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THE INFLATION REDUCTION ACT: IS THE NEW U.S. INDUSTRIAL POLICY A THREAT TO EUROPE?

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Executive Summary

The central instrument of the U.S. Inflation Reduction Act (IRA) is a funding programme for climate projects, with an officially estimated volume of 369 billion US dollars. The Act's goals are in particular the decarbonisation of energy production and use. At least 70 % of the programme for climate projects aims at subsidising private investments in low-emission technologies. Companies receive particularly high subsidies if a large share of the raw materials and primary products used comes from the U.S. – or from countries with which the U.S. has free trade agreements. The IRA subsidy volume for green technologies is roughly equivalent to the size of the European Union's (EU) Green Deal Industrial Plan.

The largest single item in the IRA is subsidies for low-emission and sustainable electricity generation. For this, 43.6 % of the planned subsidy volume is earmarked in the form of tax credits. Studies estimate that the IRA will reduce the price of electricity in the U.S. by about 1 ct per kWh. The expansion of renewable energies and the IRA's battery and hydrogen production are likely to increase demand for critical raw materials.

The GCEE estimates the overall economic impact of the IRA for Europe to be rather low. For individual industry branches, the subsidies of the IRA could increase the attractiveness of the U.S. as an investment location. However, urgent action is needed due to existing energy price differences, which have a much greater impact on the relative attractiveness of the EU than the IRA.

Potential courses of action

- Coordinate responses among EU member states. Avoid a subsidy race with the U.S. and within the EU.
- Adapt EU funding programmes: Reduce bureaucratic hurdles, simplify applications, align funding with emission reductions.
- Rapidly expand energy supply and infrastructure, increase incentives for supply and demand flexibility and strengthen European coordination in infrastructure development to reduce energy prices.
- Press ahead with negotiations on a free trade agreement with the U.S. and ratify agreements already negotiated (e.g. Mercosur).
- Secure and diversify the supply of critical raw materials: Conclude agreements with commodity-producing countries, strengthen domestic extraction and recycling and expand international cooperation.

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On 16 August 2022, the Inflation Reduction Act (IRA) was passed in the U.S. with effect from 1 January 2023.[1] As a central instrument of industrial policy, the IRA contains a funding programme for climate projects, estimated at 369 billion US dollars for the period from 2023 to 2032, significantly higher estimates exist. The funding goals are in particular the decarbonisation of energy production and use. In this way, the IRA is likely to significantly accelerate the achievement of the U.S.' climate goals.

At least 70 % of the support programme for climate projects is earmarked to promote private investments in low-emission technologies. The IRA does not set specific build-up or emission reduction targets for individual sectors or technologies. Instead, incentives are predominantly provided for switching to low-emission production processes, mainly through tax credits for investment in and production with predominantly low-emission technologies. For example, 43.6 % of the planned funding volume is earmarked for tax credits in the area of sustainable energy production. Many of these tax credits are particularly high if a large share of the raw materials and primary products used come from the U.S. or from countries with which the U.S. has free trade agreements.[2]

In the European Union (EU), the IRA is viewed critically because of possible distortions of competition and in particular the requirements on U.S. production (domestic content rules). There are fears that European manufacturing, capital formation and research in key technologies might migrate to the U.S. (von der Leyen, 2022). The rising demand for low-emission technologies might also increase the costs of implementing the EU climate targets in the short term. Over time, however, costs are likely to fall due to faster expansion of production volumes in the U.S. as a result of learning and economies of scale (Kleimann et al., 2023).

According to the GCEE, the IRA itself is likely to have only a minor impact on the overall economy in Europe. For individual industries relevant to achieving the climate targets, the IRA's production and investment subsidies could strengthen the incentive to invest in the U.S. instead of the EU. However, it is to be expected that the already existing stark energy price differences will have a greater impact in comparison. As a result, individual sectors of the economy could lose their current competitiveness. An expansion of the volume of subsidies for low-emission technologies in the EU in response to the IRA could lead to a subsidy race, which would be associated with welfare losses for both the EU and the U.S. This should be avoided. The volume of support for low-emission technologies in the EU is already at the level of the IRA. However, EU support programmes for companies could be more plannable and less bureaucratic, and approval procedures could be accelerated. In addition, subsidies could be more closely aligned with the emission reductions achieved by the subsidised activities. This requires progress in the certification of low-emission processes and products, sensibly geared to the CO_2 footprint. In view of the existing energy price differences, efforts should be made to reduce energy prices in the EU. To achieve this, energy supply should be expanded and energy infrastructure should be expanded. In order to secure the supply of raw materials for the green transformation, not least in view of the increasing global demand due to the IRA, progress should be made on agreements with commodity-producing countries for the supply of raw materials. In addition, the EU should seek to ratify trade agreements already negotiated and resume dormant negotiations on trade agreements, for example with the U.S.

Energy subsidies have an impact on the real economy through lower production costs

The IRA subsidises the energy, manufacturing and mobility sectors with about 75 billion US dollars directly, through loans, transfers and loan guarantees, according to official estimates by the U.S. Congressional Budget Office (CBO) (Leggett and Ramseur, 2022). This amount can be divided into new

[1] The IRA consists of three pillars, only one of which is discussed in this policy brief. In addition to the energy and climate programme considered here, the IRA includes a health care reform to reduce drug prices and expand the Affordable Care Act. The spending and tax cuts are to be counter-financed in the third pillar by reforming and raising the corporate profit tax to at least 15 % and improving tax enforcement. Overall, the IRA is expected to reduce the federal budget deficit by over 300 billion US dollars (The White House, 2022).

