable capacity at a scale, accompanying the increase in demand. Furthermore, producing renewable hydrogen solely with electricity from the grid in the short-term can increase CO2 emissions as it contains electricity generated

from fossil fuel sources. EU policies should ensure additional demand for renewable electricity to produce renewable hydrogen is met with additional renewable energy generation.

Additional renewable energy capacity should apply to a scenario where a **PPA has been concluded between an electrolyser, with a newly deployed renewable energy plant, a repowered renewable energy plant, or with a renewable energy plant that is no longer subsidised**. **Surplus renewable electricity generation that is curtailed would also be counted as additional**. Using curtailed renewable electricity to produce hydrogen contributes to increasing the load factor of the electrolyser and reduces the cost of renewable hydrogen.

The plant generating renewable electricity through a PPA should come into operation up to 3 years after the installation producing hydrogen starts operation. Until the renewable energy plant starts operation, the hydrogen producer can use GOs from a renewable energy plant.

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Proposals for new RED II provisions fostering the achievement of climate-neutrality

New Article – Obligations on public authorities to achieve a high level of renewable energy

Public authorities should lead by example in driving local renewable energy sourcing. The Renewable Energy Directive should oblige all public authorities to buy green energy and to ensure green tenders trigger additional investments in green energy generation. This is in line with the commitment of several countries (for example Belgium or Luxembourg) which already have developed targets for renewable energy sourcing in their public building stock. Further, Dutch regional public authorities already introduced a local renewable energy sourcing in their auction for public charging systems.

Renewable energy sourcing can follow different strategies, including contracting a renewable energy PPA but also installing renewable energy installations on-site. European rooftops offer a large potential to deploy solar PV that remains largely under-used. A recent study by the JRC estimates that we could power one quarter of the current European electricity consumption if all suitable rooftops were equipped with solar PV[17]. This potential does not include the vast amount of idle space on building façades. Installing renewable energy technologies in public buildings would also create local employment opportunities in project design and construction and support the uptake of European innovative technologies such as Building-Integrated PV (BIPV).

Obligations on public authorities to buy renewable energy that contributes to additionality, i.e. their energy sourcing must create additional investments in new renewable energy projects. Additionality should be supported by a strong monitoring system through enhanced Guarantees of Origins.

New Article – Support the uptake of renewable energy in industry through progressive quotas and targeted support.

Although a well performing EU-Emissions Trading System price signal should be the main EU instrument to incentivise industrial decarbonisation, along with through dedicated industrial policy, SolarPower Europe also supports the introduction of a general obligation on industry to progressively use a minimum amount of renewable energy.

This translates into a **progressive quota or target that incentivises the consumption of renewable energy by the industry.**

These quotas should not hamper the competitiveness of EU industrial users, especially regarding uses of renewable hydrogen that have not yet reached market maturity with conventional solutions.

[17] JRC (2019) A high-resolution geospatial assessment of the rooftop solar photovoltaic potential in the European Union. https://ec.europa.eu/jrc/en/publication/high-resolution-geospatial-assessment-rooftop-solar-photovoltaic-potential-european-union

Introducing a general mandate on industry to use a minimum amount of renewable energy is only feasible if supply and demand are balanced. Therefore, we recommend combining progressive quotas or targets on renewable energy consumption with **dedicated measures that contribute to massively deploying new renewable electricity capacities**. The introduction of an ambitious definition of additionality in Article 27 of the REDII would be the first step.

The progressive quota or targets should be complemented with measures to speed up and simplify permitting procedures for the deployment of renewable energy and storage installations and their connection to the electricity grid, while maintaining environmental standards; should provide technical support for the uptake of renewables by SMEs; should set up specific innovation programmes for renewable electricity-based production processes; and should **complement it with supply-side mechanisms** in the form of a state-backed Contracts for Difference (CfD).

