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Green tech race? The US Inflation Reduction Act and the EU Net Zero Industry Act

David Kleimann | Niclas Poitiers | André Sapir | Simone Tagliapietra | Nicolas Véron | Reinhilde Veugelers | Jeromin Zettelmeyer

Bruegel, Brussels, Belgium

Correspondence
Jeromin Zettelmeyer, Bruegel, Brussels, Belgium.
Email: jeromin.zettelmeyer@bruegel.org

Abstract

The 2022 United States Inflation Reduction Act (IRA) is a significant and welcome climate law. It also includes trade-distortive subsidies, including local-content requirements prohibited under World Trade Organisation rules – the first time the US has done this and a blow to the international trading system that could trigger protectionism in other countries. The expected IRA green subsidies are of similar size to those available in the European Union, except in renewable energy production, where EU subsidies remain larger. However, there are important qualitative differences. In this article, we conduct a quantitative and qualitative comparison of the IRA with its preexisting European counterparts. We identify three main differences: European subsidies are less discriminatory, more focused on innovation rather than deployment and more fragmented than the IRA. Some IRA subsidies discriminate against foreign producers while EU subsidies do not. IRA clean-tech subsidies are simpler, longer-term and less fragmented, and they focus mainly on mass deployment of green technologies rather than innovation. We then examine the proposed EU reaction to IRA, the Net Zero Industry Act and discuss how it should be improved by the EU co-legislators (the European Parliament and the EU Council) so as to become a useful building block towards a more comprehensive EU green industrial policy.

KEYWORDS
clean technology, green subsidies, industrial policy, Inflation Reduction Act, Net Zero Industry Act, trade policy

1 | INTRODUCTION

The 2022 United States Inflation Reduction Act (IRA), a legislative package combining large-scale green subsidies with healthcare savings and new revenue measures, is a milestone in US climate policy. While less effective than combining green subsidies with carbon pricing (Roy et al., 2021), the IRA is expected to close two-thirds of the greenhouse-gas emissions gap between current policy and the US 2030 climate target. By driving down the cost of developing and deploying clean energy, the IRA would also make it easier to close the remaining gap (Jenkins et al., 2022).

However, the IRA contains protectionist elements. These include subsidies conditional on local-content requirements (LCRs) that are prohibited under World Trade Organisation rules. This is a further blow to the international trading system, both because its signals the willingness of the US to disregard WTO rules, and because it may trigger protectionist responses in other countries. The IRA also includes large-scale manufacturing subsidies that are likely to be market- and trade-distortive. These have exacerbated European Union fears that clean-tech manufacturers and adopters will shift their production to the US, in search of an attractive mix of subsidies and low energy costs. The magnitude of this effects is very uncertain, however. The IRA will induce substitution away from Chinese inputs, which may make the EU and other economies more competitive relative to China (Kleimann et al., 2023). Furthermore, increasing trade costs associated with geographical distance favours production in Europe, where the demand for clean tech products will remain high (Springford & Tordoir, 2023).

This article explains what is in the IRA, how it compares to preexisting EU green industrial policies, how the EU is proposing to react to it, and how it should react to it. Our analysis leads to two main conclusions.

First, EU and expected IRA green subsidies are of about similar size, except in renewable energy production, where EU subsidies remain larger. However, there are significant qualitative differences. European subsidies are less discriminatory, more focused on innovation rather than deployment, and more fragmented than the IRA. The also focuses mainly on mass deployment of green technologies, whereas EU-level support tends to be more focused on innovation and new technologies.

Second, the EU's policy response should focus on single market deepening, on building a more coherent, better governed industrial policy at the EU level, and on trade reform. This requires re-calibrating and enhancing the proposed Net Zero Industry Act (NZIA), which is currently undergoing parliamentary review. With respect to trade policy, the EU should refrain from imposing local content requirements of its own, seek reform of the WTO subsidies regime, and seek understandings with its main trading partners that would limit an international subsidies race.

2 | THE INFLATION REDUCTION ACT AND EU GREEN SUBSIDIES

This section provides a brief description of the US IRA and a comparison with EU green subsides.

2.1 | Unpacking the IRA

The IRA consists of three sets of measures: a tax reform, a healthcare reform, and energy and climate legislation, including climate-related spending in the order of $400 billion over 10 years.[1]

The measures most relevant to the IRA's international impact are energy and climate subsidies.[2] These fall into three categories, and some subsidies can be cumulated[3]:

1. Subsidies for vehicle purchases, including a $7500 consumer tax credit for electric cars and a tax credit for companies, including leasing companies, that buy clean vehicles.
2. Production and investment subsidies for manufacturers of clean-tech products, including batteries and components used in renewable electricity generation.
3. Subsidies for producers of carbon-neutral electricity, as well as hydrogen and other 'clean' fuels.

