Hertie School
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Policy Brief

For climate, profits, or resilience?

Why, where and how the EU should respond to the Inflation Reduction Act

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#IndustrialPolicy
#InflationReductionAct
#GreenDealIndustrialPlan

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The US Inflation Reduction Act (IRA) has rekindled European fears of missing out in the global green technology race. However, EU member states still disagree on whether the greater risk lies in doing too much or too little. At heart, there remains significant confusion on which European sectors stand to lose competitiveness; how much the EU should fret about these losses; and whether there is a need for joint support from the EU level to avoid economic divergence. We take a first stab at the existing sectoral evidence. Our results suggest that the IRA will undercut European production costs in several sectors. This does not mean the EU must mimic the US program. However, it does mean that the EU needs to turn its piecemeal Green Deal Industrial Plan into a coherent strategy. This requires a greater focus on green industries in which Europe can develop a competitive edge and more joint financing at the EU level.

1 Intro

The US Inflation Reduction Act (IRA) has rekindled European fears of missing out in the global green technology race. The European Commission has responded by cobbling together a set of regulatory changes in a flurry. In the last three months, it has put forward a new Green Deal Industrial Plan, proposed new production targets and faster permitting in a range of green sectors, and allowed member states more legal legroom to provide financial backing for national industrial policies.

These quickfire changes are insufficient for tackling the specific challenges arising from the global push towards green industrial policy. They aim too blanketly at replacing imports with domestic production, privilege deep-pocketed member states, test the limits of fair competition in the Single Market, and push Europe towards the wrong kind of industrial policies.

The EU's first line of policy action, thus, reflects current political constraints. As such, it remains piecemeal and certainly is not the coherent strategy the EU needs.

One reason for this half-baked strategy is that member states still disagree on whether the greater risk lies in doing too much or too little. There remains at heart significant confusion on three issues. First, which EU sectors stand to lose competitiveness due to the new US climate package? Second, how much should the EU fret about these losses, given that entering a global subsidy race will be costly and comes with the risk of policy failure? And third, can possible subsidies come exclusively from individual member states, or is there a need for joint support from the EU level? Answering these questions requires a nuanced understanding of the sectoral implications of the IRA for the EU. We take a first stab at the existing data to address them.

We show that the IRA will significantly reduce production costs in several green tech industries relative to the EU, and that matching US support in Europe would be costly. The EU must therefore pick its battles wisely. It should avoid mimicking the US attempt to onshore the production of highly commoditized goods such as solar panels that it can import more cheaply from elsewhere. Instead, the EU should ramp up support for industries such as batteries, hydrogen and others that are important to reach climate targets, have broader implications for European growth and investments and in which the EU can develop a competitive edge. Importantly, this support should not come exclusively as national efforts. Given the current and prospective distribution of these sectors across member states, a European response to the IRA requires joint financing to avoid economic divergence and harness the efficiency gains of the single market.

2 What is new about the Inflation Reduction Act?

European calls for more active industrial policies to manage the green transition and reduce dangerous import dependencies have been with us for some time. The latest US climate package has led them to pick up steam. The IRA's main goal is to decarbonize US industry and electricity grid. The bill covers the next ten years[1] and constitutes the biggest fiscal policy package to address the climate crisis to date in the US. As such, it is a much-welcomed sign that the US is finally starting to green its economy.

At the same time, however, the IRA is a huge ramp-up of green industrial policy. The US is opening the fiscal tap to onshore and scale production in several key green technology sectors, such as solar, batteries, hydrogen and electric vehicles. And it is doing so without much regard for its trade partners. In Europe, the IRA has stirred up worries because the US subsidies are different both in kind and scale.

A different kind of green subsidy

First, the US will deliver subsidies to green manufacturers much faster and more predictably than what is available in the EU. Most EU support programs are project based and require lengthy notification and application procedures, making it especially challenging for small and medium-sized enterprises to receive funding. They also mostly focus on capital expenditures, helping with the initial investment needed to build up production and research capacity. In contrast, the new US subsidies operate largely through the tax code and focus on operation expenditures. That means that they are directly available and help push down the costs of production for the next ten years. As a result, they send a direct signal to manufacturers how much they can benefit from moving investments and production to the US.

[1] Importantly, many IRA incentives are available for 10 years based on their construction date. A project constructed in the early 2030s may receive credits into the 2040s (Bistline et al. 2023).

Second, the new US subsidies are partly protectionist. For some industries, government support is especially generous if production, not just of the final good, but also of its inputs, takes place in North America. The most stringent local content requirements (LCRs) are linked to extended consumer credits for electric vehicles (EVs). For green tech manufacturers, meeting Buy American provisions comes with a top-up bonus ("adder") that increases the amount of subsidies by 10%.

The main political goal of these Made in America requirements is to reduce US dependencies on Chinese imports in critical sectors of the green transition. However, they also discriminate against European producers and violate World Trade Organizations (WTO) rules, which has led to a political outcry in the EU. Since the end of last year, Washington and Brussels have negotiated strategies to dial back some of the protectionist elements vis-à-vis the EU. This has led to some carve-outs, for example for leased vehicles, and both sides are eying targeted free trade agreements that could broaden the scope of the US subsidies EU manufacturers can qualify for (see Section 6). However, most protectionist elements for green tech industries are hard-wired into the law and impossible to change ex-post.

A different scale of green subsidies

A crucial aspect of the IRA is its fiscal scope and the high unit-level subsidy it provides. The fiscal scope is surrounded by a lot of uncertainty and has led to some confusion in the debate. The Congressional Budget Office (CBO) officially puts the costs of the IRA's energy security and climate change programs for the next ten years at about USD 370 billion. Some have therefore argued that US support will be comparable to or even fall short of what is available in the EU, for example via NextGenEU and national aid for renewables (e.g. here and here). However, these comparisons can be misleading for three reasons.

First, the bulk of the spending in the IRA takes the form of uncapped tax credits.[2] Their fiscal costs will, therefore, depend on uptake, i.e., the extent to which households and companies will use the subsidies. As a result, estimates on the de facto fiscal size of the IRA differ widely. Most studies now put the costs significantly above the official numbers accompanying the legislation and current projections range from USD 800 billion to over USD 1.2 trillion (Bistline et al. 2023 for an overview). Of course, these numbers should be put in perspective. The US economy is vast - US GDP was $26 trillion in 2022 – and the spending will occur over an entire decade. Either way, the US will likely spend substantially more on green subsidies in several key clean-tech sectors than Europe plans to do.

Second, macro comparisons between the EU packages and the IRA are further complicated by the fact that the climate package is not the only new US industrial policy act. A lot of the investment spending on infrastructure or electricity grids that the EU covers in NextGenerationEU is supported in the US with the Infrastructure and Jobs Act, for example. This package was introduced in 2021 and adds another USD 1.2 trillion in federal investment. **Third, comparisons suffer from a lack of systematic data on green industrial policies at member state level.**[3] We, therefore, take a more sectoral approach to gauge the potential implications of the IRA for Europe.

[2] Crucially, the IRA allows that some of the tax credits are 'direct pay' and some are 'transferrable'. Direct pay means that the tax credits are transformed into direct grants so that entities such as nonprofits or local governments are eligible to receive them. Transferable tax credits can be transferred to unrelated third parties in exchange for cash, for example, if a company's tax bill is too small to benefit from the entire subsidy through its own tax payments.

[3] Eurostat collects data on national state aid. However, it does not aggregate the data sectorally. Moreover, more than 90% of current state aid falls under so-called block exemptions and is not recorded by Eurostat.

3 What does the IRA mean for the EU?

Three questions are critical for developing a European response to the new green tech race. First, how will the new US package affect the relative competitiveness of different European sectors? Second, how important is it economically to have these sectors in Europe? And third, should potential responses come at national or European level?

Rather than macro comparisons of different packages, these questions require detailed sectoral analyses. We take a first stab at the available empirical evidence and focus on those green tech sectors that will likely receive the bulk of new US funding. They include EVs, batteries, solar, wind power, and hydrogen. Annex 1 provides a detailed description of our findings in each industry and shows the difference in cost of energy as a cross-cutting factor for competitiveness. Table 1 below shows our indicative risk assessment resulting from this analysis. The rest of the section elaborates on the three risk dimensions and summarizes the key takeaways for the sectors. The results should be taken with a grain of salt. Up to date sectoral data is limited, risks depend on a lot of unknowns and these industries develop very dynamically. Our assessments are therefore subject to high uncertainty. However, to our knowledge, this analysis is the first to compare the risks and opportunities across clean tech sectors in a structured way. As such we hope it serves as a basis for further data-driven assessments.

