

The transformation of the Spanish basic materials sector towards a low carbon economy*

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Abstract

Since the end of 2016, the Climate Friendly Materials Platform (CFMP) brings together policy makers, industry representatives, practitioners in industrial decarbonisation, and applied researchers for the development of a shared understanding of tangible policy options and eventually common policy action at the national and EU levels to the overall goal of successfully decarbonize the basic materials sector. As part of this network, the Institute for Research in Technology (IIT) of the Universidad Pontificia Comillas organized a round-table discussion in Madrid on the 21st of January 2019. Participants from industry, governmental and non-governmental organizations discussed the current state of the Spanish basic materials sector and the domestic and global challenges the Spanish industry is facing with regard to industrial decarbonisation in the 2050 horizon. Together they identified risks for the Spanish industry especially for the post-2030 period, and concluded that a long-term strategy is required to achieve an inclusive transformation of the national and European industry, and to ensure that decarbonisation does not lead to the deindustrialization of the European economy. This report serves as a background document for the national discussion, providing in-depth analysis of the Spanish basic material sector, analysing past and current national policies, and summarizing the results of the national round-table event.

Keywords: Decarbonisation, industry, energy transition.

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1. INTRODUCTION

Production of basic materials (cement, iron and steel, paper and board, aluminium, as well as chemicals and petrochemicals) account for around 16% of European GHG emissions (DIW calculations based on EEA (2012) and EEA (2016)).¹

For some time this number was regarded to be sufficiently low to be out of the primary focus of policy makers – which was largely dedicated to improving the power sector and generally increasing energy efficiency. However, the Paris Climate Agreements' commitment to reaching *net carbon neutrality* by mid-century implies that a comprehensive industrial policy strategy is required that also tackles CO₂ emissions from the basic material production.

This is reflected in the reform of the EU ETS Directive approved in 2018 for the 2020-2030 period. The discussion remains focused on how to secure sufficient free allowance allocation to ensure that sectors like steel are protected against investment- and carbon leakage. Furthermore, it also raised awareness within the senior management of the major material producers that business as usual investment plans are not compatible with the long-term emission reduction objectives formulated in the Paris Climate Agreement, both at the European level and in many Member States.

This raises the question for the management of international companies, of whether to pursue major (re-)investments in carbon intensive production processes of basic materials during times when financing is being withdrawn from coal plants and when there are large scale write-offs on existing power stations in the power sector. Apart from concerns of carbon leakage, there are risks of changing demand patterns for carbon intensive materials and competition from new investments in climate friendly production processes.

To overcome this inertia, the European Commission was asked by the heads of Member States to outline a 2050 long-term vision for Europe. The document was presented in November 2018 (European Commission, 2018a). The Commission,

¹ About 1/3 of these emissions are indirect emissions from producing electricity for basic material producers.

as well as several Member States, hosted workshops with all basic materials sectors to inform about scenarios capable to reach carbon neutrality by mid-century and demonstrate the portfolio of existing and proven technologies.

Obviously, such a vision cannot be used in our complex market-based economies to prescribe specific technology development and choices – particularly in an environment with large-scale uncertainty and asymmetric information about costs and performance of such technologies. However, it can help to engage private actors in a dialogue about urgent decisions – and to identify the need of public policy to address knowledge spill overs and learning-by-doing externalities, financing constraints, and policy risks.

The EUKI Climate Friendly Materials European Roundtable aimed at engaging national stakeholders from Hungary, Poland, and Spain in this European discussion – focusing on the following elements.

- What is the nature of 2050 roadmaps – what elements will be part of a transformation pathway for a basic material sector?
- What is the status and outlook of national material industries?
- What is the status of national policies, what are lessons learned so far, what are the challenges ahead and what are the remaining gaps?
- What is the policy toolbox to close the gaps – what solutions can allow private actors in market based economies to pursue investments that follow the 2050 roadmaps?
- How can European policies be inclusive – *e.g.* support national developments? What is the value added of European cooperation?

The Spanish round table event was held at Universidad Pontificia Comillas in Madrid on the 21st of January 2019. The ongoing consultation process for the Climate Change and Energy Transition Law “Ley de Cambio Climático y Transición Energética” outlining the Spanish 2030 strategy served as a point of departure to discuss the transition process of the Spanish energy intensive industry

towards a net-zero economy in 2050. Participants included key players and sector associations from the (petro)-chemical, metal, cement and automotive industry, national and European public bodies, labour organizations and academia. The event was divided in four separate sessions, covering different aspects of the industrial transformation:

- The long term vision of the European Commission for 2050, the “Ley de Cambio Climático y Transición Energética” and the Spanish Energy Intensive Industry
- Carbon leakage in the national and European context
- New materials, technologies and production processes
- Recycling, re-use and the circular economy

This document provides background material about the Spanish industry and political framework, and recaps the general observations and findings of the round-table sessions. A general introduction of the status quo of the Spanish industry and its economic background is followed by the results of the round table sessions and a summary of general conclusions.