Several, but not all, of these subsidies are conditional on content produced in the US and/or North America (LCRs):

- The $7500 consumer tax credit applies only to electric cars with 'final assembly' in North America (the US, Canada or Mexico). In addition, half of the tax credit is linked to the origin of batteries and the other half to that of raw materials used in the electric cars. To obtain either half, a minimum share of the value of battery components (presently 50%) or critical minerals (presently 40%) needs to come from the US or countries with which the US has a free trade agreement (presently 20 countries).[4] These thresholds will increase by about 10 percentage points per year. In addition, from 2024 and 2025, any use of batteries and critical minerals from China, Russia, Iran and North Korea will make a vehicle ineligible for the tax credit.
- Renewable energy producers are eligible for a 'bonus' subsidy linked to LCRs. If the steel and iron used in an energy production facility is 100% US-produced and manufactured products meet a minimum local-content share, the subsidy increases by 10%, with the required local-content share rising over time.[5] A similar bonus scheme conditional on local-content shares applies to investment subsidies for energy producers.

There are no LCRs for subsidies for commercial electric vehicles, used electric vehicles or clean-tech production and investment (other than that these need to take place in the US).

[1]See Committee for a Responsible Federal Budget, 'CBO Scores IRA with $238 Billion of Deficit Reduction', 7 September 2022, https://www.crfb.org/blogs/cbo-scores-ira-238-billion-deficit-reduction.

[2]Other green spending includes support for increased efficiency for buildings and industries (estimated at $20 billion), $20 billion for competitive grants to support greenhouse gas reduction projects, and $3.2 billion for carbon sequestration.

[3]For example, an electric vehicle using a US-produced 75 kWh battery pack manufactured using US-sourced critical materials could benefit from the 10% production cost tax credit for these materials, a $3375 battery production subsidy, and the electric vehicle consumer tax credit of $7500. In contrast, clean-tech investment and production tax credits cannot be combined.

[4]See https://ustr.gov/trade-agreements/free-trade-agreements.

[5]For offshore wind, 20% in 2025, rising to 55% in 2028. For all other renewable energy production facilities, 40% in 2025, rising to 55% in 2027.

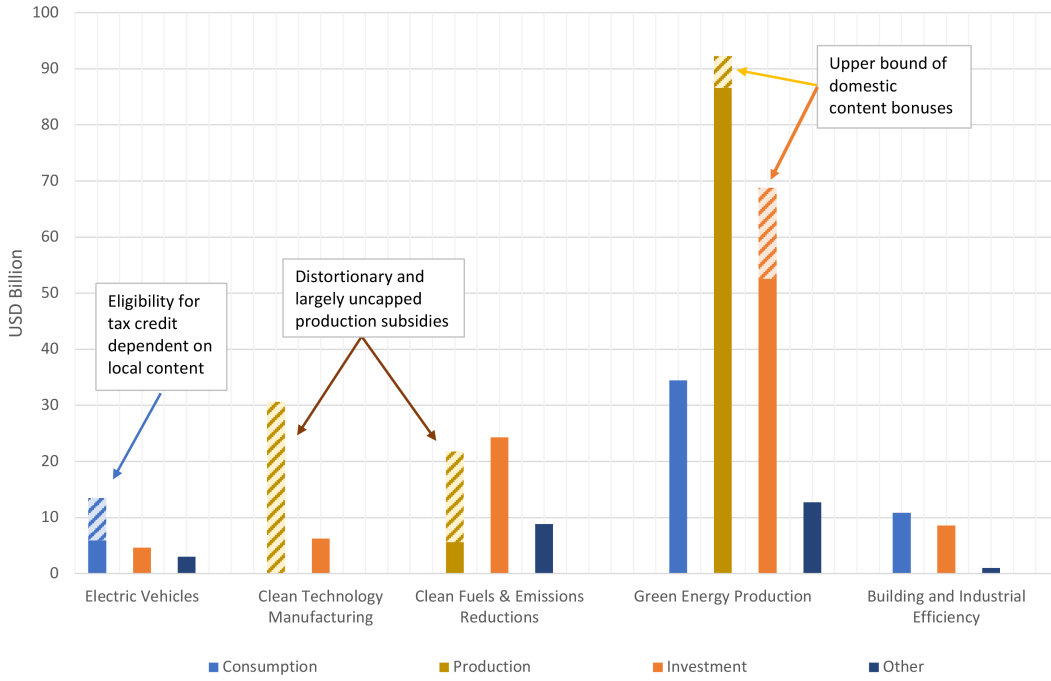

FIGURE 1 Breakdown of IRA subsidies. *Note*: The shaded area signifies spending on provisions that are trade distortive. This includes prohibited local content requirements for the consumer electric vehicle tax credit, the domestic content bonus in the green energy production subsidies, and production subsidies for clean-tech manufacturing and clean fuel that are actionable under WTO rules. For the domestic content bonus, the shaded area represents how much would be spent on domestic content bonuses if all relevant projects qualified for them. *Source*: Authors' elaboration based on CBO (2022). [Colour figure can be viewed at wileyonlinelibrary.com]