Table 1: Sector specific assessment

	1) Competitiveness risk i.e. whether the sector's international competitiveness is at risk in the EU, given foreign subsidies, structural cost differences, and gap to global technology leader	2) Economic risk		3) Divergence Risk i.e. whether subsidies would cause economic divergence within the EU, if they were mostly/ exclusively disbursed at national level
		Risk of (future) economic welfare losses i.e. risk of losing (future) economic welfare if the sector was not in the EU, e.g. because the sector is highly profitable or has large positive employment effects	Risks for security of supply i.e. high dependence on unreliable suppliers putting continuous and affordable supply at risk	
Batteries	Medium	High	Medium	High
EVs	Medium	High	Medium	Medium
Solar components	High	Low	Medium	Low
Wind components	Medium	Medium	Low	Medium
Renewable hydrogen	Medium	High	Low	High

The implications of the IRA for the competitiveness of EU clean tech are substantial but nuanced

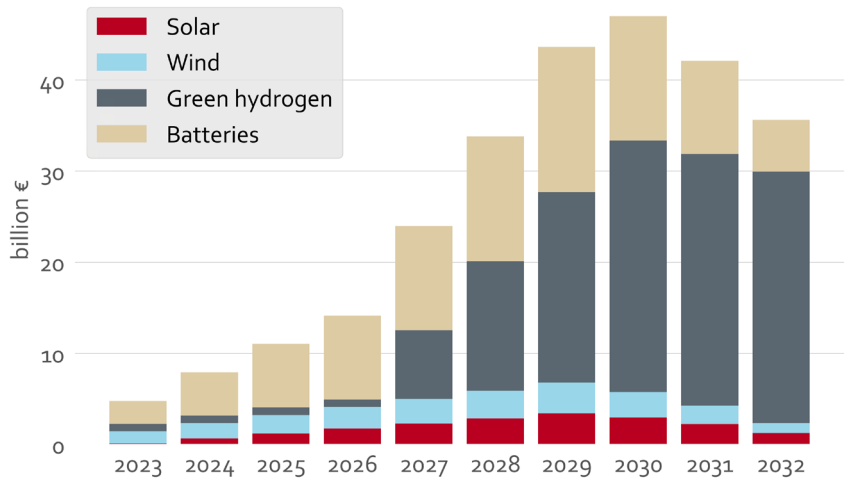
First, the implications of the IRA for EU competitiveness are substantial but differ across sectors. While the EU initially focused on the protectionist consumer credits for EVs, these subsidies likely have a limited impact in practice, at least in the short term. EU exports of EVs to the US are small in quantity. Many European manufacturers already have or are building up production facilities in the US and can benefit from the handouts. Moreover,

most EU EV exports are in the upper price segment, making them ineligible for the IRA subsidies in the first place.

However, in other sectors, the IRA could have substantial effects. For example, if US producers can make use of all subsidies within the legislation, batteries could become 30% cheaper in the US than in the EU (see p. 13), production costs for solar panels could fall by two-thirds relative to the EU (see p. 21), and prices for producing renewable hydrogen could fall to zero by 2030 (see p. 17). Moreover, in many of these sectors, the fact that the US provides direct production subsidies instead of merely supporting capital investments will make scaling the production of advanced technologies much more attractive than in the EU.

Matching US subsidies in these sectors would require a lot of additional public funding. Our estimations here come with big caveats. They assume that the EU will reach its very ambitious Net Zero Industry Act (NZIA) production targets in green tech for 2030 and make several assumptions about the pace of deployment (see also Annex 2). Nonetheless, they provide some insights about the ballpark of the emerging differences (see Figure 1). If the EU wants to match the US production subsidies and at the same time reach its production targets in hydrogen, batteries, solar and wind components, it will need to spend about €264 billion in the next decade (about €135bn without hydrogen).[4]

Figure 1: Volume of production subsidy if the EU matches the production subsidy offered by the IRA for EU production, over the IRA time horizon (until 2032 in most cases). Assumes the EU achieves its production objectives as set out in the NZIA.



All assumptions are detailed in Annex 1.

Matching US subsidies to the full extent will not be necessary. The EU already has a range of project-based subsidy schemes. They are smaller and scattered across various programs but do help fill some of the funding gap (see section 4). Moreover, because of the EU's carbon pricing system, Europe needs fewer public resources to spur private investments in green technologies than the US, where the government relies on subsidies alone. Finally, policy commitments like the Fit for 55 package go a long way towards convincing companies that a vast European market for green goods is imminent, providing a strong

[4] EU state aid rules effectively prohibit production subsidies for industrial manufacturing. However, for the production of hydrogen, the EU hydrogen bank (and analogous national instruments) have a similar effect as production subsidies (see Annex 1) but their currently planned scope is much smaller than the sums depicted in Figure 1. Figure 1 also does not show the production subsidies for the generation of renewable electricity, which are also contained in the IRA (see Annex 1). For renewable electricity, feed-in premiums are widespread in the EU and effectively act as production subsidies.

incentive to stay here. **Nonetheless, the size of the emerging funding differences clearly means that the US is not just catching up. It will now spend substantially more on green tech than the EU currently plans to do.**

An EU response should focus on those sectors in which the EU can build an absolute economic advantage

The fundamental question for the EU is, therefore, whether the economic juice of more public support is worth the squeeze. In other words, why should the EU invest tax-payer money to ensure that the industries the IRA may lure over the Atlantic remain in Europe and/or expand here, especially since we know that getting industrial polices right is complicated and comes with significant risks of government failure?

The current debate mushes together two related motivations that follow a notably different economic logic. The first concerns the security of supply. Here the idea is that the EU is too dependent on importing many key clean tech goods, especially from China. While relying predominantly on imports may minimize short-run costs, it creates long-term risks. The EU had to learn this the hard way during the pandemic and even more so when the Russian invasion of Ukraine revealed Europe's reliance on energy imports to be a major source of vulnerability.

Industrial policy can reduce this risk by providing incentives to onshore the production of critical goods. Put simply, the main goal is to use public support for domestic manufacturing to ensure supply remains stable and immune against sudden import stops. Often this implies to permanently subsidize the production of inputs with low margins that the EU could import more cheaply from elsewhere. It, therefore, also means increasing the overall costs of the green transition.

Our sectoral analysis suggests that there are few reasons for countering the IRA on security of supply grounds alone. The manufacturing of wind components is not dominated by any single exporter. Hydrogen can be produced domestically as well as imported from many countries neighboring the EU, reducing the reliance on a single source. And while China is the undisputed world leader in solar power technology, this does not necessarily mean that the EU needs to push for greater self-sufficiency. Solar panels are relatively commodified goods, and other regions, such as India and now the US, are already ramping up their manufacturing capacities. This will help the EU to reduce its reliance on Chinese suppliers. This does not mean that the EU should be naïve about concentrated dependencies. However, from a resilience and security of supply perspective, trade diversification and "friend shoring" are likely cheaper options than blanket import substitution.

However, ramping up support for clean tech may still make sense from a broader economic perspective. Here the motivation would be a more classical industrial policy one. While some clean tech sectors are already relatively mature, many are still in their infancy and their expansion is riddled with market failures such as issues with reaching sufficient scale, and network and learning-by-doing effects. Moreover, all clean tech, mature or new, continues to be disadvantaged because of insufficient carbon pricing. Left to the whims of the market, they will probably not grow as rapidly and at the necessary scale needed to fight climate change. Support therefore can make sense independent from the global environment.

The fact that other regions now provide more generous support to overcome these initial hurdles adds pressure to act. Without additional public investments, the EU could lose out in a global race on where key green industries take footing. To the degree that the sectors in question have high margins, well-paying jobs and stimulate growth and investment in other up- and downstream industries, this could result in broader economic losses. The goal of industrial policy is then to both bring down the global price of climate relevant goods and to stay in the global green race by providing temporary support to industries in which Europe could develop a competitive edge.

Our analysis suggests that there is a good economic case for more EU support in some sectors the IRA targets. This is, for example, the case for hydrogen because making hydrogen affordable will be essential for keeping several other downstream sectors competitive. The EU is currently in a good position to lead in the industry, but given the early stages of the technology, the IRA provides significant incentives to relocate investments to the US. Similarly, battery production will be a crucial source of value-added and jobs in the automotive sector. The EU industry is still nascent, and the IRA makes production in the US much more attractive at a crucial point in time for investment decisions. Our analysis also shows that, while wind power technologies' economic footprint is narrower, support could be justified in the medium term. So, while there is no reason to copycat all IRA subsidies, the EU should support those sectors in which it has a realistic shot at becoming competitive over time.

The sectors that require a response need common European support

Finally, we look into the question of where the support should come from. Given the limited fiscal resources at the EU level, industrial policies are mostly a member state domain. However, not all EU countries can afford big and costly subsidy packages. **National industrial policy solo efforts therefore risk economic divergence and unfair competition in the single market, especially if the benefiting industries matter not just for deep-pocketed but also fiscally more constrained member states.**

Our sectoral analysis shows a substantial risk of divergence in those industries for which a response would be most relevant. For example, hydrogen ecosystems must be built across the EU, especially in Southern European countries with high renewable energy potential. At the same time, the data shows that wealthier member states like Germany are already investing more in the sector than others. More national responses would increase this divergence. Similarly, EU battery production is not just located in wealthy member states such as Germany and Sweden that would be able to fend off the threat from foreign subsidies through national measures. The IRA is also putting at risk manufacturing capacities and planned investments in fiscally more constrained countries like Poland, Hungary, Spain and Italy. And even the production for wind energy components is relatively scattered across the EU with many production facilities in Germany, Spain, Italy, France, and Portugal (see p. 21). To avoid unfair competition and economic divergence and realize the efficiency gains from the scale of Single Market, the EU, therefore, cannot only resort to national subsidy bonanzas. **Instead, a response will need to come with substantial support at EU level.**

4 The EU's response so far: too broad and too national

How does the EU's political response so far fit with the results of our sectoral analysis? The IRA has triggered some hasty policy reactions. In February, the Commission put forward a new Green Deal Industrial Plan (GDIP), followed by the Net Zero Industry Act (NZIA) and substantial revision of state aid guidelines. These reactions reflect time pressures and political constraints. As such, they suffer from two important shortcomings.

