POLICY INSIGHTS
Thinking ahead for Europe

Transforming Energy-Intensive Industries

Reflections on innovation, investment and finance challenges

Milan Elkerbout

No 2017/44 December 2017

The clean energy transition – necessitated by the Paris Agreement and implemented in the EU through the Energy Union strategy – is changing the industrial landscape in Europe. Viewed through the lens of competitiveness, this transition brings about threats as well as opportunities. This transition also leads to increased integration and linkages between climate and energy policies, on the one hand, and industrial policies, on the other. The short report is a first attempt to describe these linkages and thereby make a step towards identifying key issues and emerging policy questions while starting to hint at possible answers. It is meant as a background for discussion upon which to build further research.

Keywords: Energy Union; energy transition; EU ETS; climate and industrial policy; innovation finance

Table of Contents

Milan Elkerbout is a Researcher at CEPS Energy Climate House. This Policy Insight offers some reflections on the workshop: "Game over for European power intensive industries in a low emission EU? Or rather new opportunities for innovation, growth, and job creation?" which was held at Norway House in Brussels in June 2017.

CEPS ENERGY CLIMATE HOUSE

978-94-6138-656-4
Available for free downloading from the CEPS and ECH websites

Transforming Energy-Intensive Industries

Reflections on innovation, investment and finance challenges

Milan Elkerbout

CEPS Policy Insight No 2017/44 – December 2017

Even if the EU itself does not have a lot of competences in the field of industrial policy (the Treaties refer to "support, coordinate, or supplement"), various policymakers and stakeholders have not only drawn attention to the industrial policy implications of climate and energy policies, but refer to some of these policies as industrial policies in their own right.

At the domestic level, industrial policy is the domain of national governments, many of which are in the process of defining long-term plans (2050) for climate and energy policy. This provides a further opportunity to integrate climate, energy and industrial policy. What are the risks and opportunities for competitiveness? And what can the EU and national governments do to boost competitiveness while transitioning to a carbon-neutral energy economy?

The extent of government support

A preliminary question is whether governments should provide any direct support to industry in the first place. The greenhouse gas (GHG) emissions trajectories of the power sector and of energy-intensive industries over the past few years show some divergence: where the power sector sees a sustained drop in GHG emissions in most, if not all, European Economic Area (EEA) countries, the picture is different for energy-intensive industries. Emissions dropped sharply over the course of the economic crisis, but have remained constant ever since, with some countries even showing slight increases. Both groups of sectors are included in the EU ETS. The power sector, however, is also strongly affected by renewables targets and national measures such as coal plant closures.

While a uniform carbon price can indeed lead to a concentration of emissions reductions in a single sector (as they are cheaper there), the ambition of the long-term targets (as expressed in the Paris Agreement and through the 80-95% reductions target by 2050) in combination with the absence of obvious technologies that could contribute to deep cuts in industrial emissions lead to legitimate concerns about the sustainability of current emissions levels and production practices in these industries.

The biggest energy-intensive industries, such as steel, aluminium, cement, chemicals and refineries, all require myriad new technologies and production processes if an economy-wide target such as a 95% reduction commitment is to be credible.

There are several reasons why firms are not making sufficient investments themselves, and why therefore, governments can step in. The first is that the required investments are highly capital-intensive, with long pay-back periods. The investments are also inherently risky for both policy reasons (will the policy stay the same?) and technological reasons (will the technology deliver?). Moreover, in the short term, the climate policy objectives do not demand such investments per se: while long-term targets are stringent and ambitious, in the nearer term (e.g. 2020 and 2030), they do not necessarily require action in all sectors and are less stringent in any case.

The type of investments that are required in the context of longer-term, "deep decarbonisation" scenarios are a significant order of magnitude larger than some of the marginal efficiency improvements that may be sufficient in to comply with shorter-term targets. Just like in the power sector, where the solution is not to reduce the emissions from coal-fired power plants by, say, one-third, but to generate electricity in a carbon-neutral way, energy-intensive industries require new ways to produce to the same, or similar products.