Figure 1 shows total values of IRA subsidies broken down into subsidies targeting consumption, production or investment, and indicating whether subsidies are likely to be trade distortive (throughout this section, for IRA subsidy values, we use US Congressional Budget Office estimates; CBO, 2022). Trade-distortive subsidies include subsidies with LCRs (or bonuses) and subsidies that do not contain LCRs but are 'actionable' under WTO rules. Trade distortive subsidies include the consumer electric car tax credit conditional on LCRs ($7.5 billion), most spending on clean-tech manufacturing support ($32 billion of the total $37 billion), the bulk of the clean-fuel and emissions-reduction subsidies ($16 billion), and the share of subsidies for green-energy production and investment expected to include local content bonuses. The latter could be anywhere between zero (if no producer meets the qualification criteria for the local content bonus) and $21.96 billion (if all producers meet the qualification criteria).[6]

These estimates need to be treated cautiously, as most measures are not capped in overall volume or value terms, and hence depend on uptake assumptions. If the uptake of uncapped

[6]The CBO (2022) estimates that for green energy production and investment subsidy that include domestic content, bonuses are $62.3 billion and $64.8 billion, respectively. This can be written as 56.6 + 56.6/10 for a 10% production domestic content bonus and 48.6 + 48.6/3 for the 10 percentage point investment domestic content bonus.

subsidies – such as the clean-tech manufacturing tax credit – is higher than expected, the subsidy volumes could be much higher than current estimates.[7]

2.2 | Unpacking EU green subsidies

While the EU has no flagship green subsidy scheme comparable to the IRA, it has a multitude of initiatives at EU and national levels that use subsidies for broadly similar purposes. This fragmentation makes it difficult to assess how much public support (both national and EU-level) is provided every year to clean tech manufacturing and deployment.

In the following, we make an attempt to identify the EU counterparts to the three green subsidy categories of the IRA. Table 1 provides a summary.

Electric vehicles. Almost every EU country has been subsidising the purchase of electric vehicles. Incentives differ widely from country to country, both in form (e.g. tax benefits or purchase subsidies) and value. In 2022, purchasing subsidies ranged between €10,000 in Cyprus to €1250 in Czechia. Across the entire EU, these subsidies added up to almost €6 billion and averaged around €6000 per vehicle. Unlike the support provided by the IRA, these EU purchasing incentives typically do not discriminate between different producers.

Support for clean tech manufacturing is channelled through several instruments and facilities. First, EU countries have access to loans and grants to support green investments under the Recovery and Resilience Facility (RRF), including for the decarbonisation of industry and strengthening clean-tech supply chains. Second, IPCEIs support major cross-border innovation and infrastructure projects. To date, the European Commission has approved two IPCEIs related to batteries (€3.2 billion for the period 2019–2031 and €2.9 billion for the period 2021–2028) and two related to hydrogen (€5.4 billion and €5.2 billion, respectively, for 2022–2036), partly covered by funds from the RRF. Third, the EU Innovation Fund established under the EU emissions trading system supports the demonstration and early deployment of clean technologies and processes in energy-intensive industries. In its first call in 2022, the Fund awarded grants amounting to around €1 billion. A hydrogen-specific pilot auction worth €800 million will take place in June 2023 (European Commission, 2023). Fourth, under Horizon Europe, the European Innovation Council (EIC) has a deployment leg called EIC Accelerator, which aims at scaling-up breakthrough technologies, including green tech. Fifth, the European Investment Bank (EIB) allocated around €17.5 billion in loans to the transport and industrial sectors in 2022; we estimate that approximately €3.3 billion was targeted at clean-technology projects. The EIB is also responsible for the implementation of around 75% of the EU guarantees allocated to the InvestEU programme. It is important to note that this discussion does not include *state aid*, the largest subsidy category (green and not) in the EU by far. The Treaty on the Functioning of the European Union prohibits state aid but allows exceptions, including for IPCEIs, 'to remedy a serious disturbance in the economy of a Member State', and 'to facilitate the development of certain economic activities or of certain economic areas, where such aid does not adversely affect trading conditions to an extent contrary to the common interest' (Article 107(3)). It is not possible to precisely identify the volume of non-IPCEI state aid for clean-tech manufacturing based on European Commission data; however, this is unlikely to be very large compared to the IPCEIs and particularly compared to renewable energy subsidies.

[7]For this reason, Credit Suisse (2022) estimated that the budgetary costs of the IRA could be three times higher than projected by the CBO (2022). The discrepancy is particularly large for manufacturing tax credits, which Credit Suisse projects at $250 billion instead of $37 billion. This is based on the assumption that the subsidies will make US producers cost competitive in the manufacturing of wind and solar power equipment, capturing 90% of the respective domestic US markets by 2030.