The first issue is that the current strategy is much too broad in scope. In response to the IRA, the EU Commission has proposed extremely ambitious new production targets. Instead of focusing on those industries where the EU already has an economic edge or suffers from real risk of supply issues, the NZIA aims at ramping up domestic production of a very wide range of "strategic net-zero technologies", which include solar, wind, batteries, and hydrogen electrolyzers as well as a range of other technologies.[5] The draft law stipulates that overall domestic manufacturing capacity in these net-zero technologies should approach 40% by 2030. It also defines even more ambitious sub-targets for some sectors.[6] Importantly, these targets are mere goals and not legally binding. However, if taken seriously, the strategy would imply across-the-board import substitution even for goods that are currently imported from a diversified base of trading partners.

The second problem is that the bulk of new financing would need to come from member states. The NZIA itself focuses mainly on regulatory changes. It proposes to simplify and fast-track permit-granting procedures for investments in net-zero technologies. Moreover, it introduces some qualitative selection criteria for public procurement, auctions, and consumer support schemes to reduce concentrated dependencies on countries like China. Effectively, the new law would allow member states to more frequently bypass private contractors that use suppliers from third countries that dominate a particular supply chain, in favor of domestic suppliers or suppliers from countries that are less dominant in that sector.[7]

So far, the strategy comes without any new money from the EU level. The Commission proposes reshuffling existing funds, e.g. tapping the Cohesion Funds or the Modernization Fund. Reassigning these monies to NZIA objectives in many cases would, critically, mean diverting resources from other investment projects that support energy independence and the green transition. Another funding source that the Commission claims can be used for NZIA objectives is untapped Recovery and Resilience (RRF) loans. However, this is not a viable funding strategy, since they have relatively high interest rates (which also means that some member states can get better rates on their own government bonds), and they are already meant for other purposes, such as financing energy independence from Russia under REPowerEU. In addition to reshuffling funds and RRF loans, the Commission has said it will propose an 'EU sovereignty fund' in the context of the mid-term review of the EU budget this summer. However, its scope, timing and financing sources remain unclear.

Instead, the Commission has provided member states with more legroom to design national responses. For that, the Commission has further relaxed its state aid rules. Traditionally, these rules put strict limits on national subsidies. However, they were already relaxed during the pandemic and then again when the energy crisis hit. Under the GDIP, the Commission has prolonged the existing exemptions until the end of 2025, has allowed member states to subsidize clean tech manufacturing with simpler, more effective schemes, and to disburse higher aid volumes to match the volume of foreign subsidies.

To be clear, aid provided under these rules is unlikely to divert future investment pencilled in for the US back to the EU. The matching of foreign aid is preconditioned on stringent conditions[8], and the investment aid is capped at EUR 150 million per project (EUR 350 million for projects in assisted regions). As we show above, production subsidies under the

[5] The NZIA Annex also lists heat pumps, carbon capture and storage (CCS), sustainable biogas and grid technologies as being "strategic net-zero technologies". The draft law remains ambiguous regarding the controversial recognition of nuclear power as a net-zero technology. While nuclear power is not listed among the eight designated strategic net-zero technologies in the annex, the proposal includes "advanced technologies to produce energy from nuclear processes" in the definition of net-zero technologies in Art. 3.

[6] IThe sector-specific targets are outlined in recital 17 of the proposal.

[7] The act would allow public authorities to favor products which do not originate "from a single source of supply [...], from which more than 65% of the supply for that specific net-zero technology within the Union originates", even if there are products with lower prices. Crucially, the proposal grants national governments leeway to circumvent the criteria if the corresponding price increase would be above 10%.

[8] The 'matching clause' is a direct response to the IRA, allowing EU member states to provide subsidies just high enough to retain companies' investment in the EU, up to the volume of the foreign subsidy. However, for aid volumes above certain thresholds, there are strict conditions in place: the aid must either be for an investment located in a poorer EU region or must involve projects located in three or more member states.

IRA quickly dwarf these sums. Countries like Germany and France have, therefore, been pushing for even more comprehensive flexibility but ran into opposition from smaller and fiscally more constrained member states that feared being outcompeted in the single market. However, even in their current form, these new flexibilities will test the limits of fair competition. Under the EU's Temporary Crisis Framework, Germany and France alone account for about 77% of the earmarked state aid volume. While this figure should not be overestimated (not all earmarked state aid is spent, and Germany and France are large countries hard-hit by the energy crisis), it does show the difference in capacity that countries have, if state aid floodgates are opened.

Overall, the EU's response so far constitutes a dangerous mix It combines the panicky wish to somehow answer the IRA with the institutional and political constraints of doing industrial policy in the EU. As a result, it is much too broad in scope, comes with few real instruments at the EU level and has the potential to undermine fair competition in the single market without really equipping member states with the means to compete in a global race for green tech. A effective response to the challenges of green industrial policy, thus, requires more deep-rooted changes.

5 Conclusion: what is needed for a coherent EU strategy

The IRA poses a challenge for the EU. It should focus minds in Brussels and national capitals on solving the EU's central industrial policy conundrum: What are the green tech industries the EU really needs to support and how can it do so without resorting to national measures that undermine fair competition in the Single Market and reinforce existing inequalities? This requires more focus and more common financing.

First, the EU should not throw money at all the industries the US has now decided to pamper. Instead, it should focus on those sectors in which it has a realistic shot of gaining international competitiveness. This requires shaking off some of the policy panic and ignoring siren calls from industry that characterized initial discussions on a response and identifying those sectors where the EU has an edge and that can likely stand on their own after an initial period of support. Our analysis suggests that this could include rising industries such as hydrogen and batteries, but exclude commodified goods such as solar panels that the EU can expect to import much more cheaply from a range of sources. This is by no means a final or conclusive list. However, it indicates the kind of analysis the Commission needs to provide to develop a sustainable strategy.

Second, EU green industrial policy requires a much more serious attempt to develop common financing instruments. We show that matching foreign subsidies will be costly and that national solo efforts risk divergence and unfair competition, especially in those sectors where a response to the IRA is most warranted. Moreover, common financing is crucial to establish investment policies that have sufficient scale to realistically compete with the huge markets in the US and China. The EU, therefore, needs a two-step approach. In the short run, it needs to make sure that all member states can undertake the required measures to support the industries in question. A loan-based European Sovereignty Fund that benefits from explicit carve-outs under the reformed fiscal rules could be one option here. Another powerful option could be to boost the (so far very vague) Commission idea to support clean tech manufacturing via an EU auction scheme, analogous to the pilot auctions planned by the EU hydrogen bank. Looking ahead, EU industrial policy, however, needs real common resources. Above all, this must mean a bigger joint envelope in the next EU budget.

Third, EU industrial policy requires better governance. The IRA has the advantage of largely operating through the tax code, making its support operationally simple. After deciding politically what technologies should receive support, allocation decisions are largely left to the market in the US. While the EU cannot mimic these policies directly, the Commission should think hard about how to establish more common horizontal industrial policies at the European level, allowing to leverage efficiencies of the large EU market. And where there is no alternative to project-based policies, it should keep the bureaucratic burden low, and with it the likelihood of policy failure. Getting industrial policy right is complicated, and the EU needs to ensure that its green industrial policy benefits the climate and the economy, instead of merely frittering away taxpayer money.

Annex 1

To get a more accurate, differentiated picture of the challenges and opportunities that the IRA poses for the EU, one must analyze sectors individually. The analysis below attempts this for several key sectors, serving as the basis for the synthesised analysis in section 3 and the recommendations in section 5. We analyze the following areas: electric vehicles, the battery supply chain, manufacturing of solar and wind components, and clean hydrogen. These were chosen because they are crucial for the climate transition, are economically important, have ambitious production targets in the NZIA (except for EVs), and are heavily subsidized by the IRA. We also compare the cost of energy in the US and the EU, as a cross-cutting factor for EU competitiveness.

Key area: Electric vehicles

Competitiveness risk	Economic risk		Divergence Risk
	Risk of (future) economic welfare losses	Security of supply risk	
Medium	High	Medium	Medium

What's at stake for the EU?

The automotive industry is a backbone of the European economy, accounting for over 7% of the EU's total GDP. In 2021, the EU exported €127 billion worth of automotives, generating a trade surplus of €74 billion.

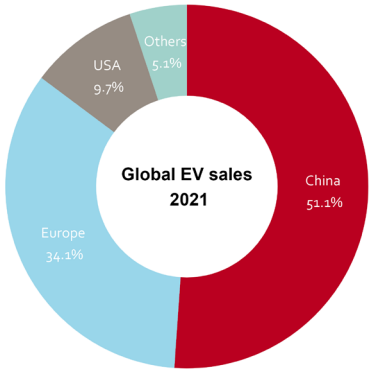
The sector plays a crucial role in job creation, providing direct and indirect employment for 13 million people, which represents about 7% of total EU employment. Given its highly integrated intra-EU value chain, the industry is not only important for big exporters like Germany. Viz, between 2010 and 2020, 3 out of 4 new automotive jobs were created in Central and Eastern European member states.