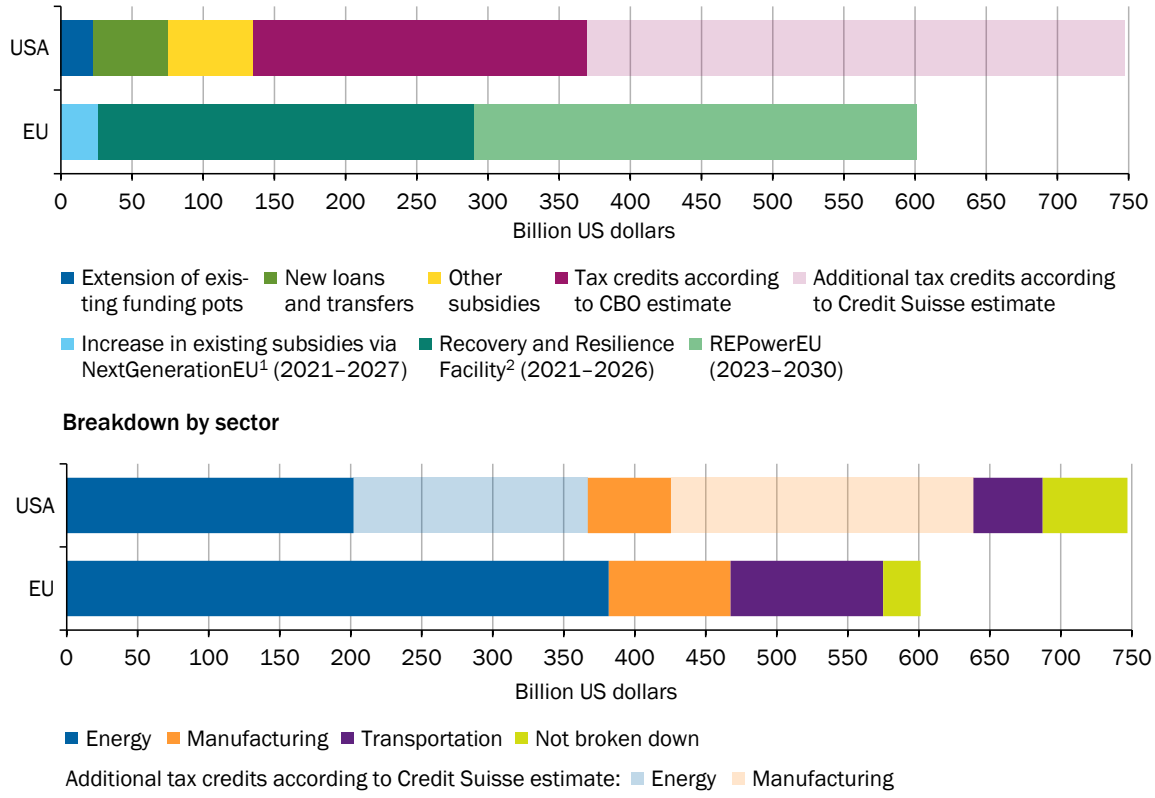
[2] For example, used electric vehicles and commercial vehicles, which include leased vehicles, are not subject to domestic content rules for subsidy eligibility (IRA Section 13402).

support programmes (about 53 billion US dollars) and the modification or expansion of existing programmes (about 22 billion US dollars). ↘ CHART 1 However, the majority of the IRA budget is earmarked for tax incentives for transformative investments, low-emission goods and energy production and the consumption of sustainable products.[3] The total volume of tax incentives is not capped in principle. With greater use of tax incentives, the estimated volume of the incentive programme for climate projects is double (Credit Suisse, 2022) to triple (Bistline et al., 2023) the official CBO estimate of 369 billion US dollars.

In response to the IRA, the European Commission presented the Green Deal Industrial Plan on 1 February 2023. The size of the Green Deal Industrial Plan, totalling around €510 billion (around 560 billion US dollars), is roughly comparable to that of the IRA programme, depending on the estimate of IRA tax credit expenditure. Green Deal Industrial Plan includes reallocated funding from the NextGenerationEU Recovery and Resilience Facility and the REPowerEU Fund (Holzhausen, 2023). The NextGenerationEU Recovery Plan was adopted by the EU in 2020 to mitigate the impact of the Corona pandemic. At its core is the €724 billion Recovery and Resilience Facility (RRF), which entered into force in February 2021, of which €504 billion has been applied for so far. The European Commission (2023a) estimates that climate spending will account for about 40 % of the total by 2026. Assuming that 40 % of the requested funds will be used for climate spending, approximately €200 billion has been allocated to this use so far.

↘ CHART 1

Comparison of funding amounts for climate projects in the IRA and selected EU programs



1 – Incl. REACT-EU, Just Transition Fund & InvestEU. At least 25 % of REACT-EU and 30 % of InvestEU to contribute to EU climate targets. 2 – To make the IRA and ARF comparable in terms of their climate subsidies, the policy sectors' shares of total climate spending in the national plans were netted against the total and also broken down into the energy, manufacturing, and mobility sectors.

Sources: Congressional Budgetary Office (CBO), Congressional Research Service, Credit Suisse, ECB, European Commission, The White House, own calculations

3 In addition to the domestic content requirements, often other requirements have to be met for the highest IRA subsidy rates. For example, the base subsidy rate for CO_2 -neutral energy production is increased fivefold if prevailing wage levels and apprenticeship standards are met (The White House, 2022).

Furthermore, within the framework of Next GenerationEU, existing programmes that are supposed to contribute to the transformation towards a green economy have been increased. So far, loans of about €220 billion from the RRF have remained unused. These were reallocated to the EU fund REPowerEU. This subsidy programme, worth a total of €310 billion, is intended to make the European energy system more sustainable and more independent by 2030. In addition to the funds of the Green Deal Industrial Plan, around 40 billion US dollars of RRF funds have already been drawn down. ↘ CHART 1

There are important differences between the IRA and the EU funding instruments in terms of design and mechanism. The IRA primarily promotes investment and production with tax credits. The subsidy amount increases proportionally with the investment or production volume. Thus, in the case of production expansions, additional subsidies are paid at the same rate. In principle, all projects that meet certain criteria known in advance are eligible for subsidies.[4] The projects do not compete with each other for a fixed total volume of subsidies. In addition, the IRA tax credits reduce the companies' costs for a reliable period of time (2023 to 2032 and partly beyond).[5] Since the total subsidy amount per company is usually not limited, there are incentives to expand production capacities (investment subsidies) and production volume (production subsidies). The induced cost reduction thus improves the supply-side conditions of the affected sectors, which have a direct effect on real economic activity in the subsidised sectors as well as in upstream and downstream sectors via lower costs. If the expansion of production is accompanied by learning effects, the companies' economies of scale are likely to increase further. However, the use of subsidies is also likely to lead to deadweight losses by companies that do not need the subsidies, for example due to cost degression as a result of learning effects.