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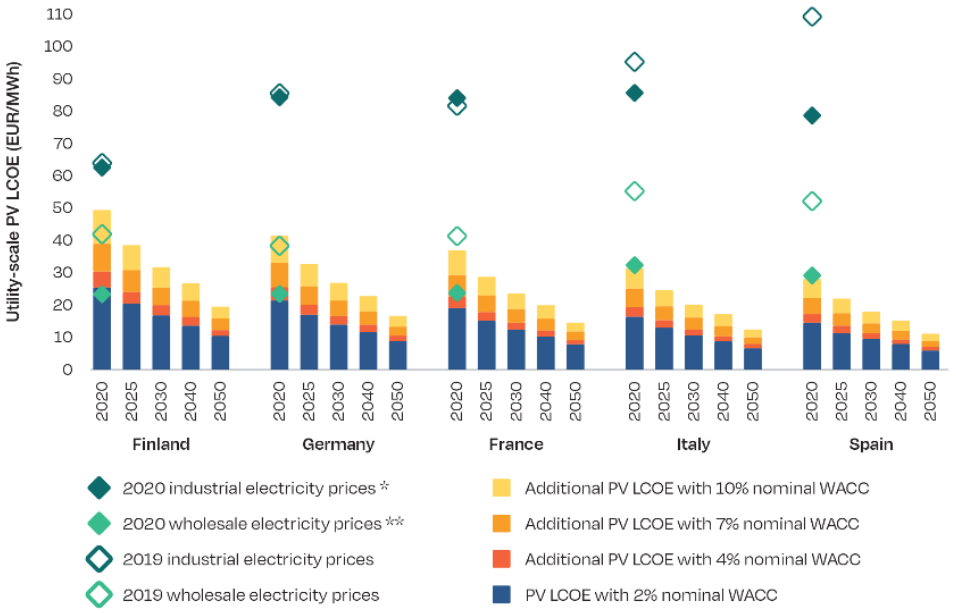
Recommendations for Energy System Integration to accelerate the delivery of the 2030 target.

Measures to build a more integrated energy system.

The successful integration of the EU's Energy System will be essential for achieving the EU's increased climate and energy ambitions. The most important measures to enable energy system integration are **accelerating electrification and using renewable energy across all sectors** (buildings, heating and cooling, industry, and transport)**, fostering the use of electricity and energy storage**, **applying the energy efficiency first principle**, and **leveraging the use of renewable hydrogen and derived fuels to decarbonise sectors which may be hard to electrify**.

SolarPower Europe's 100% Renewable Europe study shows that **ambitious policies to foster renewable-based electrification will underpin cost-effective energy system integration and enable the development of a more circular and optimised energy system**. Solar energy is already cost-competitive against both industrial and wholesale electricity prices across the EU, even considering the significant reductions caused by the COVID-19 pandemic.

PV LEVELISED COST OF ELECTRICITY (LCOE) IN FIVE EU LOCATIONS, 2020-2050



*: H1 2020 average national price for medium-size industrial consumers (without taxes).
**: H1 2020 average national price for wholesale baseload electricity.
SOURCE: European Commission (2020); Eurostat (2020); ETIP PV (2020).

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Beyond cost-effective decarbonisation, increased penetration of renewable electricity in end-use sectors will unlock demand-side flexibility, enabling the achievement of the EU's 160 GW demand-side flexibility potential[18].

Meeting this potential will require accelerating the deployment of demand-side flexibility resources such as the smart charging of electric vehicles as well as the heating and cooling of buildings coupled with smart building automation and control systems.

Promoting renewable based electrification can unlock significant energy efficiency gains, of up to 23% (compared to 2020 energy consumption)[19]. Renewable based electrification of energy supply and end-use sectors optimises the energy system, as energy system losses are minimised, and generated electricity is used productively. The following measures are crucial to building a more integrated energy system:

Support electrification of energy consumption

Introducing specific measures supporting the electrification of sectors such as transport, building, and industry will be a key driver for the further uptake of renewables and to build a more integrated energy system. In parallel, the EU should use the whole arsenal of EU policies to facilitate the broader electrification of the economy. This means among other things:

- **Regarding infrastructure**, ensure a further alignment of the Trans-European Networks for Energy (TEN-E) Regulation with the climate-neutrality objective and earmark EU funding and financing tools to support electrification policies via network optimisation, transformation, and decentralisation.
- **Regarding the building sector**, the Energy Performance of Buildings Directive (EPBD) should introduce minimum requirements to generate renewable electricity and deploy flexibility resources in buildings within Member States' building codes.
- **Regarding the transport sector**, revise the key legislations that will facilitate and accompany the electrification of the sector, such as CO2 Standards Regulations, Alternative Fuels Infrastructure Directive. It should also promote and fund self-generated electricity for charging stations for e-mobility.
- **Regarding the industry sector**, facilitate the development of power purchase agreements for the industry, through a thorough implementation of the Renewable Energy Directive.