Encouraged by government subsidies and regulatory emission requirements, the deployment of electric vehicles in the EU has increased steeply in recent years. In 2021, one in six cars sold in the EU was an electric vehicle. However, EV deployment is very unevenly spread among EU countries. As such, it tends to be higher among wealthier member states, which also provide higher coverage of charging points. Meanwhile, the share of battery

EVs amounted to around only 1% of the total fleet in Cyprus, Poland, Czechia or Slovakia in 2021. Globally, China and the EU are in the lead in terms of market penetration, with the US aiming to catch up (see Figure 2). However, the Chinese EV market is considerably larger in scale, as China alone comprised over 50% of global electric car sales in 2021 (see. Figure 3)

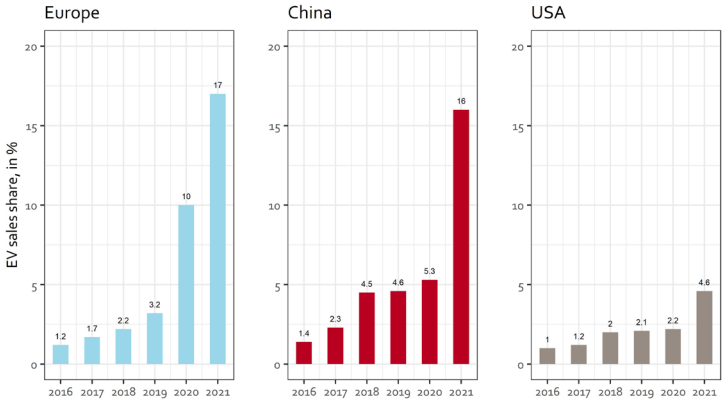
In this context, the EU automotive industry will have to undergo massive structural changes if it wants to secure a significant share of future EV production in the EU. Compared to the traditional automotive value chain, European carmakers have so far failed to achieve a similar level of vertical integration or secure a local supply base within the EU. Therefore, EV production in the EU remains highly dependent on imports of battery components and struggling to meet the steeply increasing demand for EVs. Recent trends indicate a shift in global trade relations, as China becomes an export-hub for electric vehicles sold in the EU.

Figure 2: Contributions of China, Europe, and the United States to 2021 global electric vehicle sales.



Source: ICCT, 2022

Figure 3: Electric car sales share in Europe, China, and the United States, 2016-2021



Source: IEA, 2020

What does the IRA mean for electric vehicles?

The IRA extends existing purchasing incentives to accelerate the deployment of electric vehicles (EVs) in the US. These consumer incentives come in the form of tax credits and are available both for new and used clean passenger vehicles, as well as for clean commercial vehicles. The main "Clean Vehicle Tax Credit" offers consumers up to $7,500 for the purchase of a new EV. Moreover, the IRA abolished the previous cap of 200,000 EVs sold per manufacturer, guaranteeing the general availability of the tax credit until 2032. Likewise, starting 2024, middle-income buyers will face fewer bureaucratic hurdles as they can then use the full tax credit amount as a down payment at the time of sale of the vehicle. Additionally, income and price caps are included to prevent the subsidy mainly benefitting high-income households in the purchase of luxury EVs, as with the previous tax credit.

However, the $7,500 tax credit also comes with controversial caveats for foreign automakers since it is tied to rigorous local content requirements (LCRs). In this way, the "Clean Vehicle Tax Credit" is only applicable to EVs which have been assembled in North America. Moreover, from mid-April onwards, additional requirements on the origin of battery components and the battery's critical minerals will enter into force and become increasingly rigid over time (see table 2).[9] Those requirements will be complemented by the so-called "foreign entity

[9] The first half of the credit amount will hinge on the condition that a certain percentage of the value of the battery components must be manufactured or assembled in North America. The other $3,750 will only be available if a percentage of the value of the critical minerals contained in the EV's battery is recycled in North America or extracted or processed in the US or in a country with which the US has a free trade agreement.

of concern" clauses which, crucially, disqualify EVs with batteries or critical minerals of Chinese origin. Confronted with these LCRs, the EU and other trade partners of the US have complained about the discriminatory nature of the tax credits, claiming that the domestic supply chain constraints could pose a breach of WTO law (e.g., Reuters, 2022).

Table 2: The ratcheting up of the IRA's local content requirements over time

Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Battery Components %	50%	60%	60%	70%	80%	90%	100%	100%	100%	100%
Battery Component Foreign Entity of Concern Rule	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Critical Minerals %	40%	50%	60%	70%	80%	80%	80%	80%	80%	80%
Critical Minerals Foreign Entity of Concern Rule	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: US Department of the Treasury 2023

While this protectionist stance is designed to incentivize the establishment of a domestic EV supply chain, the LCRs bear the risk of depressing the availability of the tax credit in the short run. This is due to the large dependency of current EV supply chains on Chinese inputs. In 2021, the US accounted for only 7% of the global battery production and remained highly reliant on imports of critical minerals used in EVs. Given that the construction of new mines and battery factories would take several years, some EV producers may decide that the potential benefits of a temporary tax credit do not compensate for the necessary adjustment costs and risks. In any case, meeting all the LCRs will be extremely challenging for carmakers in the near future. Therefore, even US companies such as General Motors estimate that their EV models will be unable to benefit from the full credit until 2025.

What is the EU doing on electric vehicles?

At the end of 2022, almost all EU member states offered comparable purchasing incentives, tax reductions and/or tax exemptions to stimulate the uptake of electric vehicles. While these subsidies vary greatly in design and size across the continent, some EU countries offer even higher subsidies than the US. Crucially, unlike the US, European purchasing incentive schemes do not discriminate between domestic and foreign production, thus prioritizing a swift adoption of EVs in Europe.

Nevertheless, the EU also employs protectionist elements to promote EU-based EV production. Accordingly, it imposes a 10% tariff on imports of EVs, whereas the US duty on imported EVs from Europe is just 2.5%. However, EU tariffs are in line with international trade regulation, as they do not discriminate against certain countries. And they are lower than Chinese import tariffs of 15 to 25% on European vehicles. In practice, this has facilitated a recent surge in imports of Chinese EVs into the EU.

Unlike the US, the EU does not rely on subsidies alone to accelerate the deployment of EVs. Rather, increasingly stringent CO2 emission standards are meant to guide the transition to zero-emissions mobility. As such, the EU set new targets that effectively phase out the sale of CO2-emitting vehicles by 2035. In combination with existing purchasing subsidies, this legislation can be expected to provide greater planning and investment certainty to the automotive industry, therefore stimulating the market for clean vehicles in Europe.

Overall risk assessment from IRA for electric vehicles:

In the short run, the Clean Vehicle Tax Credit's negative impact on the European automotive industry is likely to remain limited. This is because the number of European EVs exported to the US continues to be relatively low. According to IHS Markit, no more than 54,020 EVs were exported to the US in 2021 - a miniscule quantity compared to the 2.3 million EVs sold in Europe in the same year. Notably, most of these EVs would have not been eligible for the subsidy regardless of their production origin, as they were predominantly positioned in the luxury segment. At the same time, European carmakers had already started producing some EV models in their existing US plants before the IRA was announced. Ultimately, this could even result in a temporary competitive advantage for European manufacturers over Asian rivals which so far do not produce EVs in the US for the most part.

Arguably, the Biden administration has proven to be open to compromise Thus, discussions in a dedicated US-EU taskforce have resulted in substantial concessions to European carmakers. For example, based on a broad interpretation of the IRA's "Commercial Clean Vehicle Tax Credit", leased EVs are now classified as commercial cars. Since the subsidy scheme for commercial vehicles is not restricted by any LCRs or price caps, this "leasing loophole" could be especially beneficial for higher-priced EU-made EVs. The adjustment concerns a significant market segment, as nearly every fifth new vehicle is leased in the USA. Furthermore, the US Treasury Department's recently issued guidance has opened the door for the EU to qualify as a trading partner under the critical minerals requirement through a "targeted critical minerals agreement". This could increase the likelihood that European carmakers will be eligible for at least half of the "Clean Vehicle Tax Credit".

However, the EU would be mistaken to disregard the bigger picture. The EV market is growing fast as consumer interest is picking up and especially Asian carmakers are presenting more affordable options. While the current global undersupply of EVs makes it unlikely that investments in EV manufacturing represent a zero-sum game in the near future, today's strategic decisions will shape Europe's future as a hub for automotive production. As such, the EU is home to both volume and premium car brands produced across multiple EU countries. The large-scale export of EU-made vehicles has been a central element of the EU's industrial model and a guarantor for jobs for many decades. However, capacity gaps in the European EV supply chain have led to prioritizing the production of premium EV models, promising higher profit margins. Alarmingly in terms of European convergence, this EV production has been mainly concentrated in Western EU countries so far. Overall, the EU needs to find a response to increasingly protectionist tendencies and broad-based manufacturing subsidies along the EV supply chain in the US and China if it wants to capture a significant share of EV production in the volume segment as well. Otherwise, the EU might end up as a niche producer of luxury EVs.

Key area: EV battery supply chain

Competitiveness risk	Economic risk		Divergence Risk
	Risk of (future) economic welfare losses	Security of supply risk	
Medium	High	Medium	High

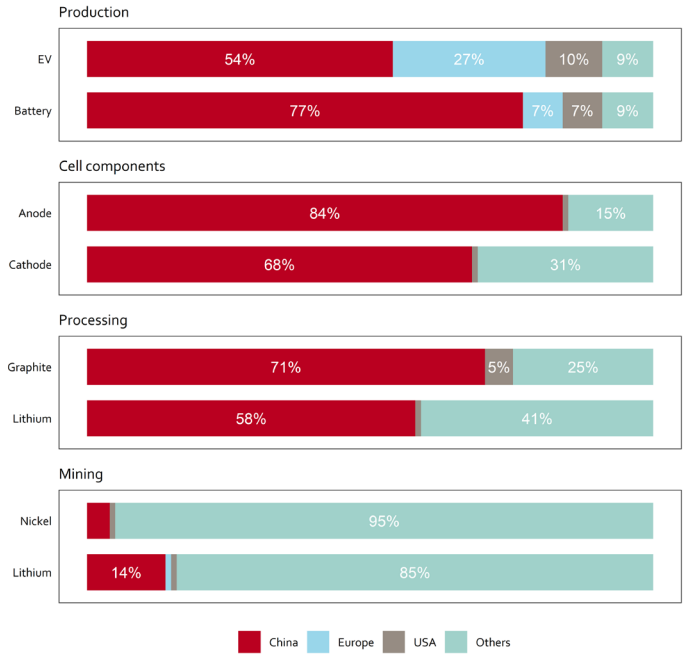
What's at stake for the EU?