While the IRA's funding approach focuses on planning security for companies, the EU's funding approach is associated with greater planning security and the possibility of control for the state. In contrast to the IRA, German and EU subsidies must often be applied for in a time-consuming manner. Their approval, amount, purpose and duration are decided on a case-by-case basis. The total volume of direct production subsidies is often capped in the EU. This creates competition with the aim of ensuring that the most competitive companies receive the subsidies. Such competitive allocation is done, for example, for the Important Projects of Common European Interest (IPCEI). However, given the complex application procedures, it is uncertain how efficiently such procedures allocate funds. In addition, large parts of the funding in the EU and Germany, also due to the regulations of the EU internal market, are not investment- or production-oriented, but are awarded, for example, as R&D subsidies, which are only indirectly reflected in more efficient production processes or new products.[6]

Economy wide impact from U.S. energy cost reductions are likely to be small

The largest single item of the IRA, according to CBO (2022), is subsidies for low-emission electricity generation, accounting for about 30 % of the total. Various estimates suggest that the IRA is likely to reduce electricity prices in the U.S. by up to 1 ct per kWh over the next decade (Roy et al., 2022; Bistline et al., 2023; EIA, 2023). As energy prices influence production and investment decisions of companies (Bae, 2009), these energy cost savings are, on the one hand, likely to influence the location choices of multinational companies and thus foreign direct investments (Barteková and Ziesemer, 2019) in favour of the U.S. On the other hand, the competitiveness of companies already located in the U.S. is likely to be improved.

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[4] For example, the subsidy per kilogram of hydrogen depends on the CO_2 emissions. The basic subsidy rate is 0.60 US dollars per kilogram of hydrogen multiplied by the applicable percentage between 20 % and 100 % depending on the CO_2 emissions in the production process. The basic subsidy rate can be increased if other criteria are met (see below; IRA Section 13204).

[5] For example, the hydrogen production volumes of all eligible production facilities that start operation before 1.1.2033 are subsidised for ten years from the start of operation (IRA Section 13204). For renewable energy, the subsidies apply for ten years from the start of operation if construction of the power plant begins before 1.1.2025 (IRA Section 13101).

[6] All previous IPCEIs have funded R&D projects with a total of €31.7 billion. Only one, Hy2Use, also subsidises the development of hydrogen infrastructure. The Innovation Fund, on the other hand, which receives revenue from the CO_2 certificate emissions, also subsidises the construction of production facilities (European Commission, 2023b, 2023c).

However, compared to the expected and historical energy cost differences between the EU and the U.S. without the IRA, the energy cost reduction brought about by the IRA is small. The EU's exchange-traded electricity prices have significantly exceeded those of the U.S. in recent years. Between 2010 and 2019, the exchange traded electricity price in Germany was about 1.2 ct per kWh higher than the electricity price in the U.S. The difference increased dramatically since the middle of 2021 and reached its maximum so far at the beginning of the fourth quarter of 2022. Over the last 100 trading days before 5 May 2023, the difference averaged 9 ct per kWh, about two and a half times the electricity price in the U.S. Market expectations in the form of forward prices can be used to estimate future developments (GCEE Annual Report 2022 item 302). The difference in electricity futures prices for the U.S. and Germany is expected to average about 6.6 ct per kWh by 2030. The electricity price reduction through the IRA would thus account for 15 % of the average electricity price difference.

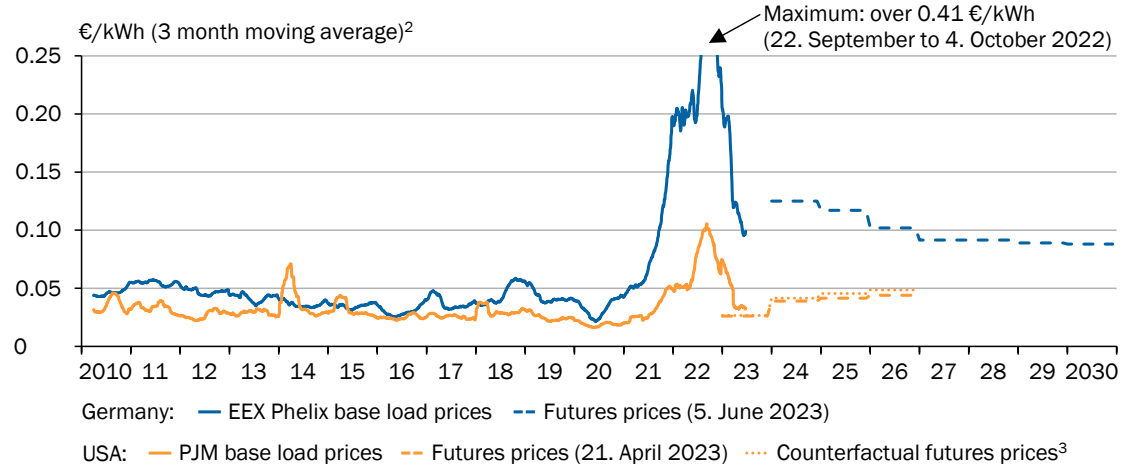
↘ CHART 2

An energy price differential between two countries of 10 % would be associated with 0.2 % higher imports, from the country with low energy prices to the country with higher energy prices (Sato and Dechezleprêtre, 2015). An increase in the electricity price differential between the U.S. and the EU of just under 15 % could therefore be associated with an increase in imports from the U.S. of less than 0.3 %, as the electricity share of the average energy mix is well below 100 % (in Germany, for example, between 35 % and 65 % (GCEE Annual Report 2022 item 316)). This is likely to affect energy-intensive goods in particular. A similarly small effect is found by Wolverton et al. (2022). This study shows that the production of U.S. industry falls by 0.8 % if the price of electricity rises by 10 %.

There have also been major changes in the energy cost differential between the U.S. and other countries in the past. For example, the extensive expansion of shale gas production in the U.S. has resulted in the price of natural gas (TTF) in Europe being almost 140 % higher than the price of natural gas (Henry Hub) in the U.S. between 2006 and 2015, while it was almost 4 % lower between 1995 and 2005 (IMF, 2023). The impact of the expansion of shale gas production can therefore provide evidence to estimate the economic consequences of an IRA-induced electricity price reduction in the U.S. For example, Melick (2014) shows that manufacturing output and employment in the U.S. increased by only 2 to 3 % compared to Europe, despite the price benefits from shale gas extraction. Depending on

↘ CHART 2

Expected electricity price differences between the USA and Germany[1]



1 – The chart shows the development of exchange electricity prices for the USA and Germany between 2010 and June 2023 as well as the expected future electricity prices expressed by futures prices of different trading days. In addition, the chart shows the counterfactual expected electricity prices for the USA without taking the IRA (Inflation Reduction Act) into account. For this purpose, the difference in electricity prices in the USA projected by Roy et al. (2022) was added to the futures prices. 2 – For the USA prices in US dollar/kWh converted into €/kWh. For the conversion of futures prices, the last available daily rate is used. 3 – Projection by Roy et al. (2022), without taking the IRA into account.