Accelerate the deployment of energy storage.

In SolarPower Europe's 100% Renewable Europe study, the growing cost-competitiveness of electricity storage, means this technology is a key enabler for a secure, renewable-based energy system, absorbing the variability of renewable output and backing up to 24% of the European electricity demand by 2050.

[18] European Commission (2016). Impact Assessment Electricity Market Design Regulation and Directive. https://ec.europa.eu/energy/sites/ener/files/documents/mdi_impact_assessment_main_report_for_publication.pdf

[19] SolarPower Europe and LUT University (2020): 100% Renewable Europe: How To Make Europe's Energy System Climate-Neutral Before 2050. https://www.solarpowereurope.org/100-renewable-europe/

In the study, the overall energy storage output increases through the next 30 years across the three scenarios[20] by 50 to 100 times, with a share of up to 25% of final energy demand.

Storage is a cost-effective solution to support energy system integration. As a result of optimization efforts in manufacturing, economies of scale, advancements in materials efficiency and an uptake of electrified mobility, the cost of battery storage has substantially decreased in the last decade, leading to reaching cost parity for solar PV and storage with traditional energy sources. Further cost reductions are expected to come from material and battery design innovation and new (or emerging) battery chemistries. Looking at the larger picture in terms of energy storage and flexibility options, electrolysers can also contribute to grid stability through interruptible services. Further cost reductions are also expected through research and innovation in electrolysers.

Storage can smooth out the electricity supply during peak and low electricity production periods. Storage provides a reliable delivery from the production site to the electricity grid and helps regulate the voltage and frequency levels of the electricity grid. Storage limits the curtailment of excess electricity. As illustrated in a recent study by RTE and the IEA on the technical feasibility of a power system with a high-RES share[21], the deployment and use of new flexibility resources such as batteries and electric vehicles with smart charging is among the key measures to transition towards climate neutrality.

Storage allows for a more decentralized and smarter electricity infrastructure. Electricity storage capacities allow for a better utilization of local energy resources, increases local security of energy supply, shortens transport distances, reduces investment into transmission and distribution infrastructure, and reduces transmission and distribution losses.

[20] The report modelled three distinct scenarios with the following boundary conditions and main results:
Laggard scenario: A slower energy transition up to 2050 results in only in a renewable energy share of 62% and approximately a 90% reduction in GHG emissions by 2050, missing the EC's climate neutrality and Paris Agreement targets.
Moderate scenario: A medium pace energy transition towards 100% renewables by 2050, meeting the EC's climate neutrality vision with zero GHG emissions and the 2°C Paris Agreement target.
Leadership scenario: A rapid energy transition in the next two decades resulting in 100% renewables and zero GHG emissions in the energy system by 2040, achieving the ambitious 1.5°C Paris Agreement target.

[21] IEA and RTE (2021). Conditions and requirements for the technical feasibility of a power system with a high share of renewables in France towards 2050.

To accelerate the deployment of storage **the RED II must complement the existing policy framework to provide additional support mechanisms for the storage of renewable energy**, including direct and indirect incentive schemes, time-of-use tariffs, or tax exemptions for prosumers. It could also establish a European target for storage of renewable energy, as indicated in our proposals for the revision of Article 3 of the REDII.

Critical European legislative initiatives to accelerate the uptake of renewable electricity storage, beyond the REDII.

Ensure a smooth implementation of the CEP at national level, in particular for provisions of the Directive on common rules for the internal market for electricity and the Regulation on the internal market for electricity related to active consumers' rights, the framework for electricity storage, smart meters, and dynamic tariffs.