The development of industrial technologies and processes that would enable such a transformation takes place in multiple phases, from early-stage pilots in a lab, to demonstration projects and finally to demonstrating new technologies at scale. Only when this final stage has been reached will the market play a leading role in disseminating new technologies. In earlier stages, public support plays a vital role. This includes funding for R&D, but also project funding to bridge the gap between pilot projects and production at scale – i.e. crossing the "valley of death".

Technological transformations

What kind of technologies are we talking about that will need to be developed in order to attain the ambitious mid-century climate targets? To some degree, the answer is inherently unknowable at this stage, as some sectors lack even the concepts on how complete decarbonisation could be achieved in theory. However, there are a number of technology groups that would enable a substantial contribution in emissions reductions across different sectors.

The first of these is Carbon Capture and Storage (CCS). CCS has been part of discussions on climate mitigation for years, with sceptics pointing out how successful CCS applications have barely materialised so far. Nevertheless, for various energy-intensive industries, CCS remains an important building block of long-term decarbonisation strategies. In the cement sector, a combination of efficiency-improving technologies could help achieve a 50% reduction, but further reductions depend on CCS. Likewise, the steel, chemicals and refining industries all have residual emissions to different extents for which capture and storage seems the only viable option.

A second cross-cutting technology is hydrogen. Provided the hydrogen is produced with renewable energy, hydrogen can aid the decarbonisation effort in multiple sectors, including energy-intensive ones – by being a substitute for fuels used in industrial processes – but also in transport and as an energy carrier for storage. In particular, the steel and refinery sectors have developed potential production processes based on hydrogen.

These are just two examples of broader technology groups. Specific applications of either of the two will of course require bespoke implementation, technical design and financing. But even successful applications at a smaller scale may lead to spill-overs into other sectors, as it will increase the market for storing CO_2 and for the industrial use of hydrogen. The two also potentially reinforce one another, as captured CO_2 may be used as an input in the production of hydrogen – an example of carbon capture and use (CCU).

Besides investing in specific technology groups, the transformation of energy-intensive industries should lead to the emergence of new industrial clusters and associated value chains. To illustrate, steel companies have developed several strategies to significantly (if not quite completely) reduce emissions over the coming decades, using either a combination of increased electrification with direct-reduced iron and hydrogen, or by capturing emissions. The increased use of hydrogen requires vast amounts of renewable electricity to produce, just as increased use of direct-reduced iron in electric arc furnaces would. Renewable electricity production is therefore central to industrial decarbonisation, even if there is no direct electrification of processes.

Conversely, if a steel company would opt for capturing CO_2, it also makes sense for it to use some of the captured CO_2 in industrial processes. Here, steelmaking could become linked to the chemicals industry, as certain base chemicals such as those based on ethanol can be made using CO_2, together with other gases produced during steelmaking. As CO_2 is a common input in chemicals production, alternatives need to be developed if traditional sources, such as fossil fuel production, disappear over the course of the energy transition. The cement industry, meanwhile, envisages the combustion of waste in cement kilns, which operate at a sufficiently high temperature as to avoid residual emissions. This also brings in circular economy into low-emission industrial value chains.

Financing, investment and market-making

How should such a technological shift be financed, and what is the order of magnitude of both the financing needed and the financing available? Much of the difficulty of financing new, innovative technologies revolves around covering the “valley of death” in between the initial R&D process and the wider, market-driven uptake of these technologies. The various stages of bringing new technologies to the market are sometimes expressed as technology readiness levels (TRL), ranging from one through nine. The valley of death covers TRL 4-7, and is widely considered the stage in which public funding is paramount.

However, given the necessity of creating new technologies that help achieve long-term climate targets, lower TRLs in the R&D phase should also be supported. Concerns about the competitiveness of industry play a role here as well. Any investments, including but not limited to those in R&D, require sufficient free cash flow at the firm level. This free cash flow, however, may at any given time be widely impacted by macroeconomic and competitive conditions. The outlook for any investment and growth in a sector plays a major role. Some technologies are considerably more complex and therefore costlier if they are to be retrofitted to existing plants. Applications to greenfield investments could be more attractive from a technology perspective, but this requires that there is a solid business case for new investment – irrespective of technology and carbon intensity – in the first place.