TABLE 1 Examples of annual support to green tech manufacturing and deployment in EU.

Source of funding	Instruments	Period	Value (€ billions)
EU and national support to clean-tech manufacturing[a]			**6.8**
NGEU - RRF[b]	Loans and grants	Per annum	0.3
IPCEIs[c]	Loans, grants, guarantees, tax advantages	Per annum	1.3
EIB[d]	Loans	2022	3.3
EU Innovation Council[e]	Grants and equity	2022	0.7
EU Innovation Fund[f]	Grants	2021	1.2
EU and national support for the deployment of renewable energies			**84.4**
EIB[g]	Loans	2022	4.4
National support schemes[h]	Various (mainly feed-in-tariffs)	2020	80
National incentives for electric-vehicle deployment			**€6000/car**
National support scheme	Purchase allowance[i]	2022	€6000/car on average in EU

[a]Support to clean manufacturing includes support to green hydrogen and batteries.

[b]This estimate includes the amount of loans and grants approved under the RRF for battery-related projects and divides it by the number of years of its duration (2020–2026). The large share of the funding available for projects related to hydrogen falls under the umbrella of the IPCEIs. Based on data from the Bruegel dataset on European Union countries' recovery and resilience plans.

[c]The estimate for the IPCEIs includes the overall amount of public funding granted by EU countries for four IPCEIs (two batteries- and two hydrogen-related) divided by the number of years they are expected to run. Based on data provided by European Commission.

[d]This estimate includes the overall amount of loans granted to industries and transport for projects related to batteries, hydrogen and electric vehicles in 2022. Based on data provided by the European Investment Bank.

[e]This estimate considers the amounts provided in 2022 for the EIC Accelerator. It notably includes the budget for EIC Challenge (€536 million devoted to technologies for Open Strategic Autonomy and 'Fit for 55', as well as a third of the €630 million budget allocated to open calls – this being just a working assumption.

[f]This estimate considers the value of support to small- and large-scale projects awarded in the first call for projects. Appraisals for the second call for projects are still ongoing at time of writing. Based on data provided by European Commission – European Innovation Fund.

[g]This estimate includes the value of loan disbursed for renewable energy-related projects (i.e. solar and wind) by the EIB in 2022.

[h]This estimate includes the amount of support offered by EU countries in the form of direct transfers, tax expenditure, FiT/FiP, RES quotas and others in 2020. *Source*: European Commission, Directorate-General for Energy.

[i]This estimate is the average subsidy offered for the purchase of a new battery-electric passenger car across EU countries.*Source*: Authors based on data provided by the European Automobile Manufacturers Association and government websites.

Renewable energy subsidies. In 2020, the latest year for which consolidated figures are available, subsidies given by EU members to electricity production from renewable energy sources (RES) amounted to €80 billion (0.57% of EU GDP), with Germany leading the ranking (0.94% of GDP, or €33 billion). Feed-in tariffs and feed-in premiums represented 79% of total RES subsidies in 2020, for a total of €63 billion. In terms of technology, solar energy received the largest share of subsidies (€30 billion), followed by wind (€21 billion), and biomass (€18 billion). Renewable energy is also supported by EIB loans (roughly €4.4 billion in 2020).

2.3 | Comparing the IRA and EU green subsidies

The comparison of IRA and EU green subsidies is fraught with difficulties. First, estimates for EU clean-tech manufacturing support and renewable energy subsidies are based on approved aid volumes and on the extrapolation of recent aid, while IRA estimates are based on the take-up assumptions in CBO (2022). Second, support items are missing on both the EU and the US sides. Estimates for clean-tech manufacturing support exclude national-level state aid (except for the IPCEIs). IRA figures obviously exclude state- and local-level support, and federal programmes outside the IRA. However, it can be said that IRA and EU subsidies for electric vehicle purchases and clean-tech manufacturing are of a similar size, while renewable energy subsidies would still be much higher in the EU, assuming that the EU and its members continue to subsidise at the same rate as in recent years.[8]

The main difference between the US and EU may therefore not be in the total expected volume of green subsidies (except on renewable energy, where the US is expected to continue to lag the EU), but rather on the qualitative side. First, IRA subsidies discriminate against foreign producers in a way that EU subsidies do not. Second, the IRA provides its clean-tech manufacturing support in a particularly simple way – via tax credits covering 10 years – while comparable EU support is more fragmented, generally viewed as slower and more bureaucratic, and sometimes shorter term. Third, in the clean-tech area, the IRA focuses mostly on mass deployment of current generation technologies, whereas EU level support tends to be more focused on innovation and early-stage deployment of new technologies.

3 | EUROPE'S RESPONSE TO THE IRA

3.1 | The Net Zero Industrial Act

In March 2023, the European Commission published a legislative proposal for an EU response to the IRA: the NZIA, which proposes an industrial policy to promote cleantech manufacturing organised in four steps.