Sources: EEX, EZB, PJM, Refinitiv Datastream, Roy et al. (2022), own calculations

the estimate the IRA is equivalent to between a quarter and two-thirds of the accumulated cost savings from the expansion of shale gas production, which accumulated to about 1,400 billion US dollars between 2008 and 2017. Against this background, the energy cost reduction from the IRA is likely to have rather little impact on U.S. production and on production relocations to the U.S. In contrast, the already existing electricity price differences between the U.S. and Germany could have a greater impact.

Not least, the share of energy costs in the turnover of companies in the manufacturing sector in Germany is only 2.3 % on average (for the period of 2016 to 2018). However, there are considerable differences between companies and economic sectors. For the median company, the share of energy costs in turnover is only 1.6 %, for many companies even less than 1 % (GCEE Annual Report 2022 items 318 ff.). Only a small number of very energy-intensive companies are likely to revise their investment decisions solely as a result of the IRA-induced reduction in electricity prices in the U.S. At the same time, there is evidence that companies can adapt well to changing electricity prices by reducing energy consumption without changing labour demand or their competitive position (von Graevenitz and Rottner, 2022; von Graevenitz et al., 2023).

Individual industries could be more affected by the IRA

In addition to the reduction of relative energy prices in the U.S., direct production subsidies for low-emission technologies and purchase premiums for low-emission products will have an impact on global value chains and individual industries in European economies. For example, the IRA will stimulate demand for European high technology in the production of low-emission energy sources. For example, German manufacturers are technological leaders in the production of efficient electrolysers (OECD, 2023), a technology that will be increasingly in demand in the U.S. for the production of green hydrogen that is promoted by the IRA (NWR, 2022).

The hydrogen industry is a so-called infant industry, where there is considerable uncertainty about future market structures and international competitive positions. At the moment, both the hydrogen-producing and -using industries are in an early development phase. In the U.S., the IRA is likely to lead to learning effects and efficiency gains along the entire value chain. However, it is difficult to assess whether these learning effects will lead to substantial competitive advantages for the U.S. over Europe in the long term. Finally, certain spillover effects could also occur in Europe after the adjustment of global value chains. It is unclear how quickly international knowledge transfers of the potential learning effects will occur. Different generations of semiconductors have been found to have different degrees of learning effects and knowledge transfers, both within companies and internationally to other companies (Irwin and Klenow, 1994; Gruber, 1998).

Hydrogen production tax credits in the U.S. are up to 3 US dollars per kg of hydrogen produced over a ten-year period, or alternatively up to 30 % of investment costs on a one-off basis (The White House, 2023)[7]. It is estimated that production subsidies reduce the costs of producing green hydrogen in the U.S. from over 4 US dollars to between 0.9 US dollars and 1.2 US dollars per kg in the short term, compared to around €4 (4.4 US dollars) in Europe (NWR, 2022). With this cost advantage, the price of green hydrogen in the U.S. is roughly on par with the price of conventional fossil hydrogen. However, given the currently still high transport costs and the expected demand for green hydrogen in the U.S., it is relatively unlikely that large quantities of subsidised green hydrogen will be imported from the U.S. to Europe in the coming years.[8]

Low green hydrogen costs are likely to accelerate the adoption of low-emission production technologies in the U.S., for example in steel or ammonia

[7] The subsidy is differentiated according to the CO_2 emissions of hydrogen production over the entire life cycle and, assuming that the requirements for labour standards and training places are met, amounts to 60 ct per kg for hydrogen with a CO_2 footprint between 4 and 2.5 kg CO_2 per kg hydrogen, 75 ct per kg for a CO_2 footprint between 2.5 and 1.5 kg, 1 US dollars for a CO_2 footprint between 1.5 and 0.45 kg, and 3 US dollars for a CO_2 footprint of less than 0.45 kg (Internal Revenue Code Title 26 Section 45V). An analogous gradation is applied to investment cost subsidies.

[8] The transport costs of hydrogen from the US (Texas) to Europe (Portugal) are currently 2.1 to 2.7 US dollars per kg (IEA, 2022a), assuming the shortest distance (7,500 km linear distance).

production. Low-emission production in these industries will be cheaper than in Europe, which could lead to import substitution. This effect will be more significant in industries where green hydrogen accounts for a larger share of total costs, such as ammonia production (Egerer et al., 2023b). In steel production, where the capital costs for the assets to produce iron by direct reduction and steel by electric arc furnaces account for a large share of total costs (Egerer et al., 2023a), import substitution might be less relevant.

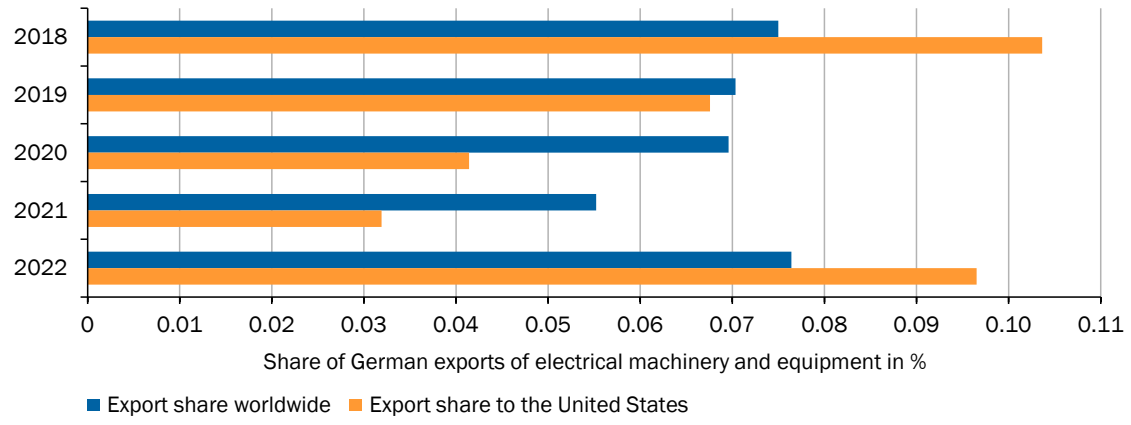
The substantial subsidy for green hydrogen is likely to be an incentive to build large capacities for its production in the U.S. Accordingly, the demand for electrolysers to produce green hydrogen in the U.S. is expected to increase. In December 2022, the National Hydrogen Council expected that, assuming a two-thirds share of green hydrogen in U.S. hydrogen demand, the electrolysis capacity required there in 2030 would be around 78 GW for the production of green hydrogen (NWR, 2022). This compares to just over 10 GW of capacity that is estimated to have been built in the U.S. by 2030 without the IRA (IEA, 2022b). In comparison, projects with a capacity of 40 GW are planned in Europe by 2030 and the EU's targets envisage an expansion to a total of 95 GW by 2030. Accordingly, demand in the EU is likely to be similar to that in the U.S.