Public funding is inherently bound by constraints, both on the overall amounts available, as well as the intensity of the funding – how much of a given project will be covered by public money? The intensity can be capped at a given share, but also expressed as covering a discrete element of the project; e.g. to cover the policy risk. Both quantity and intensity merit reflection in the context of what is needed for power-intensive industries to go forward.

In terms of the amounts of funding required, firms in some of the most energy-intensive industries around have quoted sums on the order of €1-2 billion for a single demonstration project. Strategies involving more longer-term transformation of (potentially) low-carbon processes easily run into double digit figures. No pocket change in any case. Public institutions are understandably cautious about engaging public money in dear projects with uncertain results. As a consequence, these institutions may want to cap the public-funding intensity. Yet, from the perspective of an investing firm, the absolutely amount of funding put into a risky project is more important than the relative share it constitutes as part of the project. More specifically, it is the share of this private contribution that is considered risky. As such, the public-funding contribution ideally addresses specific sources of risk that inhibit the engagement of private funds.

The intensity notwithstanding, it is important that the funding instruments available correspond to the amount of funding that is necessary in order to credibly contribute to long-term decarbonisation targets. The number of funding schemes that can potentially contribute to climate targets is almost as big as the number of sectors that require breakthrough technologies. The European Commission frequently highlights the contribution of the Horizon 2020 research programme, and the EFSI and ESIF investment plans launched in the aftermath of the eurozone crisis. These funds have indeed mobilised considerable sums of money, but their objectives go far beyond, or are wholly different, from supporting climate policy. In any case, such funds are competing with other objectives, and in the case of EFSI/ESIF, are temporary. Given the long timelines inevitably associated with transforming energy-intensive industries, the financing environment should likewise be stable and long-term.

With the existing and future EU ETS funds, such continuity could be created: there will be allowances to be auctioned for decades to come. Additionally, funds generated this way need not compete with other objectives; they can be specifically targeted. However, monetising allowances brings its own set of problems. It requires renewed political commitments to determine the exact number of allowances to be monetised, which makes the overall quantity of funding available uncertain. This sum could be fixed in the legislation, however. Moreover, ring-fencing a number of allowances, either in absolute terms (as with the NER300 and the upcoming Innovation Fund) or as a percentage of total allowances (as with the Modernisation Fund, which will be generated from 2% of total EU ETS allowances in the period 2021-30), still leaves the exact amount of funding available contingent on the carbon price at the time of monetisation. This exacerbates the uncertainty and makes it harder for the private sector to prepare investments that could leverage the funds generated by the sale of ETS allowances.

Beyond this, it is also a matter of basic scale: the NER300 monetised 300 million allowances when EUA prices barely went beyond €5, and often below. The Innovation Fund planned for the post-2020 trading period of the EU ETS will likely make available 500 million allowances for monetisation, while carbon prices have also appreciated over the past year. But even at a carbon price of €10, considering that the Fund will cover a 10-year period, €5 billion is not necessarily transformational in light of the scale of the type of projects that ideally would be supported. Additionally, the governance of these funds can be further constrained by additional requirements to guarantee geographical balance, sectoral balance and technology neutrality – the latter leading to a multitude of (possibly smaller) projects being supported.

Finance versus regulation and policy

It is not sufficient to simply ensure that financing is available. In fact, plenty of money is available for investment, both private and public (subject to political constraints). It is more important that a plausible business case for investment in low/zero-emission technologies can be made. In short: there needs to be a market for such solutions. This requires connecting financing opportunities with an amenable regulatory and policy landscape.

One element of supporting the case for investment, is the desirability of passing carbon costs throughout value chains. Absent this pass-through, producers investing in low-emissions technologies will still need to compete with those who maintain a carbon-intensive course, without the marketplace reflecting the costs of carbon. The EU ETS can play an obvious role here, as the main carbon pricing instrument in the EU. At the same time, the main impact of an ETS is to put a price on carbon by creating scarcity in emissions allowances.