As EVs replace internal combustion engine vehicles, batteries could become the new oil. Global demand is set to increase by about 30 percent per year by 2030. Hence, there is a race to onshore battery supply chains.

Thanks to its decade-long subsidies, China dominates global output of EV batteries. Crucially, it also controls most of the processing of critical minerals and production of battery cell components.

The battery typically represents over 30% of the overall cost of an electric vehicle. While Europe accounts for more than a quarter of global EV production, it only plays a minor role in the EV battery value chain so far. Recent supply chain disruptions have underscored that high dependency on imports can result in input shortages constraining European producers' ability to meet rising EV demand.

Figure 4: Geographical distribution of the global EV battery supply chain (selected critical raw materials)



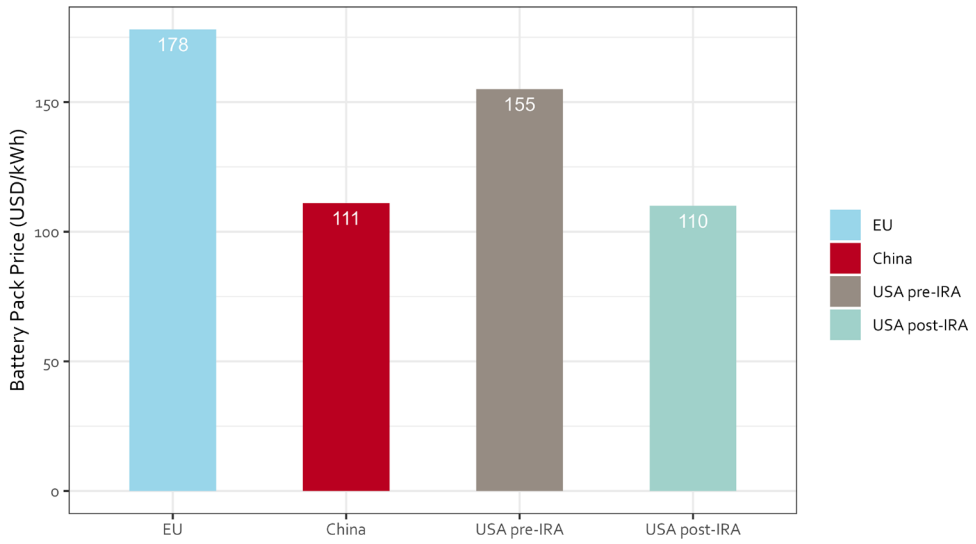
Source: IEA, Global EV Outlook 2022

What does the IRA offer on EV batteries?

The IRA offers significant incentives for building up large-scale US-based EV battery production, aiming to reduce China's grip on the industry. For this purpose, the IRA extends the total funding of the existing "Advanced Energy Project Credit" to $10 billion. This ITC (investment tax credit) can be used to establish, expand, or re-equip plants for EVs, batteries or critical materials. However, the alternative "Advanced Manufacturing Tax Credit" (AMTC) is widely considered the real game changer as it provides long-term support for scaling up battery production in the US until the end of 2032.

The AMTC is expected to shave the average production cost for each US-made battery pack by nearly one-third. It achieves this by providing a Production Tax Credit (PTC) of $35 per kilowatt hour (kWh) of capacity for each battery cell produced and an additional PTC of $10 per kWh of capacity for each battery module produced. In practice, this would mean that a battery company that produces one million EV battery packs with a capacity of 60 kWh could receive tax credits of up to $2.7 billion per year. Considering the estimated lithium-ion battery pack price in 2021, these IRA subsidies seem capable of making US batteries globally competitive, positioning them on a price par with Chinese batteries (see Figure 5).

Figure 5: Average lithium-ion battery pack price in China, Europe, and the United States, 2021



Source: BloombergNEF, 2021

Moreover, the AMTC does not only target the final production stage of EV batteries, but rather comprises additional PTCs for upstream inputs as well. These PTCs reduce the production costs of electrode active materials and critical materials by 10%. Crucially, the various PTCs can be stacked by companies and are easily monetizable since manufacturers can receive the tax credits in the form of a direct payment from the US government during the first five years. Before their phase-out at the beginning of the next decade (i.e., 75% in 2030, 50% in 2031 and 25% in 2032), the PTCs will be available to US-based manufacturers without any cap.[10]

In view of the recently announced investments in battery plants in the US, the estimated magnitude of the subsidies for EV batteries is likely to be substantially understated. According to Atlas Public Policy, companies announced US battery plant investments totaling approximately $73 billion in 2022 – more than triple the amount in 2021. Therefore, while the US Congressional Budget Office estimated $30.6 billion[11] of disbursed funding for the AMTC over the next ten years, Benchmark Mineral Intelligence predicts the amount of battery-related PTCs alone could approach $136 billion instead. If these investments materialize, Cowen estimates that the US could achieve an annual battery manufacturing capacity of 920 GWh by 2031.

[10] PTC for critical minerals is exempted from the phase-out.

[11] However, the estimate does not only reflect PTCs for battery manufacturing, but also for the production of solar and wind.

What does the EU offer on batteries?

Acknowledging the strategic relevance of the battery sector, the EU has implemented a more active industrial policy. In 2017, the European Commission launched the European Battery Alliance (EBA), an industry-led initiative that aims to spur and streamline a well-integrated EU-based battery value chain. Complementing this effort, many member states are pursuing initiatives to establish their own battery value chains (e.g., Germany or Hungary), hoping to ensure their role in the future automotive supply chain. Those strategies vary visibly, depending on the countries' comparative advantages. For instance, Poland and Hungary have been very successful in attracting established Asian battery manufacturers, offering relatively cheap production costs and proximity to existing assembly plants of European carmakers. On the other hand, Nordic countries rather aim to become a center for sustainable battery production, betting on promising European start-ups such as Northvolt. Importantly, what these efforts have in common, is their reliance on state aid (national state aid as well as European funding under NextGenerationEU (e.g., PERTE VEC in Spain).

While the EU has established several subsidy schemes, these rely mainly on selective upfront support to enable battery-related investments in research or production facilities. This approach includes dedicated funding of €925 million for R&I activities across the battery supply chain under Horizon Europe, as well as loans of up to €1 billion from the European Investment Bank (EIB) in 2020. Under the InvestEU program, these loan-based investments into battery supply chains are expected to increase further. Importantly, the European Commission also facilitates the provision of larger amounts of national state aid to battery projects via the so-called Important Projects of Common European Interest (IPCEIs). In 2019 and 2021, two IPCEIs for the battery value chain were approved, comprising public funding of €3.2 billion and of €2.9 billion by multiple member states to support battery-related projects.[12]

Unlike the US, the EU's strategy has not focused on competing with Asian market leaders in terms of price but on qualitative standards for green and efficient batteries. The provisionally agreed on EU Sustainable Batteries Regulation will require all batteries placed in the EU market to meet these standards, as well as gradually introducing requirements for carbon footprint and recycled content. By combining this approach with CO2 emission standards for vehicles, the EU has attracted significant investments in European battery manufacturing across the continent in recent years. Indeed, a T&E analysis shows that EU production may be able to meet the rising domestic demand for lithium-ion battery cells during the second half of the current decade if all the planned battery plants in the EU materialize. Currently, Poland, Hungary, Germany, and Sweden host the largest production facilities up and running. Notably, the European market seems to remain particularly attractive for Chinese battery makers which have continued to announce new battery projects in the EU in 2023. This trend can be explained by fierce competition among producers in China, and the disadvantages Chinese battery companies might face in the growing US market due to the restrictions imposed by the IRA.

Overall risk assessment from IRA for batteries:

The battery sector is of considerable strategic interest for the EU. In future, continued reliance on Asian batteries and battery components could put European EV manufacturers at a serious disadvantage vis-a-vis competing producers that are better placed to secure

[12] These numbers only account for the public funding. Additionally, the IPCEIs are expected to leverage an extra €14 billion in private funding..

adequate battery supply. In this light, the establishment of EU-based battery production is an important tool to protect Europe's attractiveness as a manufacturing base for automotives, fostering co-development and the creation of jobs upstream in the EV supply chain and downstream in growing sectors such as battery recycling.

As the IRA has rapidly changed the landscape, the recent surge in announced investments in the EU seems fragile. The IRA's broad-based support for battery manufacturing is in stark contrast to the EU's focus on innovation projects. While investments in emerging technologies such as sodium-ion and redox-flow batteries should not be neglected, as those sustainable alternatives could decrease its dependency on critical raw materials in the future, the EU needs to foster more suitable conditions for the scaling-up of manufacturing. Otherwise, it risks losing previously announced large-scale production projects to the other side of the Atlantic. There is anecdotal evidence that large battery producers are reassessing their investment priorities (e.g., Tesla, Northvolt, and VW). According to a T&E analysis, countries with the largest share of battery production at risk include Germany, Hungary, Italy, and Spain. Around 68% of the announced battery production capacities across the Union for 2030 could be at risk. While EU countries equipped with greater fiscal firepower might be able to convince companies to stick to their plans under the freshly relaxed state aid rules, other member states are less likely to be in a position to secure investment into battery production without access to additional EU support. Accordingly, there is a risk of growing regional divergence if public financial support is mainly disbursed via national budgets in the future.