[8]How robust would this comparison be to the addition of state-level support on the US side and of (non-IPCEI) state aid on the EU side? With respect to electric vehicle purchases and renewable energy subsidies, the message would be much the same. California provides state-level electric vehicle subsidies of up to $2000 to the federal subsidy, making the average US subsidy level somewhat more generous than that in the EU. Renewable energy support at the state level would also add to the US total, but the overall US level would still appear to be much smaller than that in the EU. According to a 2020 report by the International Renewable Energy Agency, total renewable energy support amounted to $6.7 billion in the US in 2017, against €78 billion in the EU (Taylor, 2020). With respect to clean-tech manufacturing, we do not know the answer. Allocating both (non-IPCEI) state aid in the EU and state-level subsidies in the US to clean manufacturing requires an extensive data effort.

First, it lists net-zero technologies considered to be 'strategic'. These include solar photovoltaic and solar thermal, onshore wind and offshore renewables, batteries and storage, heat pumps and geothermal energy, electrolysers and fuel cells, sustainable biogas and biomethane, carbon capture and storage (CCS) and grid technologies.

Second, it defines an overall benchmark target for EU domestic manufacturing in these technologies to meet at least 40% of the EU's annual deployment needs by 2030. The NZIA also proposes a target for an annual injection capacity in CO2 storage of 50 megatonnes (Mt) CO2 by 2030, to spur the development of CCS.

Third, it outlines a governance system based on the identification of Net-Zero Strategic Projects (NZSPs) by member states, with a minimal check by the European Commission. NZSPs must contribute to CO2 reductions, competitiveness and security of supply, and should involve technologies close to commercialisation.[9] This approach represents a break with what has been done so far in the EU: support focused on earlier stages of technology development, including research, early-stage development and prototyping.

Fourth, the NZIA outlines a set of policy instruments, mostly at national level, to support the selected NZIA projects:

1. Acceleration of permitting and related administrative procedures, within time limits preset by the EU, including by identifying a one-stop-shop national authority in charge of these projects.
2. Coordination of private funding. The Commission estimates that meeting the headline 40% target by 2030 will require €92 billion in investment, with the bulk (around 80%) coming from the private sector, to be facilitated by a 'Net-Zero Europe Platform fostering contacts and making use of existing industry alliances'.
3. Limited public subsidies, mainly at national level (see below). Support for NZSPs is to be prioritised in national and EU budgets. However, the NZIA proposal does not allocate new EU-level funding, and neither is such funding being allocated in parallel.[10]
4. Public procurement procedures and auctions that include 'sustainability and resilience' criteria, which can be given a weight of up to 15%–30%. At the same time, bids that include the use of equipment for more than 65% from a single non-EU country would be penalised.

The NZIA proposal also mentions other areas, including regulatory sandboxes and a skills agenda, but without implementation details. Although the Commission acknowledges skills shortages as a major constraint (an estimated shortfall of 180,000 skilled workers in hydrogen and 66,000 in solar PV in 2030, for example), the NZIA does not develop a strategy to tackle this problem, limiting itself to coordinating initiatives, such as Net Zero Industry Academies, through the Net-Zero Europe Platform.

[9]TRL (technology readiness level) classifies technologies by their stage of development. NZIA targets TRL 8 indicating technologies that have been tested and 'flight qualified' and are ready for implementation into an existing technology.

[10]An EU-level 'Sovereignty Fund', which might include clean-tech support, mentioned in speeches by Commission President Ursula von der Leyen in spring 2023, has not materialised. Instead, on 20 June, the Commission proposed a repackaging of existing EU funds under a so-called Strategic Technologies for Europe Platform (STEP), introducing a 'sovereignty seal' as an 'EU quality label for sovereignty projects' and a 'sovereignty portal' for accessing funding opportunities under STEP. See European Commission press release of 20 June 2023, https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_3347.

Since EU countries are assigned the role of main provider of public funds for NZSPs, it is important to read the NZIA in parallel with the Temporary Crisis and Transition Framework (TCTF), modified by the European Commission in early March 2023 in response to the IRA (European Commission, 2023). The TCTF outlines conditions under which the Commission will approve 'aid accelerated investments in sectors strategic for the transition towards a net-zero economy', defined as batteries, solar panels, wind turbines, heat pumps, electrolysers and carbon capture usage and storage, as well as the production and recycling of priority components and critical raw materials.[11] Specifically, EU countries are allowed to:

1. Provide more support to cleantech production located in disadvantaged regions, capped at a certain percentage of the investment costs and nominal amounts, depending on the location of the investment and the size of the beneficiary;
2. Grant higher percentages of the investment costs if the aid is provided via tax advantages, loans or guarantees. This implies that state aid is not limited to funding capital expenditures but that operating expenditures (OPEX) can also be covered, up to the identified funding gap. This approach is novel for Europe as it has been only rarely adopted previously, most notably in the case of cohesion regions;
3. Provide matching aid, that is, the amount of support the beneficiary could receive for an equivalent investment in the alternative location, or the amount needed to incentivise the company to locate the investment in the EU. This part is perhaps the clearest revision of the state-aid guidelines as a reaction to the IRA. This matching-aid option requires individual notification and must respect several safeguards: (i) investments must be in assisted areas, as defined in the applicable regional aid map or (ii) cross-border investments involving projects located in at least three countries, with a significant part of the overall investment taking place in at least two assisted areas, one of which is an 'a' area (outermost regions or regions where the GDP per capita is below or equal to 75% of the EU average). Furthermore, the beneficiary should use state-of-the-art production technology from an environmental emissions perspective. Finally, the aid cannot trigger relocation of investment between EU members.