However, the increased demand for electrolysers should not lead to supply bottlenecks in Europe. According to IEA calculations from the third quarter of 2022, the global supply capacity of electrolysers in 2023 is around 21.5 GW. However, it is expected to grow strongly in the coming years. Total production capacity by 2030 is expected to be 374.1 GW (IEA, 2022b). Accordingly, about one-fifth of the electrolyser production expected between 2023 and 2030 would be needed to meet estimated U.S. demand. However, prior to the IRA, overcapacity of electrolyser production compared to announced green hydrogen projects was expected to exceed 100 GW by 2030 (IEA, 2022b). The additional demand from the U.S. is less than this overcapacity. In addition, increased demand due to IRA subsidies is expected to drive up the price of electrolysers, which in turn increases the supply of electrolysers. Through these market mechanisms, the above estimates of electrolyser supply are likely to represent a lower bound on the amount produced during this period. However, whether an expansion of electrolyser production will actually occur depends largely on the availability of critical materials such as iridium (IEA, 2022a).

The countries of origin of electrolysers with the largest market shares in 2022 were China and Europe with 55 % and 30 % respectively, while North America accounted for just under 12 % (IEA, 2022b). For German manufacturers such as ThyssenKrupp and Siemens Energy, the expansion of demand in the U.S. will increase export potential. The U.S. is already a significant sales market for German exports. ↘ CHART 3 As investment support for hydrogen

↘ CHART 3

Share of electroplating, electrolysis and electrophoresis machines[1] in German electrical engineering[2] exports



1 – According to the Harmonised System (HS). Machines and apparatus for electroplating, electrolysis or electrophoresis.
2 – Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles.

Sources: International Trade Centre, own calculations

production facilities is subject to the domestic content provisions of the IRA, incentives may arise for German manufacturers to produce electrolysers in the U.S.[9] This, together with the growing demand and thus increasing market size, should lead to production capacities for electrolysers being built in the U.S. However, strong negative effects on the expansion of electrolyser production in Europe are not to be expected, as the local market is also sizeable and European companies are market leaders in this field.

Other industries could also shift investment activities to the U.S. in the medium term. The U.S. is already an attractive production location due to its large sales market. By lowering costs and increasing demand, the IRA further increases the attractiveness of the U.S. as a production location for foreign companies. Tesla, for example, is scaling back its plans to expand battery production in Germany, and the battery manufacturer Northvolt from Sweden has also stopped building a factory in Germany for the time being (Greive et al., 2023). At the same time, Volkswagen is planning to expand existing production capacities in the U.S., especially for battery production (Volkswagen Group, 2023). ↘ BOX 1 There could also be a potential lack of capital formation in Europe in power generation, aviation and metal processing (Aurubis, 2022; White et al., 2022). However, it is unclear to what extent these are bandwagon effects on investment decisions that have already been made and would have been made even without the IRA subsidies. Companies with limited capital formation could reduce their investment activity in Europe as a result of higher capital formation in the U.S. For example, there is empirical evidence from the U.S. that financially-constrained companies that gain new investment opportunities in one of their locations pull capital and labour from other locations to relocate them (Giroud and Mueller, 2015). This could scarce the capital available in Europe for the green transformation in the EU.

A relocation of production facilities products needed for the green transformation to the U.S. could also lead to research and development also being relocated in the medium term. This could reduce Europe's innovative strength. For example, Fort et al. (2020) show that within companies, innovation power is much stronger in R&D locations geographically close to production sites than in R&D locations further away. However, innovations at newly established sites are mostly new applications of existing processes as well as process innovations (Gumpert et al., 2023).

↘ BOX 1

Market for electromobility expected to grow in the U.S., but also worldwide, due to the IRA

The IRA introduces tax credits for e-cars for the period from 2023 to 2032, which provide a subsidy of up to 7,500 US dollars per car for the purchase or lease of new cars (Krämer, 2023). However, the number of cars that actually qualify for the subsidy is significantly limited by other criteria such as the maximum selling price for e-cars of 55,000 US dollars (excluding SUVs and vans, which are subject to a limit of 80,000 US dollars) and a maximum household income up to which buyers receive the subsidy. In addition, there are requirements regarding the share of domestic production or production in a country with which the U.S. has a free trade agreement. These requirements will become stricter over time: the required share of battery production and critical raw materials used will increase from 50 % at present to 100 % by 2029. In addition, the vehicles must be assembled in North America (U.S. Congress, 2022).

Estimates on the use of these subsidies and on the effect of the IRA on the sales of e-cars vary considerably. Based on the Congressional Budget Office's estimate of 14.1 billion US dollars, and assuming a maximum subsidy of 7,500 US dollars, the expected average annual

[9] The investment cost subsidy for green energy production increases by up to 10 percentage points from 30 % to 40 % if domestic content requirements are met for materials used in the power plant, such as steel, but also for processed inputs, such as electrolysers (IRA Section 13102). For processed products such as electrolysers, the required domestic content of all processed products used in a project is 40 % in 2023, rising to 55 % in 2026 (IRS, 2023). The production subsidies for green hydrogen, on the other hand, do not contain any domestic content provisions for the electrolysers used (Internal Revenue Code Title 26 Section 45V).

production volume is a about 200,000 e-cars (calculation based on CBO, 2022). Bistline et al. (2023) estimate significantly higher costs of 390 billion US dollars by 2031, which corresponds to just under 5.8 million e-cars produced per year. Based on this estimate, the share of e-cars in all new cars sold would increase from about 7 % in 2022 to 44 % in 2030. Without the IRA, the authors expect an increase to 32 %. Taking into account currently implemented policy measures, including the IRA, the IEA (2023) estimates a similarly high share of just under 50 % in 2030. In contrast, in the last estimate before the IRA was announced, e-cars were only expected to account for 20 % of all new cars in the U.S. in 2030 (IEA, 2022c).