In addition to this, **the review of the EEAG framework should allow for support to storage as a critical enabler for energy system integration** by:

- **Ensuring decentralised and prosumer-based solar and storage are eligible to receive investment subsidies.**

- **Introducing the notion of "load specificity" in competitive tenders on for example, grid friendliness or load profile, in line with the Renewable Energy Directive, article 4.2.** Load specificity would value projects which supply specific generation profiles or provide ancillary services to the grid. Generation profiles or grid services could be satisfied by specific generation technologies such as wind or solar, depending on the existing generation load, or through a combination of technologies in hybrid plants that couple solar and storage or that are upgraded with power electronics. This would support investment in flexible clean energy and would value smart grid location, such as locating plants near consumption points to reduce the need for network reinforcement.

  Such tenders exist on islands or in areas with poor interconnectivity, to ensure investments into new renewable energy capacities meet the resource adequacy constraints of the territory.

  Projects that combine generation and storage provide larger benefits to the energy system and for this reason they should be prioritized in the allocation of grid capacity. In Portugal this measure, combined with multi-use-options, lead to highly competitive tendering bids in hybrid auctions.

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Support the Energy Efficiency First Principle by promoting renewable-based electrification.

Energy efficiency is an important principle to achieve the EU's climate targets. The energy efficiency first principle should be reflected in the RED II through the promotion of on-site renewables and the promotion of renewable-based direct electrification of end-use sectors.

Directly consuming self-generated electricity is the most energy efficient way to consume energy. If directly self-consuming solar power is not possible, the second-best approach is to store the energy and use it in the future. The deployment of decentralised battery energy storage systems should therefore also be promoted in this regard.

The EU should do more to promote renewable-based electrification as a cost-effective strategy to deliver energy savings. Pursuing ambitious policies to promote renewable-based electrification would reduce primary energy consumption by 23% (compared to a 2020 baseline) and minimize energy losses, increasing the efficiency of the energy system. Furthermore, to ensure consistency with the energy efficiency first principle, the RED II should ensure renewable hydrogen is employed only in hard to abate sectors and end-uses where direct electrification is not technically or economically feasible.

Renewable hydrogen, renewable fuels, and low-carbon fuels – expanding the use of renewables beyond power

The European Union has a unique opportunity to ensure **renewable hydrogen –hydrogen produced from 100% renewable electricity sources– can play a strategic role in achieving carbon neutrality by 2050.** The further deployment of renewable energy projects to produce hydrogen at the scale required to achieve climate neutrality, will create additional sustainable jobs, foster industrial growth, and help the EU recover from COVID-19's economic impact. It is furthermore, a very important opportunity to boost Europe's industrial leadership in future-proof clean energy technologies.

Renewable hydrogen will be crucial to decarbonise hard to abate sectors **where direct electrification with renewables is still too expensive or not technically viable.**

Measures to support the uptake of renewable fuels in end-uses

To build the demand for renewable hydrogen and derived e-fuels, **SolarPower Europe supports the introduction of a minimum share or quota for renewable fuels, including renewable hydrogen, in those sectors** where direct renewable-based electrification is not technically viable or economically not feasible.

SolarPower Europe believes that to successfully achieve a climate neutral Europe by 2050, **fuels that are not renewable, such as methane-based or low-carbon hydrogen, should not be promoted through the RED II**.

Carbon Contracts for Difference (CCfDs) **are not the most appropriate instrument to support the uptake of renewable fuels and they should therefore not be covered by the RED II.** Instead, they could be introduced as part of a broader industrial policy instrument. CCfDs aim to support the deployment of low-carbon technologies, materials, or processes that enable industrial decarbonisation. They are therefore a promising instrument to promote decarbonisation and modernisation of EU industries. However, such

instruments are not directly targeted to support the uptake of renewable energy use in industry. This is because CCfDs are not solely focused on energy use. Secondly, when used to support the decarbonisation of energy uses in industry, CCfDs will primarily encourage the most affordable low-carbon fuels in the short term which are mostly based on gas and nuclear energy.