As proposed by the European Commission, the NZIA is unlikely to achieve its aims, while likely generating unintended costs. It also falls well short of a comprehensive green industrial policy for Europe. To promote cleantech manufacturing, two steps should be taken. First, in the legislative process, the NZIA should be rebooted, to make sure that at least some specific areas of intervention are dealt with efficiently and that the risk of unintended consequences is minimised. Second, the EU needs to move beyond the scope of the NZIA and start working on the development of a broader EU green industrial policy strategy.

3.2 | How to enhance the NZIA

The European Parliament and Council of the EU should reboot the proposal and refocus its objectives, sharpening its limited instruments, improving its governance and adding financial incentives to ensure implementation.

[11]See https://competition-policy.ec.europa.eu/system/files/2023-03/overview_of_TCTF_section_2.8_schemes.pdf.

3.2.1 | Refocus the objectives.

Drop the 40% domestic manufacturing target and replace it with key performance indicators (KPIs) that capture the trend and resilience effects of cleantech investment. The success of the NZIA should be measured on the basis of whether it can mobilise the massive private investments required to meet Europe's cleantech needs, and whether these make Europe more competitive and more resilient. Such KPIs should replace the ad-hoc 40% domestic manufacturing target.

Adopt a technology-neutral approach instead of cherry-picking specific technologies, in order to include all technologies that today and in the future could contribute to reaching Europe's climate, competitiveness and resilience goals.

3.2.2 | Sharpen the instruments

Make sure the NZIA delivers on its key goal of streamlining permitting. While permitting is not necessarily the most important barrier to the development of cleantech manufacturing in Europe, it is – and will realistically remain – a useful NZIA instrument. At this point, it is important to ensure that the NZIA delivers on this item. This will not necessarily be easy, considering member states' competence in this area, but it will require stronger governance than what is currently envisaged.

Be bolder on strategic public procurement. NZIA takes a first step towards more strategic utilisation of public procurement. This is good news, as public procurement has so far been a neglected instrument in the European Green Deal toolbox (Sapir et al., 2022). However, the 10% cost-gap safeguard included in the proposal (allowing the procuring authority to choose the cheaper bid, even if it has a lower sustainability score, if the cost gap exceeds 10%) will likely make this step irrelevant. One way of making it more effective while limiting the cost for procuring authorities might could involve: (i) linking the cost-gap safeguard threshold to the sustainability and resilience score of a bid, up to some maximum (for example, for projects that do very well on sustainability and resilience it could be as high as 30%); (ii) partly subsidise, using EU funds, the difference between the costs of the winning bid (taking account of the resilience and sustainability score) and the lowest-cost bid (see discussion of financial incentives below).

3.2.3 | To ensure implementation, strengthen governance and offer financial incentives

To make sure these instruments are used effectively, the NZIA 2.0 requires both strong governance and the right financial incentives.

Strong governance is needed to address the key challenge in developing an EU green industrial policy: coordination. Alignment of different stakeholders, policy competences and instruments must be steered to achieve the stated objectives. The NZIA proposal does not tackle this central point, referring only to the establishment of a Net-Zero Europe Platform, which seems to be conceived as a forum to share best practices rather than a real steering and coordination body. NZIA 2.0 needs to ensure that the European Commission plays a meaningful coordination role, starting with closer coordination between the main relevant Commission directorates for the NZIA: internal market, competition, energy, growth and trade. Strong governance is also required to monitor and evaluate

which NZIA policy interventions work and which do not, measured against the KPI of growing private cleantech investment. This will help learn fast and adapt policymaking fast, if needed.

As the EU has limited tools to foster national action and steer coordination, it must be able to offer some incentives. Limited EU resources should be used to part-pay for projects that involve pan-European collaboration. When it comes to strategic procurement, EU funds (including the EU Innovation Fund, REPowerEU or Cohesion Funds) could be used to part-fund national public procurement of innovative clean technologies, to encourage the roll-out of clean technologies at EU scale without creating excessive costs for the government entities undertaking the procurement.

3.3 | What the EU should do beyond the NZIA

The EU needs to go beyond the NZIA in three ways. First, through single market reform that benefit both clean tech and other innovative sectors. Second, through the creation of a governance framework at the EU level, backed by adequate funding. Third, through trade policy.