In view of recent decisions by major battery producers to prioritize investments in the US, the EU cannot simply ignore the IRA's production subsidies. The IRA's PTCs are more accessible, less fragmented, and likely larger in size. Accordingly, there is a significant gap between funding available in Europe and the forecast subsidies under the AMTC targeting the battery sector. This remains true despite available EU-level funding of more than €8 billion on top of national funding and loans under the InvestEU program. Just to match the IRA's PTCs of $45/kWh for battery cells and battery modules while they are available and achieve the NZIA's indicative target of covering 90% of the EU's annual demand for batteries in 2030, the EU would need to invest more than $102 billion over the next decade.[13] This calculation does not include the other PTCs offered along the EV battery supply chain. While the EU should not completely abandon its more nuanced and selective approach to industrial policy, it seems clear that the simplification and streamlining of current funding alone is unlikely to off-set the advantages of IRA subsidies when it comes to battery manufacturing.

Key area: clean hydrogen

Competitiveness risk	Economic risk		Divergence Risk
	Risk of (future) economic welfare losses	Security of supply risk	
Medium	High	Low	High

[13] Note: This calculation is based on the European Commission services' estimate of 610 GWh for battery deployment in 2030. When using industry projections for battery deployment as high as 1000 GWh, the estimated investment needs would increase significantly. See Annex for details on the calculation and underlying assumptions.

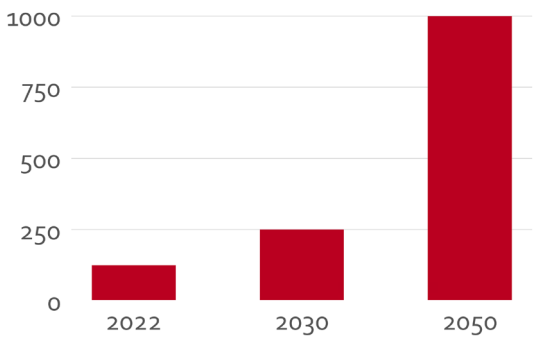
What's at stake for the EU?

The clean hydrogen market is still very small, but is expected to increase massively, potentially to $250 billion in 2030 and even to over $1 trillion in 2050, as shown in Figure 6. Under suitable framework conditions, the EU could capture a sizeable part of the market.

Moreover, leading on hydrogen will likely bring high indirect economic benefits for the EU. Hydrogen will be used in some clean industrial manufacturing, so regional leaders in the hydrogen ecosystem improve their chances of taking a big market share of certain types of future industrial output.

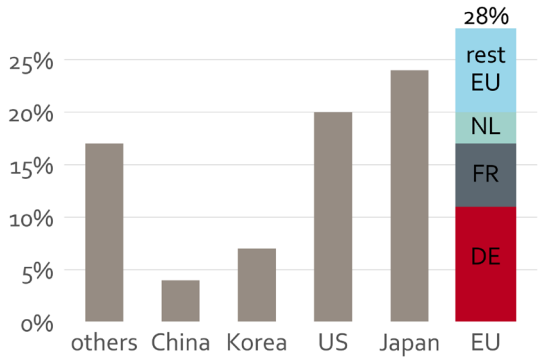
The EU is in a good starting position in the clean hydrogen race. It has been very active in supporting R&D in recent years, with EU companies filing more patents than other regions in the world, as shown in Figure 7.

Figure 6: Total addressable hydrogen market, in USD billion



Source: Goldman Sachs

Fig 7: Percentage of filed hydrogen patents



Source: European Patent Office

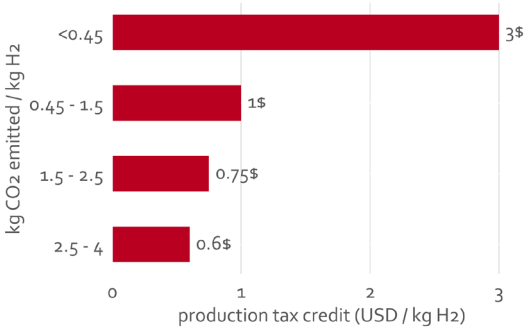
What does the IRA offer on hydrogen?

The IRA makes clean hydrogen very cheap in the US, with relatively high predictability. It does this via two channels: 1) cheap clean electricity (see section below) needed for electrolysis, and 2) a massive subsidy per kilogram of clean hydrogen. As shown in Figure 8, the subsidy depends on CO2 emissions, with hydrogen produced from renewable electricity eligible for $3 per kg. This reduces the price for renewable hydrogen drastically, and could result in cost-free renewable hydrogen by 2030, as shown in Figure 9.

The volume of US hydrogen support might be much higher than stated in the CBO's official estimates. The IRA likely understates future clean H2 demand and hence the total volume of IRA subsidies for H2, which come in the form of uncapped tax credits. The Department of Energy announced as a strategic goal 10 million tonnes of clean H2 for 2030, and 20 million tonnes for 2040. If this ambitious goal were to be achieved, and half of the 10 million tonnes in 2030 were to receive the $3 / kg subsidy, it would cost the US $15 billion per year (in 2030). In contrast, the IRA puts the total estimated budget for H2 production tax credits at only 13 billion over the entire spending period.

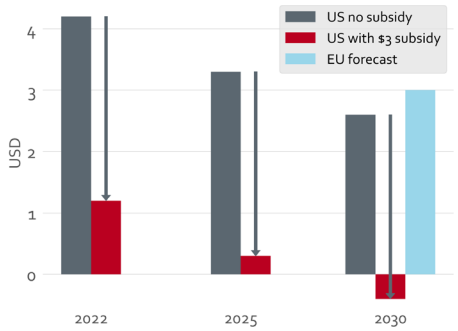
The IRA puts in place local content requirements for hydrogen, but their impact pales in comparison to the pull-factor of cheap hydrogen in the US. Local content requirements for IRA subsidies also figure in the hydrogen ecosystem, e.g. a 10% additional tax credit for manufacturing electrolyzers with materials from the US. While these provisions do discriminate against EU firms, their negative effect is likely small, at least when compared to the big pull that the US will give to the entire hydrogen ecosystem by making clean hydrogen cheap.

Figure 8: IRA subsidy per kg hydrogen according to CO2 emissions



Source: IRA

Figure 9: Hydrogen price per kg in US and EU



Source: BCG, German Hydrogen Council

What does the EU offer on hydrogen?

The EU has been very active in the hydrogen space in recent years, but total support volumes are hard to assess. A Commission report estimates that €900 million of public funds were spent in 2022. One important channel for hydrogen subsidies is two 'Important Projects for Common European Interests' (IPCEIs), which have a joint volume of more than €10 billion and will be disbursed over a shorter time period than under the IRA. Moreover, there are many subsidies via non-IPCEI state aid. The German "H2Global" instrument, which subsidizes the price of hydrogen, received €3.53 billion from the German budget this year, plus €900 million in 2021 from the German stimulus package. However, while these sums are substantial, the volumes for hydrogen support remain below what is on the table in the US.

So far, the EU provides mostly initial investment support for hydrogen projects, not continuous subsidies to lower the price of hydrogen. Some support instruments are planned or extant in the EU that will reduce the burden of high hydrogen prices, such as Carbon Contracts for Difference, or the 'EU Hydrogen Bank', on similar lines to the German H2Global mentioned above and starting with a €800 million auction round this year. However, the largest part of subsidies in the EU by far is spent on R&D and investment costs, not on lowering the price of hydrogen. Projects under IPCEIs, for instance, are typically focused on providing support to facilitate the switch to hydrogen projects, e.g. for setting up factories to use hydrogen instead of natural gas. In economic terms, the EU's focus has been on lowering CAPEX, not OPEX.

Overall, absent changes to the subsidy approach, or a big increase in the planned Hydrogen Bank's budget or national equivalents, the price of hydrogen will most likely be much higher in the EU than in the US. This is driven by the large subsidy in the US per kg, as well as by the higher price of electricity in the EU. The German National Hydrogen Council estimates wholesale market prices of €3-4 in Germany in 2030 (see Figure 9).

The EU can ensure clean hydrogen supply with relatively little effort and cost. Since hydrogen can be produced with electrolyzers, using as inputs just electricity and water, security of supply is naturally less of a concern than for fossil fuels or rare materials. The manufacturing capacity of electrolyzers is forecast to be sufficiently high (at least in the short term). Moreover, the EU aims to produce renewable hydrogen within Europe, further improving resilience. For the substantial amounts to be imported, the EU needs to avoid overreliance on single, unreliable suppliers. This can be achieved e.g. by building infrastructure for multiple import routes from neighboring countries (such as the "hydrogen import corridors" presented in REPowerEU), and by building some spare shipping capacity to cushion supply disruptions.

Overall risk assessment from IRA on hydrogen:

The expected accelerated build-up of a hydrogen industry in the US creates some opportunities for the EU, but they are outweighed by significant risks. There are two potential benefits for the EU: First, a growing market in the US could stimulate exports and increase profits for European manufacturers, for instance of electrolyzers. However, hydrogen isn't the automotive industry: there are no large-scale hydrogen industry incumbents in the EU that could satisfy increased global demand and profit in the process. Second, the EU plans to import vast amounts of hydrogen. To the extent these imports come from the US, the IRA makes them cheaper for EU consumers. However, transporting hydrogen via ship is very expensive, meaning imports will predominantly arrive via pipeline from neighboring countries (see our policy brief on hydrogen transport), and only small amounts will arrive by ship. Overall, the IRA upside for the EU on hydrogen is hence limited.