Instead, the RED II could introduce dedicated support mechanisms enabling the uptake of renewable fuels, such as renewable hydrogen, at production and end-use levels. At production level, introducing CfDs for the renewable electricity supplied to the hydrogen producer can help reduce the cost of renewable hydrogen production, providing a competitive supply of renewable hydrogen to industrial end-users. Such contracts can be backed by the State through CfDs or encouraged on a market basis through PPAs. For end-users, direct investment support to industrial users can support the adaptation of industrial processes needed to switch to renewable hydrogen. Such supports should not duplicate CCfDs at the risk of introducing double compensation mechanisms.

The obligation of energy suppliers to certify to consumers the share of energy from renewable sources by Guarantees of Origin shall be extended only to renewable fuels. The system should clearly identify, and differentiate, the origin of the natural resource used to produce the renewable fuel. Suppliers of renewable fuels should certify to consumers the origin of the resource, so there is no possible confusion for end-users to choose hydrogen produced from 100% renewable energy sources.

That said, the **cooperation mechanisms set out in RED II where Member States can support renewable hydrogen projects in other Member States and in third countries while counting the energy produced as their own, should be extended to cover renewable hydrogen, but not regardless of its end use.** A cooperation mechanism that considers the end-use of renewable hydrogen is highly recommended. Therefore, the use of hydrogen should be promoted only in those end-use sectors where direct electrification with renewable energy sources is not cost efficient or not technically feasible. Renewable fuels should be reserved for the hard-to-abate sectors, for example where electric drive trains are not suitable, as these fuels are particularly energy inefficient. For example, a synthetic fuel used in an internal combustion engine has an efficiency of 13%, while using electricity in a battery electric vehicle has an efficiency of 69%, according to Agora Energiewende[22].

Renewable hydrogen, renewable fuels, and low-carbon fuels in the transport sector

SolarPower Europe supports the introduction of supply obligations if designed in the spirit of renewable hydrogen quotas, as outlined in the Measures to support the uptake of renewable fuels section above. The introduction of such obligations should be subject to the recommendations of an impact assessment regarding renewable fuels penetration in transport. In line with our position above, we stress that if such obligations should be designed, they should abide by the two follow principles:

(i) the obligation should strictly exclude low-carbon fuels and be only focused on liquid or gaseous *renewable* fuels, accounted on the basis of a robust methodology to be established pursuant article 27 of the RED II and taking account the solar industry's recommendations, and;

[22] Agora Energiewende (2018) The Future Cost of Electricity-Based Synthetic Fuels

(ii) it should incentivise the use of gaseous or liquid renewable fuels only where direct electrification is not technically feasible or not cost-efficient.

The accounting methodology for fuels should strictly exclude low-carbon fuels and be based on the energy value of renewable fuels, rather than on avoided greenhouse gas emissions. Switching to an accounting methodology based on greenhouse gases may support the deployment of non-renewable fuels that are not in the scope of the Renewable Energy Directive, rather than accelerating the use of renewable fuels. Regarding the use of renewable and low carbon fuels in aviation and transport, such measures should only target renewable fuels, as the scope of the Renewable Energy Directive only covers renewable energies.

Principles for a robust and comprehensive certification and verification system covering all renewable fuels.

A robust and comprehensive certification and verification system for renewable hydrogen will be crucial to support its uptake and place it in the right path to meet the renewable hydrogen capacities stated in the EU Hydrogen Strategy. For this reason, the system should be:

- **Harmonized across Europe, cover all end-use sectors, all renewable fuels, and demonstrate that renewable hydrogen and renewable synthetic fuels are produced from additional renewable electricity**.
- **Distinguish the origin of CO2 in the fuels**.
- **Comprise a comprehensive, precise, and science-based uniform EU-wide terminology** of different types of hydrogen.
- **Assign GOs for renewable electricity and renewable hydrogen** to guarantee that consumers can make informed choices and minimise the risk of stranding assets.
- **Incorporate sustainability criteria that considers full lifecycle greenhouse gas emissions** from production to usage, to robustly measure the gains in terms of GHG emissions reductions when choosing renewable hydrogen and thereby, facilitate investments in additional renewable electricity generation.