3.3.1 | A deeper single market

To develop a full-fledged green industrial policy, the EU needs to leverage its greatest asset: the single market. Only a well-functioning, globally linked EU market will be able to achieve a similar scale to the domestic markets of the US and China. Fragmented national measures will not lead to private investments in cleantech ecosystems at the scale that Europe needs to become a globally competitive, resilient, cleantech powerhouse. To achieve this, the EU needs to foster and deepen its single market for goods, services, components, energy, capital, people and ideas. Without such 'horizontal' policies, targeted 'vertical' policies (including NZIA instruments such as permitting, public procurement and skills) will not deliver results at the needed scale.

Take the example of skills. This is a major bottleneck for the development of cleantech manufacturing in Europe, more than permitting. While the EU has limited competence in this field, providing the right incentives to member states could catalyse national action.

Banking union and capital markets union also require a new push. The cost of accessing finance is an important factor in firms' clean-tech investments. The EU financial system is highly bank-dominated and fragmented along national lines, which makes it ill-suited to enabling the massive investments needed for the green transition through the provision of private capital. Major policy initiatives have been undertaken to that effect, particularly since 2012 (banking union) and 2014 (capital markets union), but they remain unfinished and have largely stalled in recent years. They must be revived as part of a comprehensive EU response to the IRA.

To be a forceful lever for private cleantech manufacturing investment, the single market must be open and competitive. The EU needs to preserve the power of its competition policy toolbox to avoid incumbency, protectionist and rent-seeking traps.

3.3.2 | A technology-open industrial policy at the EU level

Instead of expanding state aid at the national level, which could fragment the single-market fragmentation and fan political tensions between EU countries, the EU needs to develop a well-targeted industrial policy at the EU level. This should focus on: (i) supporting the development

and scaling-up of pan-European public-private ecosystems; (ii) the whole innovation cycle of cleantech in an integrated manner, from disruptive innovation to deployment at scale; (iii) areas in which market, network and transition failures are most likely and government selection failures least likely, ensuring additionality and leveraging of other (member state) public and private funding. It could envisage a portfolio of funding instruments, which is well balanced between top-down and bottom-up solicited projects.

To achieve these goals, the EU could consider the creation of an EU version of the US Advanced Research Projects Agency, with an emphasis on Energy and Climate ('ARPA-EC'), aimed at fostering high-risk, early-stage development projects for new cleantech manufacturing technologies. An EU ARPA-EC could also issue competitive tenders for new technological alternatives to critical components, products or services when there are supply concerns in existing green technologies, thus addressing the EU's demand for resilience and autonomy by calling on the EU's science and innovation capacity. ARPA-EC should connect to complementary funding schemes, both at national and at EU level, including the European Research Council (ERC) and EIC. The ERC and EIC should maintain their focus on supporting bottom-up ideas, thus balancing the top-down cleantech NZIA programmes.

It is important to stress that an ARPA-style approach requires more than just importing a label. To ensure the unique character of an ARPA-EC as risk-taking public funder for energy and climate, sufficient funding will be required, to allow it to take a portfolio approach and make multiple high-risk bets. Equally important is to design it properly for success, most notably, by giving autonomy and organisational flexibility, especially flexibility to recruit and accommodate the venture-capital entrepreneur type of policy programmers and officers. Calls must have clear quantifiable goals and trackable metrics, so that policy officers can be given high levels of autonomy, together with clear mandates and accountability.

The EU could also fund the creation of support schemes designed to top-up national and other EU funding in projects that demonstrate pan-European collaboration or coordination, contributing to the creation of cleantech ecosystems at EU scale. A particular line of action to address the critical lack of skills for green investments, would be the funding of programmes to stimulate the intra- and extra- EU mobility of cleantech skills. These could be targeted specifically at fostering intra-EU mobility between upstream and downstream parts of European cleantech ecosystems.

3.3.3 | A trade-policy response that both respects and seeks to improve international rules

How should the EU respond to the prohibited LCRs and actionable production subsidies featured in the IRA in view of the near impossibility of a legislative amendment of the IRA in the current Congress?

Bilateral EU–US negotiations have been taking place within the framework of a dedicated 'IRA Taskforce' since October 2022, focusing on the IRA implementing regulations, which have been adopted by the US administration in December 2022 and March 2023 respectively.[12] The IRA regulatory process and the guidelines that were issued by US administration on these occasions are relevant for the electric vehicle tax credit and associated LCRs for battery and critical mineral components. The IRA prescribes that parts and components supplied by US 'free trade

[12]https://www.irs.gov/inflation-reduction-act-of-2022.

agreement' partner jurisdictions are to be treated as local content for the purposes of EV tax credit eligibility. The implementation guidelines issued by the IRS broadly clarify that the term 'free trade agreement' is not defined under US law but would, for IRA purposes, require three substantive elements: trade preferences and provisions on environmental and labour protection. If the EU was treated as an FTA partner, some of the EU's most pressing political and legal concerns about the IRA would be eliminated. However, EU intermediate inputs would still be subject to the requirement that final assembly into finished products take place in North America. Moreover, domestic production subsidies, such as the clean manufacturing tax credit, remain unaffected by the implementation guidelines. As such, the most pressing EU commercial concerns about the IRA will remain unaddressed.