Outside the U.S., IRA funding is also expected to lead to an expansion of the global market for e-cars. For example, for 2030, both the expected share of e-cars in all new cars in Europe has been revised upwards from 40 % to just under 60 %, and the projected global sales have been revised upwards from 30 million to 40 million (IEA, 2022c, 2023). Europe, with 10.5 million e-cars sold in 2030, would continue to be a larger sales market than the U.S. with 8.2 million e-cars sold (IEA, 2023). Production close to the market is likely to be of even greater importance for e-cars than for cars with internal combustion engines due to higher transport costs (Klier and Rubenstein, 2022).[10] Moreover, in the automotive industry, individual markets have so far mostly been served from a single market- and model-specific production country (Head and Mayer, 2019). Therefore, while the IRA is likely to lead to an expansion in the production of production of e-cars in North America, it is unlikely to have a negative impact on production in Europe.

With 30 % to 40 % of value added, batteries are a central part of the e-car value chain (IEA, 2022c). So far, battery production is dominated by China, with about 75 % of the production of lithium-ion batteries and similarly high shares in the production of chemical components for batteries. The purchase premiums for e-cars included in the IRA exclude e-cars with batteries that contain Chinese-made components, with the aim of becoming less dependent on Chinese battery production. The requirements for the share of critical materials and batteries produced, which must come from domestic production or from countries with a free trade agreement with the U.S., also pursue the goal of becoming less dependent on China. To build up U.S. production of battery cells, the Advanced Manufacturing Production Tax Credit 45X subsidises them with 35 US dollars per kilowatt hour and battery modules with 10 US dollars per kWh (U.S. Congress, 2022). Currently available batteries with a storage capacity of 100 kWh are thus subsidised by up to 4,500 US dollars. With maximum subsidies, the production costs for batteries can drop by a third. Alternatively, companies that process critical minerals can apply for a tax credit of up to 30 % of investment under Advanced Energy Project Credit 48C when investing in equipment (U.S. Congress, 2022). This equipment subsidy, which also subsidises the construction of battery factories, is approximately 3 to 20 times higher than comparable European subsidies (R&D or commercial IPCEI or EU ETS Innovation Fund; VDMA, 2023).

Battery cell production is expected to expand rapidly in the U.S. and be sufficient to meet demand locally (Mehdi and Moerenhout, 2023). However, it is likely to be difficult to meet the requirements for the origin of critical materials. For example, the U.S. is expected to rely on imports of anode and cathode materials, which currently account for about 60 % to 70 % of battery value added, for the foreseeable future (Mehdi and Moerenhout, 2023). Trost and Dunn (2023) estimate that if raw material imports from countries with free trade agreements were expanded to the maximum, around 2.5 million batteries per year would meet the requirements of the IRA in 2027. This is likely to be less than half of what would be needed for the e-cars sold in the U.S. In a scenario with less expansion of imports, the authors expect about 1 million batteries per year. Since the majority of battery production is not likely to be subsidised, the IRA is unlikely to lead to large-scale production shifts to the U.S. Since the purchase subsidies for e-cars are also

[10] The transport costs of e-cars and batteries are higher than those of conventional combustion vehicles and engines, partly because of the greater weight and partly because of the increased safety regulations due to the greater risk of fire (Klier and Rubenstein, 2022; Mayer and Vicard, 2023).

subject to these requirements, the batteries produced with critical materials that come from countries with which the U.S. has a free trade agreement are likely to be installed in e-cars sold in the U.S. The batteries promoted accordingly are therefore not likely to be in direct competition with European batteries. However, for the battery value chain in Europe, the increase in demand for critical materials from countries with which the U.S. has a free trade agreement could be problematic. This could complicate diversification efforts by European manufacturers.

Potential courses of action

The GCEE shares the fears expressed by various parties regarding the IRA only to a limited extent. The subsidies under the IRA itself will probably have only a minor overall economic impact on the EU. For individual industries relevant to achieving the climate targets, the IRA's production and investment subsidies could increase the incentive to invest in the U.S. rather than in the EU. However, it is to be expected that the already existing significant energy price differences will have a greater impact in comparison. As a result, individual sectors of the economy could lose their current competitiveness.

Avoid subsidy race – revise subsidy system

In order to strengthen the competitiveness of European companies, additional subsidies are also being called for in the EU as a response to the IRA. However, a subsidy race would be associated with considerable welfare losses for both the U.S. and the EU and should therefore be avoided. In the EU, the steering effect intended by the IRA subsidies in the direction of low-emission technologies is already to going to be achieved in many areas with the CO_2 emissions trading scheme. A comparison of the scope of the subsidy programmes also shows that the EU already promotes low-emission technologies to a comparable extent as the U.S. with the IRA. However, the design of the support programmes in the EU could be adapted. The IRA's tax breaks are more predictable for companies than the European subsidy programmes. They are also likely to cause less bureaucracy than subsidies awarded through the application process. In the EU, existing programmes could be reviewed to see where the bureaucratic hurdles for eligible companies to claim subsidies can be reduced. Member States should coordinate their response and agree on a common approach at European level as far as possible. National subsidy programmes in response to the IRA should not lead to bidding competition between Member States. EU state aid rules should continue to ensure this.

It may also be useful to align subsidies more closely with the emission reductions achieved by the subsidised activities, for example by establishing certification – as is done in the U.S. in the case of hydrogen subsidies – on the basis of the CO_2 footprint of activities and products. This is most compatible with European emissions trading and reduces regulatory uncertainty and complexity. As many of the technologies needed for the green transformation need to be new or further developed, policy should increasingly promote innovation in this area (GCEE Annual Report 2020 items 436 ff.). In addition, for example, the special regulation for research funding for small and medium-sized companies set out in Article 25 of the EU's General Block Exemption Regulation (GBER) could be used in the context of the German research allowance (GCEE Annual Report 2020 item 588).