The main risk for the EU consists in falling behind in the global hydrogen race. The extensive IRA subsidies could make the US the premier location for investments in hydrogen. To the extent that investments in the US and the EU are zero-sum (i.e. an investment takes place either in the US or in the EU, not in both), this poses a serious risk. Hence, clean hydrogen is an area in which the IRA poses a significant threat. For the EU not to fall behind, it needs to make the conditions for the hydrogen economy more favorable at home, including by lowering the price of hydrogen, for instance by boosting the budget for the EU hydrogen bank.

Within the EU, there is a risk of divergence if public support comes mostly from national budgets. While the overall use of hydrogen will differ between member states (e.g. depending on the amount of hydrogen-reliant industrial production), all of them will participate in the hydrogen economy to some extent (for instance in hydrogen production, transport to other countries, industrial consumption, or energy storage). Consequently, all member states would benefit from investments in their hydrogen economy since they will likely pay off in future. However, public hydrogen support is currently concentrated in some member states.[14] While there may be some positive spillovers to other member states if rich countries spend public funds on hydrogen, there is large risk that countries with greater fiscal headroom will buy their hydrogen industries a head start, rendering subsequent catch-up hard to achieve, and this may well distort the single market.

[14] The data availability on state aid for clean hydrogen, including its distributions over EU member states, is relatively poor. However, there are strong indications that those countries with more fiscal space have already been spending more; Germany, for instance, has committed significant amounts to renewable hydrogen (allocating over €3.5 billion to the German H2Global, which will lower the price of hydrogen).

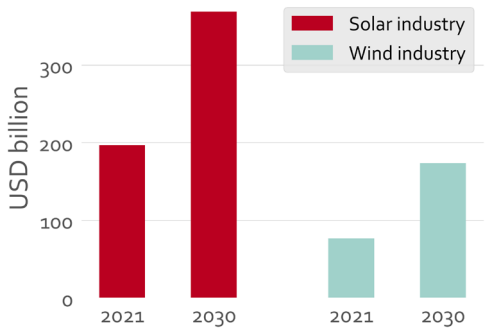
Key area: Manufacturing of wind and solar components

	Competitiveness risk	Economic risk		Divergence Risk
		Risk of (future) economic welfare losses	Security of supply risk	
Solar components	High	Low	Medium	Low
Wind components	Medium	Medium	Low	Medium

What's at stake for the EU?

The solar and wind markets are mature and sizeable. Given their important role for the energy transition, they will grow significantly, but not with the explosiveness and economic opportunities of some other clean tech technologies.

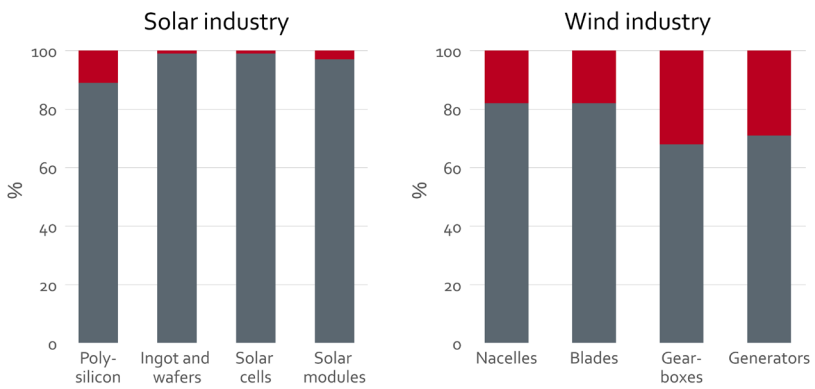
Figure 10: Market value of the solar and wind industries



Source: Precedence Research (1, 2)

The EU has a relatively weak position in the solar industry, capturing only small shares in global markets, as shown in Figure 11. In wind, the EU has a much stronger foothold, with a high number of leading European companies and high innovativeness, resulting in a sizeable EU share of global manufacturing capacity.

Figure 11: EU market share in the solar industry and EU share of global production capacities of wind industry



Source: McKinsey, WindEurope

What does the IRA do to incentivize manufacturing of wind and solar components?

The IRA heavily supports the manufacture of wind and solar components. It does so via two channels: First, the Act increases demand for wind and solar electricity by subsidizing its production (see energy section below) as well as by subsidizing solar and wind parks. Higher demand for green electricity in turn increases the demand for solar modules and wind turbines. Second, the IRA directly subsidizes component manufacturing, either via production or investment tax credits.

The total volume of IRA subsidies for solar and wind manufacturing is large and uncertain. The US Congressional Budget Office estimates that the manufacturing tax credits for solar, wind and batteries will amount to $31 billion. Credit Suisse forecasts a much higher demand for the uncapped clean tech manufacturing tax credits, with $58 billion for solar and $41 billion for wind alone. While there is great uncertainty about these figures, the subsidies are clearly high enough to be a game changer for the US solar and wind manufacturing industry, with substantial effects on overseas markets.

The total effect of IRA subsidies is difficult to estimate but could reduce the US production cost of solar modules by up to 60%, and wind turbines by up to 50%. Some analysts (McKinsey, IEA, Credit Suisse) predict that the IRA will make US-manufactured solar modules the cheapest in the world, substantially undercutting even Chinese prices towards the end of the decade. For wind, the cost reduction is on a less drastic scale, but still impressive. This sizeable price effect arises party because, for both wind turbines and solar modules, the production tax credits are stackable: both the final product and its various inputs are eligible for subsidies.

What does the EU offer?

The EU's solar industry, once a leader, is very small today. Today, the clearly dominant player is China, which takes the lion's share in all key parts of the industry's value chain. EU companies, in contrast, play a much smaller role across the board, supplying less than 1% of global solar modules (see Figure 11 above). The EU only has a sizeable market share in manufacturing a single key input, solar polysilicon, at around 11%. However, the EU plays an important role in manufacturing the machines used in the solar manufacturing industry, with a market share of about 50%. Moreover, some EU companies are technologically on par with Chinese companies in some areas (in particular polysilicon and some types of solar cell production).

While Chinese dominance in solar is a slight concern for EU security of supply, there are various mitigating factors that reduce the risk. First, manufacturing capacity is already sufficient to satisfy demand in the short term, and other regions are planning to ramp up their capacity (notably the US with the IRA, and India). Second, solar is a mature technology and commodified good, making it relatively easy to ramp up manufacturing capacity (compared to e.g. computing chips).

Compared to solar, the EU's wind turbine industry is large and globally competitive. The EU has about 30% of global production capacity (see Figure 11), and EU manufacturers took about 42% of the global wind turbine market in 2022. Unlike the solar industry, the EU has been able to increase its market share in the last decade, by almost 10%. The EU also hosts the highest number of innovative companies and continues to generate high-value patents. The strong EU position and the production capacity in other world regions also means that the resilience risk is relatively low for the EU. However, this risk needs to be monitored, since Chinese manufacturers have been quickly increasing their global market share in recent years.

EU policy makers have high ambitions for both the wind and solar industry. In line with the objective of the 'Solar Alliance', launched in December 2022, the NZIA aims for 30 GW of annual solar PV manufacturing capacity in Europe by 2025 (currently, the EU has a capacity of less than 1GW per year, according to the NZIA staff working document). On wind, the political ambition clearly is to defend or even increase EU market share. The NZIA sets the goal of increasing EU manufacturing capacity from currently 13GW to 36GW in 2030, resulting in a market share of 85% in the EU.

Financial support from the EU and MS for solar and wind manufacturing is relatively scarce and complicated. As in most areas, the EU focuses its support on research and innovation. Subsidies for investment in factories or production is less common, and nowhere near the scale of the IRA. The 'Solar Alliance' mentioned above receives no EU funding, for instance. The funding landscape in the EU is also more complicated and difficult to navigate: there are no less than 11 funding programs for offshore wind at EU-level, plus member state support schemes.

Overall risk assessment from the IRA for wind and solar manufacturing:

With the funding now available, it will be very challenging for the EU to achieve its manufacturing ambitions, especially for the tiny solar industry. Consider, as one illustrative example, a solar module manufacturing plant in Italy that received €118 million of its roughly €600 million investment costs from EU funding (RRF and Innovation Fund). If the company were in the US instead of in Sicily, it could receive the production tax credit for photovoltaic modules of $0.07 per watt. With the plant's annual production capacity of 3GW, at an assumed utilization factor of 75%, over the lifetime of the IRA, it would receive a whopping $ 1.26 billion - ten times what it received in the EU. As shown in Figure 1 in section 3, if the EU wanted to match IRA production subsidies for wind and solar and achieve its production targets within the NZIA, this would require about $41 bn over the next decade (see annex 2). The large subsidy difference between the US and the EU is likely one reason why some companies are scrapping their plans to build plants in the EU.

The generous IRA funding for solar and wind components hence poses a substantial risk for the EU. For wind component manufacturers, the growing demand in the US could at first stimulate their exports – but the subsidies available for US-based firms are likely to quickly render EU products uncompetitive in the US market, once American production capacity has increased sufficiently. For solar, the EU subsidies pale in comparison to what the IRA provides. To the extent that the EU continues to import solar products, higher foreign production subsidies that lower the global price are welcome. But political ambitions to establish the EU alongside solar powerhouses like China (and potentially soon the US) will likely falter without a step change in subsidies.