In order to meet the 'FTA partner' conditionality for EV tax credit eligibility, the EU and the US have embarked on the negotiation of a bilateral agreement on critical raw materials.[13] The US has already concluded an agreement of this kind for the same purpose with Japan, which, however, remains remarkably shallow in substance.[14] In these negotiations, in any case, the EU must not accept to become a party of a discriminatory institutional arrangement that would violate Article XXIV of the General Agreement on Tariffs and Trade (GATT) on regional trade agreements.

If negotiations fail, the EU could immediately initiate a WTO dispute targeting the LCRs attached to the electric vehicle and clean-energy tax credits. Pursuing this option would send an unambiguous political signal that the EU continues to invest in the WTO's rules-based system, values the balance of concessions codified in the WTO agreements, and holds the US accountable for breaches of obligations.

The European Commission could also launch a countervailing duty investigation to determine whether the US has granted a specific subsidy to a US firm or sector, and if such a subsidy causes or threatens to cause injury to EU industries. In case of a positive finding, the Commission would propose to the EU countries duties to countervail the US subsidy. However, this remedy is only available if foreign subsidies directly and negatively affect the economic situation of the domestic industry and is limited, in its application, to subsidised exports.

A more desirable but more challenging option would be to start negotiations on a plurilateral or multilateral agreement on permissible environmental subsidies (Clausing & Wolfram, 2023; Kleimann, 2023). This would be a response not just to the IRA, but to the problem that the design and scale of desirable environmental subsidies is on a collision course with existing international subsidy rules and national trade remedy (i.e. anti-foreign-subsidy) regulations, and risks provoking an international subsidy war. Various forums could host the technical and political negotiations necessary to generate an enabling and permissible environment for appropriate net global welfare enhancing subsidies. The EU should provide much needed leadership by initiating this process.

4 | CONCLUSION

The US IRA is a game changer in several respects.

First, by helping the US – the second largest CO_2 emitter in the world behind China – meet its 2030 climate target, the IRA will contribute significantly to global efforts to reduce carbon emissions.

[13] https://ec.europa.eu/commission/presscorner/detail/en/IP_23_3214.

[14] https://ustr.gov/sites/default/files/2023-03/US%20Japan%20Critical%20Minerals%20Agreement%202023%2003%2028.pdf.

Second, the IRA sets a worrying precedent for the global trading system. For the first time, the US has put in place LCR subsidies, in clear violation of WTO rules. This comes in addition to the US's disregard for certain WTO rules and, more broadly, the refusal of major countries to stick to international trade norms. It is happening when the international community badly needs greater cooperation to tackle perhaps its biggest-ever challenge, climate change.

Third, the economic impact of the IRA through both competitiveness effects and innovation spillovers could be substantial for the EU. This said, the magnitude of these effects is highly uncertain – and even whether they will benefit or hurt the EU on balance.

The NZIA as proposed by the European Commission is a partial and poorly designed response to the IRA. The European Parliament and EU members in the Council of the EU must reboot the NZIA and make sure it both delivers on its limited scope of action and minimises the risk of unintended consequences. In parallel, the EU needs to advance a much broader and stronger green industrial policy strategy, resting on three pillars: horizontal single-market reforms, an upgraded steering and co-ordination body at the EU level, and a strong, central advanced research funding agency in the mould of ARPA. Delivering on this strategy should be a priority goal of the new EU institutional cycle from 2024.

At the same time, the EU should be mindful of – and react to – IRA subsidies that are distortionary and threaten to displace green-tech production of certain goods and services from the EU to the US. In particular, the EU should not tolerate the use of LCR subsidies by the US (or any other trading partner) since they inevitably cause economic disruption, impede climate policy roll-outs and blatantly violate WTO rules. The most pragmatic way to address this is to continue the negotiation of a bilateral agreement on critical raw materials in order to be treated as 'free trade agreement' partner for IRA purposes, which would result in EU content being treated as 'local'. Such a solution would be acceptable if compliant with WTO rules. A more principled (and equally pragmatic, if negotiations fail) approach would be to launch WTO proceedings to obtain redress. In the medium term, the EU should engage partners for the negotiation of a plurilateral or even multilateral agreement setting out best practice standards for environmental subsidies.

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CONFLICT OF INTEREST STATEMENT

The authors declare to have no competing interest.

DATA AVAILABILITY STATEMENT

None.

ORCID

Simone Tagliapietra https://orcid.org/0000-0003-0193-3884

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