A carbon price signal in and of itself cannot be expected to drive investment and innovation, even if it can play a supporting role in enabling carbon cost pass-through. Moreover, the system of free allocation, designed to safeguard competitiveness of energy-intensive industry, in itself hinders this pass-through, as it shields producers from the direct impact of a carbon price, even if there is still an opportunity cost in holding allowances. On the other hand, it does improve the balance sheet of firms, whose health is a necessary precondition for private investment.

There is in any case a discrepancy between observed (or even expected) carbon prices, and carbon prices at which transformational technology investment starts to make economic sense. The deep decarbonisation strategies for the steel sector described earlier are estimated at having abatement costs of between €100 and €500 per tonne of CO_2. Even ignoring the upper bound, it is clear that policies beyond carbon pricing are required to enable their development in relevant time horizons.

Another requirement is that whenever public funding is made available for innovation, it should clearly be thus demarcated, so that it does not turn into general support for a firm's day-to-day operations. Especially in the context of climate and energy policies being seen as a potential instrument or contributor to industrial policy, such demarcation is essential to ensure that the European industrial environment remains competitive. The environmental state aid guidelines are a central element to this.

More generally, predictability in regulation and policymaking is widely seen as desirable for fostering investment and growth. Yet, to a certain degree, democratic processes are inherently unpredictable. There will always be new ministers, parliamentarians and commissioners to populate the EU legislative institutions. Even so, the governance of the Energy Union, together with the European Semester could allow for some streamlining of the regulatory and financial planning that should underpin the transformation of power-intensive industries. In particular, these national climate and energy plans could create more transparency in the direction of mid- and long-term policies.

Key issues for a future policy debate

- The energy transition is about making **transformational, not incremental changes** in numerous energy-intensive industries, if long-term climate objectives are to be reached. And while most industrial GHG emissions are concentrated in just a few sectors, all energy-intensive sectors require such transformational solutions.
- '**Big money**' is needed: transformational change is expensive. Combined with the large number of sectors involved, this will require many multi-billion euro investment projects.
- A sound and convincing **investment case is** more important than public co-financing, if private capital is to be involved. There must be a market for low/zero-carbon products. Projects (if successful) should not be just test cases, destined only to be ignored later.
- **The pass through of carbon cost** is essential to trigger impacts on the value chain. Such impacts will require more than simply the current EU ETS. A different approach to safeguarding the competitiveness of trade exposed, carbon-intensive sectors may be needed.
- **Future industrial clusters and value chains** also provide economic **opportunity**, but for these opportunities to emerge, capital has to be mobile – the political economy plays an important role in this context as it affects the necessary shifts, both in technological and geographical terms.

ABOUT CEPS

Founded in Brussels in 1983, CEPS is widely recognised as the most experienced and authoritative think tank operating in the European Union today. CEPS acts as a leading forum for debate on EU affairs, distinguished by its strong in-house research capacity and complemented by an extensive network of partner institutes throughout the world.

Goals

- Carry out state-of-the-art policy research leading to innovative solutions to the challenges facing Europe today
- Maintain the highest standards of academic excellence and unqualified independence
- Act as a forum for discussion among all stakeholders in the European policy process
- Provide a regular flow of authoritative publications offering policy analysis and recommendations

Assets

- Multidisciplinary, multinational & multicultural research team of knowledgeable analysts
- Participation in several research networks, comprising other highly reputable research institutes from throughout Europe, to complement and consolidate CEPS' research expertise and to extend its outreach
- An extensive membership base of some 132 Corporate Members and 118 Institutional Members, which provide expertise and practical experience and act as a sounding board for the feasibility of CEPS policy proposals

Programme Structure

In-house Research Programmes

Economic and Finance
Regulation
Rights
Europe in the World
Energy and Climate Change
Institutions

Independent Research Institutes managed by CEPS

European Capital Markets Institute (ECMI)
European Credit Research Institute (ECRI)
Energy Climate House (ECH)

Research Networks organised by CEPS

European Network of Economic Policy Research Institutes (ENEPRI)
European Policy Institutes Network (EPIN)