If the wind industry were to receive public support to reach the NZIA targets, pursuing a mostly national approach creates divergence risks. Wind component factories are located in many EU member states, including those with less fiscal headroom. If the build-up of wind component manufacturing was financed with national state aid, there would likely be fewer subsidies available in poorer member states, which would pull investment and production towards more richly-endowed states. Since wind production is likely to have positive long-term effects (company profits, employment), unbalanced national state aid could accentuate divergence.[15]

[15] Note that if national subsidies were to be disbursed as production subsidies, they could have especially negative effects. Many wind component companies (e.g. Vestas, Siemens Gamesa, Nordex) have multiple production locations in the EU, many of which are not running at full capacity. Consequently, companies could relatively easily shift production, potentially resulting in an inefficient and expensive subsidy race. While currently national production subsidies are not allowed under state aid rules, some member states (including Germany and France) are advocating for it.

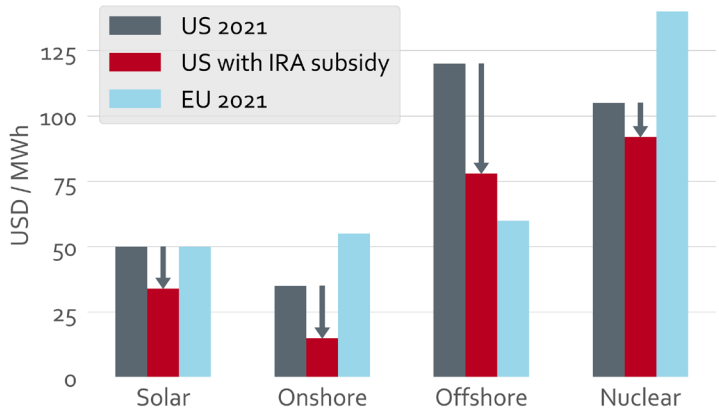
For the solar component industry, the divergence risk within the EU is low. Of the little solar manufacturing capacity that exists in the EU today, some is located in member states with less fiscal space. If solar manufacturing received state aid exclusively from national budgets, locations there might suffer, with new production facilities likely to be built in more generous member states. However, given that profitability of most solar production in the EU will be low, this would likely only have limited negative effects for less supportive countries. Hence, the harmful economic distortion induced by asymmetric state aid would likely be small.

The cost of energy

What does the IRA do?

Via a host of different types of financial support, the IRA reduces the cost of clean energy. Figure 12 shows the IRA effect on solar, wind and nuclear energy costs. While offshore wind is still relatively costly in the US, costs are expected to significantly drop and reach closer to EU-levels in this decade, even before IRA subsidies are taken into account.

Figure 12: Cost of solar, wind and nuclear electricity (LCOE)



Source: IEA, BCG, Credit Suisse

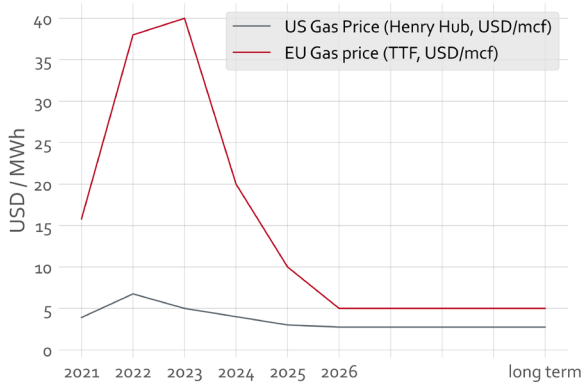
What does the EU do?

The EU member states provide high and increasing renewable energy subsidies, totalling EUR 81 billion per year before the energy crisis. Compared to the IRA's time horizon of about 10 years, the volumes for renewable energy are hence much higher (10 x 81bn = EUR 810 bn in the EU, compared to USD 240 billion, about €221bn, for clean energy in the IRA). Yet, costs of renewable energy are forecast to remain higher in the EU, as shown in Figure 12 above. There are various reasons why costs in the EU are expected to remain higher – one of them is simply that the EU has a lower renewable potential, i.e. has fewer suitable locations for harnessing wind and solar energy.

Overall risk assessment for EU from IRA energy subsidies

While the IRA subsidies make clean energy cheaper than in the EU, the US also has cheaper fossil energy - despite EU fossil fuels subsidies of about EUR 50 billion a year. Natural gas prices were higher before the gas crisis, skyrocketed last year because of the war in Ukraine, and are expected to remain about twice as high as in the US long-term.

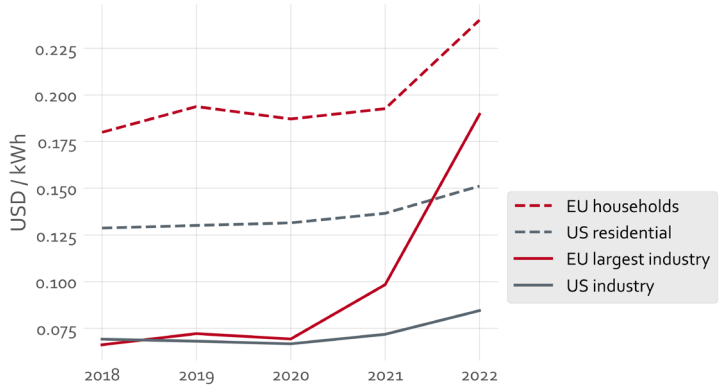
Figure 13: EU and US natural gas prices



Source: Fitch ratings

Lower costs for fossil fuels and renewables are reflected in a lower price of electricity in the US compared to the EU. As shown in Figure 13, electricity prices for households and industry were already lower in the US than in the EU in the past. With the decreasing costs of clean energy in the US through the IRA, this difference will likely get larger over time, absent EU action.

Figure 14: Electricity prices for households and industry



Source: Eurostat (1,2), US EIA

Overall, energy – clean and dirty - is cheaper in the US, and the IRA could widen this price gap further. For the vast majority of businesses, energy costs constitute only a small part of their costs, making them just one factor among others in choosing a production location. However, for energy-intensive industries, the difference can be substantial. For the glass industry, for instance, energy costs in the EU were about 10% of total production costs before the energy crisis. A back-of-the-envelope calculation is illuminating: If the cost of energy in the EU is twice as high as in the US (as forecast for natural gas), then US-based production for glass has a cost advantage of 5%.

Annex 2: Assumptions underpinning Figure 1

General assumptions: The per-unit subsidy assumed equals the IRA production subsidy, converted with an exchange rate ($/€) of 0.92. For solar and wind components and batteries, the subsidy is phased out by 25% in 2030, 50% in 2031 and 75% in 2032 (following the provisions of the IRA's Advanced Manufacturing tax credit). For hydrogen, there is no subsidy phase-out in the considered period.

Assumptions solar components: We convert the IRA production subsidies for various solar components into $/Watt, yielding a cumulative production subsidy of $0.18 / Watt. We take the following components into account: polysilicon ($0.01/W), wafers and ingots ($0.06/W), cells ($0.04/W), and module assembly ($0.07/W); we exclude all subsidies for inverters and tracking systems. We assume the NZIA target of 30GW solar manufacturing capacity is reached, and that the manufacturing capacity levels are linearly built up from currently 1GW (reaching a manufacturing capacity of 38GW per year in 2032). To determine production levels, we assume that the factories produce at a utilization of 80%, resulting in about 157GW of solar equipment being manufactured over the whole period.

Assumptions wind components: We add the IRA production subsidy for nacelles ($0.05/W), tower (0.03/W) and 3 blades ($0.06/W), resulting in $0.14/W. We assume that the NZIA target of 36 GW wind manufacturing capacity in 2030 is reached, and that manufacturing capacity builds up linearly from currently 13 GW (to 42.7GW in 2032). To determine production levels, we assume that the factories produce at a utilization of 80%, resulting in about 222GW of wind equipment to be produced over the whole period.

Assumptions batteries: We add the IRA production subsidy of $35 per kilowatt hour (kWh) of capacity for each battery cell produced and the production subsidy of $10 per kWh of capacity for each battery module, resulting in an overall production subsidy of $45/kwh (which equals the alternative production subsidy for battery modules without cells). Additional PTCs reducing the production costs of electrode active materials and critical materials by 10% are excluded. We assume that the indicative NZIA target of covering 90% of the Union's battery annual battery demand, translating into 549 GWh in 2030 is met, and that manufacturing capacity builds up linearly from currently 75 GWh (reaching a manufacturing capacity of 684.4 GW in 2032). To determine production levels, we assume that the factories produce at a utilization of 80%, resulting in about 3038 GWh of battery capacity to be produced over the whole period.

Assumptions hydrogen: We assume that the EU target of domestically producing 10 million tonnes of renewable hydrogen in 2030 is achieved, as reiterated in the NZIA. To keep our estimate of the subsidy volume conservative and hence as low as possible, we do not assume a linear or a quadratic build-up of production levels, but instead assume that levels stay low until 2026, then quickly increase linearly to 10 MT in 2030, and then plateau at 10 MT in 2031 and 2032 (assuming a plateau is conservative, since volumes can be expected to further increase after 2030). It should be noted that producing 10 million tonnes of renewable hydrogen is an ambitious target; its generation would require roughly 45% of all solar, wind and hydro electricity generated in Europe today.

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