Expand energy supply in order to reduce energy price difference

Since energy price differences are likely to have a much stronger impact on Europe's attractiveness as a business location than the IRA itself, efforts should be made to reduce energy prices in Europe. To this end, the energy supply should be increased by accelerating the expansion of renewable energies. (GCEE Annual Report 2022 item 336). In Germany, the construction of hydrogen-capable gas power plants is necessary in the near future (Federal Government, 2023; EWK, 2023). Similarly, the electricity and hydrogen infrastructure should be expanded promptly and the necessary quantities of hydrogen procured in order to be able to operate gas-fired power plants in a climate-neutral manner by 2035 at the latest (GCEE Annual Report 2022

items 340 and 519 f.). Flexibilities and storage capacities in the electricity system should also be increased and the expansion of the distribution grids should be driven forward at the greatest possible pace (EWK, 2023; GCEE Annual Report 2022 box 17). Stronger incentives to make electricity demand and supply more flexible and to expand electricity supply in regions with high electricity demand could reduce the overall costs of the electricity system. To this end, a reform of the structure of grid charges or the strengthening of regionally differentiated price signals, for example by dividing the market area into price zones, could be helpful (EWK, 2023). In order to reduce regulatory uncertainty and thus increase planning certainty, it is important to bring about timely decisions within the framework of the "Climate Neutral Electricity System Platform". Further options for action at national level would be, for example, to expand the areas available for renewable energies or to improve planning law (GCEE Annual Report 2022 items 338 ff.). In addition, the electricity tax could be reduced to the European minimum (GCEE Annual Report 2020 items 382 ff.).

At the European level, the measures envisaged in the EU Green Industrial Deal to simplify and accelerate planning procedures should contribute to accelerating the expansion of generation and transmission infrastructure (European Commission, 2023d). In addition, it is necessary to strengthen the cooperation of the member states in the Europe-wide expansion of energy infrastructure. This would reduce the overall costs of the European energy system (GCEE Annual Report 2022 items 529 ff.). Joint European procurement of (renewable) energy imports can also have a cost-reducing effect due to the EU's greater negotiation power and economies of scale (Bauer et al., 2023; GCEE Annual Report 2022 items 288 and 518).

Secure raw material supplies – strengthen trade agreements

The accelerated expansion of renewable energies and the expansion of e-car production in the wake of the IRA are likely to further tighten the availability of critical raw materials in the short term. At the same time, the strict domestic content requirements for critical raw materials are likely to provide significant incentives for the expansion of North American raw material production. This could create new opportunities for diversification of European raw material supplies. However, it is important to prevent a deepening of the dependency on China for critical raw materials due to the IRA if U.S.-based companies sharply increase their demand for raw materials from other sourcing countries. To this end, it could be helpful to deepen cooperation within the framework of the Minerals Security Partnership, an initiative to which the U.S., the European Commission and other developed economies belong (GCEE Annual Report 2022 box 23). At the same time, incentives to build domestic capacity for raw material extraction and recycling should be strengthened, for instance in the framework of the EU Critical Raw Material Act (GCEE Annual Report 2022 items 524 ff.). Finally, the supply of raw materials should be improved through new agreements with raw material producing countries (GCEE Annual Report 2022 items 514 ff.).

In addition, the EU should seek ratification of trade agreements that have already been negotiated (Mercosur) and move forward swiftly with ongoing negotiations (GCEE Annual Report 2022 items 511 ff.). This makes particular sense in light of the fact that current trading partners of the U.S. are also likely to experience a decline in exports to the U.S. due to domestic content provisions. At the same time, a resumption of negotiations on a free trade agreement with the U.S. should be sought, even if a conclusion of these negotiations will only have an effect in the longer term.

References

Aurubis (2022), Aurubis decides on € 530 million investment package to accelerate growth and sustainability, press release, Hamburg, 20 December.

Bae, S. (2009), The responses of manufacturing businesses to geographical differences in electricity prices, Annals of Regional Science 43, 453-472.

Barteková, E. and T.H.W. Ziesemer (2019), The impact of electricity prices on foreign direct investment: Evidence from the European Union, Applied Economics 51 (11), 1183-1198.

Bauer, F. et al. (2023), The market ramp-up of renewable hydrogen and its derivatives - the role of H2Global, FAU, eex, OTH and H2Global Policy Paper, Friedrich-Alexander-Universität Erlangen-Nürnberg, European Energy Exchange AG, Ostbayerische Technische Hochschule and H2Global, Nürnberg, Leipzig, Regensburg and Hamburg.

Bistline, J., N. Mehrotra and C. Wolfram (2023), Economic implications of the climate provisions of the Inflation Reduction Act, NBER Working Paper 31267, National Bureau of Economic Research, Cambridge, MA.

Federal Government (2023), Gaskraftwerke in Deutschland, Antwort der Federal Government auf die Kleine Anfrage der Fraktion der CDU/CSU, Drucksache 20/5400, Deutscher Bundestag, Berlin, 25 January.

CBO (2022), Estimated budgetary effects of public law 117-169, to provide for reconciliation pursuant to title II of S. Con. Res. 14, Cost Estimate September 7, 2022, Congressional Budget Office, Washington, DC.

Credit Suisse (2022), Treeprint: US Inflation Reduction Act, ESG Report, Zurich.

Egerer, J., N. Farhang-Damghani, V. Grimm and P. Runge (2023a), The industry transformation from fossil fuels to hydrogen will reorganize value chains: Big picture and case studies for Germany, SSRN Scholarly Paper 4390325, Social Science Research Network, Rochester, NY.

Egerer, J., V. Grimm, K. Niazmand and P. Runge (2023b), The economics of global green ammonia trade - "Shipping Australian wind and sunshine to Germany", Applied Energy 334, 120662.

EIA (2023), AEO2023 Issues in focus: Inflation Reduction Act cases in the AEO2023, U.S. Energy Information Administration, Washington, DC.

European Commission (2023a), Recovery and Resilience Scoreboard, https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/index.html?lang=en, accessed 14.4.2023.

European Commission (2023b), Innovation fund projects, https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund/innovation-fund-projects_en, accessed 24.6.2023.

European Commission (2023c), Important Projects of Common European Interest (IPCEI), https://competition-policy.ec.europa.eu/state-aid/legislation/modernisation/ipcei_en, accessed 24.6.2023.

European Commission (2023d), Communication: A Green Deal industrial plan for the net-zero age, COM(2023) 62 final, Brussels.