Annex 1 - Background information

SolarPower Europe 100% Renewable Europe study shows that supporting the massive deployment of renewable electricity across all sectors is the most cost-efficient way to achieve climate-neutrality even before 2050.

However, the sequence of action is also critical. By 2030, prioritizing the direct and renewable-based electrification of the building, transport, and heating sectors will be the most cost- efficient and fastest way to achieve significant CO2 emission reductions. The massive roll-out of renewable electricity sources such as wind and solar power will also enable, even before 2030, the production of competitive renewable fuels including hydrogen, which will enable the full decarbonation of hard-to-abate and hard-to-electrify sectors.

Accelerating the electrification of the European economy will be essential to successfully achieve the European Green Deal's objectives. According to SolarPower Europe 100% Renewable Europe's Moderate

scenario [23] the overall rate of (direct and indirect) electrification in the EU will rise from about 6% today to about 23% in 2030, reaching 85% in 2050.

The EU has made good progress in decarbonising its energy production through the deployment of renewable energy sources, **reaching a 34% share of renewables in gross electricity consumption in 2019[24] and the EU is projected to reach 62% in 2030[25]**. However, **significant efforts are needed to increase the renewable-based direct electrification across all end use sectors**.

Subsectoral trajectories to climate neutrality

Electricity and gas

SolarPower Europe 100% Renewable Europe's Moderate scenario shows that **high electrification rates (up to 85%) are key for achieving a climate-neutral and renewable-based energy system.**

The potential for renewable-based electrification in Europe is enormous. Total installed renewable capacities in Europe could **reach 1,200 GW in 2020, 2,500 GW in 2030, and up to 9,900 GW by 2050**. Solar energy is driving the bulk of this transition, thanks to its cost-competitiveness and high degree of versatility. **In 2021, solar energy has become the most affordable and easily deployed renewable energy source in history,** poised to generate at least 60% of Europe's electricity by 2050.

Heating and cooling

SolarPower Europe 100% Renewable Europe's report shows that in the heat sector, electricity use is expected to rise from less than 3% today and reach 64% by 2030. The strong efficiency gains obtained through direct electrification result in an only marginal increase of heat generation and total installed capacity through the transition period.

While the **share of fossil-based heating decreases from over 75% in 2020 to around 20% in 2030 and to zero by 2050**. **The share of renewables in the heat sector grows from about 20% in 2020 to around 60% in 2030.**

Heat pumps coupled with electric heating play a crucial role through the transition, with a share of around 50% heat generation by 2030 and over 60% by 2050. While the production of RE-based synthetic fuels starts scaling up after 2030, by 2050 the share of renewable methane (synthetic methane and biomethane) reaches 35% of high temperature heat demand, while renewable hydrogen represents 65%.

[23] SolarPower Europe and LUT University (2020): 100% Renewable Europe: How To Make Europe's Energy System Climate-Neutral Before 2050. https://www.solarpowereurope.org/100-renewable-europe/

[24] Eurostat (2020). Renewable energy statistics. https://ec.europa.eu/eurostat/statistics-explained/index.php/Renewable_energy_statistics#Share_of_renewable_energy_more_than_doubled_between_2004_and_2019

[25] SolarPower Europe and LUT University (2020): 100% Renewable Europe: How To Make Europe's Energy System Climate-Neutral Before 2050. https://www.solarpowereurope.org/100-renewable-europe/

Transport

SolarPower Europe 100% Renewable Europe's Moderate scenario shows that direct renewable-based electricity in transport is expected to rise from about 1% in 2020 to 8% in 2030, reaching 34% in 2050.

Fossil fuel consumption in the transport sector will decline from about 98% in 2020, to about 83% in 2030, and reach zero by 2050. A strong **direct electrification trend in road transport contributes to decreasing the overall final energy demand for transport from over 7,200 TWh in 2020, to 6,200 TWh in 2020, and to 5,000 TWh by 2050**. The massive demand for renewable energy-based synthetic liquid fuels for the marine and aviation sectors kicks in from 2040 onwards, up until 2050.

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