EWK (2023), Stellungnahme zum Strommarktdesign und dessen Weiterentwicklungsmöglichkeiten, February 2023, A. Löschel, V. Grimm, F.C. Matthes and A. Weidlich, Expertenkommission zum Monitoring-Prozess "Energie der Zukunft", Berlin, Bochum, Freiburg, Nürnberg.

Fort, T.C., W. Keller, P.K. Schott, S. Yeaple and N. Zolas (2020), Colocation of production and innovation: Evidence from the United States, Working Paper.

Giroud, X. and H.M. Mueller (2015), Capital and labour reallocation within firms, Journal of Finance 70 (4), 1767-1804.

von Graevenitz, K. and E. Rottner (2022), Do manufacturing plants respond to exogenous changes in electricity prices? Evidence from administrative micro-data, ZEW Discussion Paper 22-038, Leibniz Centre for European Economic Research, Mannheim.

von Graevenitz, K., E. Rottner and A. Gerster (2023), Bridge electricity price: Continuing past mistakes?, ZEW policy brief 06, Leibniz Centre for European Economic Research, Mannheim.

Greive, M., M. Koch, A. Meiritz, J. Olk and C. Volkery (2023), Subsidy programme: USA makes first concessions in battery dispute - Scholz arrived in Washington for talks, https://www.handelsblatt.com/politik/in-

ternational/subventionsprogramm-usa-machen-erste-zugestaendnisse-im-batterie-streit-scholz-zu-gespraechen-in-washington-eingetroffen/29014704.html, retrieved 3.3.2023.

Gruber, H. (1998), Learning by doing and spillovers: Further evidence for the semiconductor industry, Review of Industrial Organization 13 (6), 697-711.

Gumpert, A., K. Manova, C. Rujan and M. Schnitzer (2023), Multinational firms and global innovation, mimeo.

Head, K. and T. Mayer (2019), Brands in motion: How frictions shape multinational production, American Economic Review 109 (9), 3073-3124.

Holzhausen, A. (2023), A Faustian bargain: Europe's answers to the US IRA, Special Report 07 February 2023, Allianz Research, Munich.

IEA (2023), Global EV Outlook 2023, International Energy Agency, Paris.

IEA (2022a), Global Hydrogen Review 2022, International Energy Agency, Paris.

IEA (2022b), Electrolysers: Analysis, https://www.iea.org/reports/electrolysers, retrieved 8.5.2023.

IEA (2022c), Global EV Outlook 2022: Securing supplies for an electric future, International Energy Agency, Paris.

IRS (2023), Domestic content bonus credit guidance under Sections 45, 45Y, 48, and 48E, Notice 2023-38, Internal Revenue Service, Washington, DC.

Irwin, D.A. and P.J. Klenow (1994), Learning-by-doing spillovers in the semiconductor industry, Journal of Political Economy 102 (6), 1200-1227.

IMF (2023), Primary Commodity Prices Database (PCPS), https://www.imf.org/en/Research/commodity-prices, accessed 12.6.2023.

Kleimann, D. et al. (2023), How Europe should answer the US Inflation Reduction Act, Policy Contribution 04/23, Bruegel, Brussels.

Klier, T.H. and J.M. Rubenstein (2022), North America's rapidly growing electric vehicle market: Implications for the geography of automotive production, Economic Perspectives 5 / 2022, Federal Reserve Bank of Chicago.

Krämer, M. (2023), Europe competing for the green transformation, Audit Committee Quarterly I/2023, 82-83.

Leggett, J.A. and J.L. Ramseur (2022), Inflation Reduction Act of 2022 (IRA): Provisions related to climate change, CSR Report R47262, Congressional Research Service, Washington, DC.

von der Leyen, U. (2022), Speech by the President: College of Europe in Bruges, Speech, College of Europe, Bruges, 4 December.

Mayer, T. and V. Vicard (2023), L'Inflation reduction act américain : un danger pour la production automobile hexagonale ?, http://www.cepii.fr/BLOG/bi/post.asp?IDcommunique=977, retrieved 3.5.2023.

Mehdi, A. and T. Moerenhout (2023), The IRA and the US battery supply chain: Background and key drivers, Commentary June 8, 2023, Center on Global Energy Policy at Columbia University, New York, NY.

Melick, W.R. (2014), The energy boom and manufacturing in the United States, FRB International Finance Discussion Paper 1108, Board of Governors of the Federal Reserve System, Washington, DC.

NWR (2022), Assessment on the Inflation Reduction Act, Statement, National Hydrogen Council, Berlin.

OECD (2023), OECD Economic Reports: Germany 2023, OECD Publishing, Organisation for Economic Co-operation and Development, Paris.

Roy, N., D. Burtraw and K. Rennert (2022), Retail electricity rates under the Inflation Reduction Act of 2022, RFF Issue Brief 22-07, Resources for the Future.

Sato, M. and A. Dechezleprêtre (2015), Asymmetric industrial energy prices and international trade, Energy Economics 52, S130-S141.

The White House (2023), Inflation Reduction Act Guidebook: Building a Clean Energy Economy, Version 2, January 2023, Washington, DC.

The White House (2022), By the numbers: The Inflation Reduction Act, https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/15/by-the-numbers-the-inflation-reduction-act/, retrieved 24.6.2023.

Trost, J.N. and J.B. Dunn (2023), Assessing the feasibility of the Inflation Reduction Act's EV critical mineral targets, Nature Sustainability, 1-5.

U.S. Congress (2022), Inflation Reduction Act of 2022, H.R.5376, 16 August.

VDMA (2023), EU-Reaktion auf den Inflation Reduction Act im Bereich der Klima-Transformationstechnologien, Discussion Paper February 2023, VDMA Competence Center Klima&Energie, Frankfurt am Main.

Volkswagen Group (2023), Volkswagen Group strengthens activities in North America: Canada becomes location for first gigafactory of battery subsidiary PowerCo SE outside Europe, press release, Wolfsburg/ Salzgitter, 13 March.

White, S., G. Chazan, R. Milne, A. Bounds and S. Fleming (2022), European industry pivots to US as Biden subsidy sends 'dangerous signal', https://www.ft.com/content/59a8d135-3477-4d0a-8d12-20c7ef94be07, accessed 27.3.2023.

Wolverton, A., R. Shadbegian and W. Gray (2022), The U.S. manufacturing sector's response to higher electricity prices: Evidence from state-level renewable portfolio standards, NBER Working Paper 30502, National Bureau of Economic Research, Cambridge, MA.

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