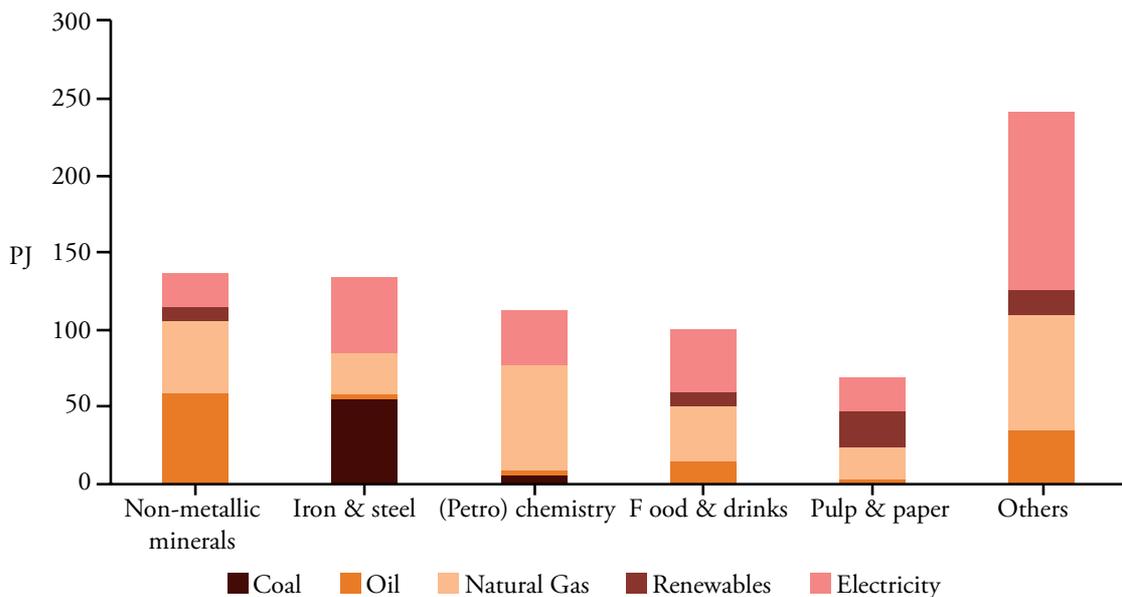
2. THE SPANISH INDUSTRIAL SECTOR

The industrial sector accounted for 23.5 % of the total energy consumption in Spain in 2016 (IDAE, 2018). Economic activities related to the extraction, processing and production of basic materials heavily rely on fossil-fuel based energy carriers and account for more than 60% of the total energy consumption of the industrial sector. As can be seen in Exhibit 1, processing of non-metallic minerals has the highest energy demand across all economic activities. Coal and petroleum products are used for the production of cement, chemicals, glass, ceramics and derivatives of those. The share of renewable energy use, here primarily the use of biomass in cement kilns, is low. The importance of the non-metallic minerals sectors within the national energy balance is one of the key features of Spain and is representative for other southern European countries like Italy and Greece. The steel and metal industry comes second and can be characterised by its high share of electricity use. As of 2014, more than 70% of domestically

produced steel came from secondary steel production using electric arc furnaces (World Steel Association, 2016). Due to the ongoing sector transformation, the share of secondary steel production has been growing over the last years. Furthermore, Spain is the third biggest aluminium producer in the European Union, an industry that uses primarily electricity for its production processes. Other relevant industries are the (petro)-chemical sector, the food industry and the production of pulp & paper. Remaining industrial activities primarily use electricity and natural gas, which replaced other fossil fuels after the extension of the national gas network over the last 30 years.

Exhibit 1

Industrial Energy Consumption in Spain in 2016



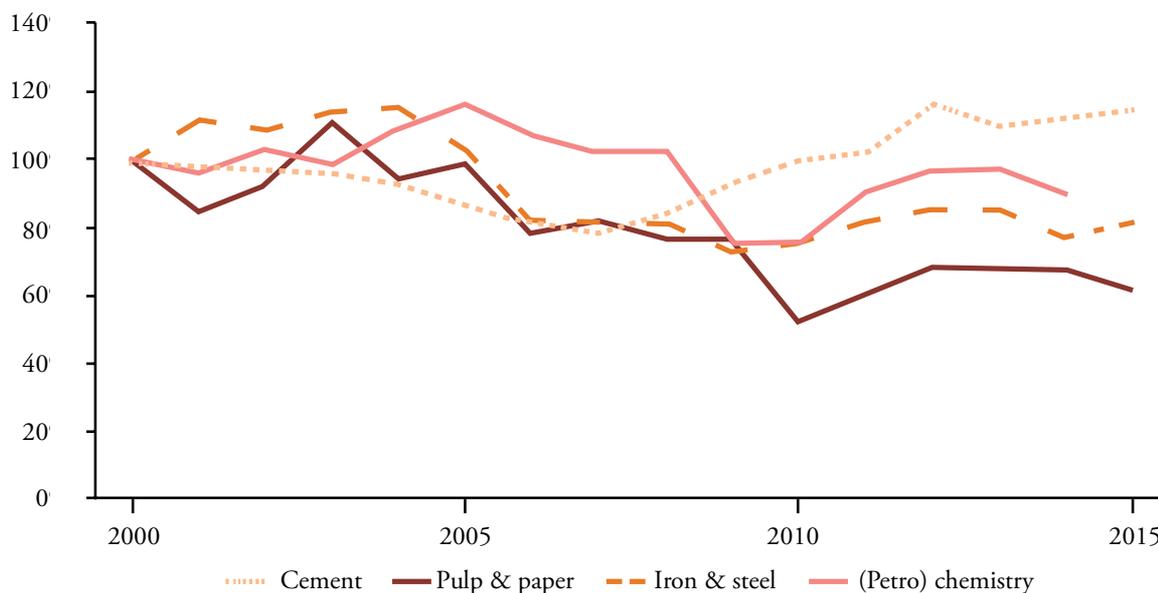
Source: IDAE, 2018.

The Spanish economy was heavily impacted in the aftermath of the global financial crisis of 2007-2008 and the burst of the housing bubble. National demand of basic materials like cement collapsed and resulted in the subsequent reduction of total industrial greenhouse gas emissions. Within the 10 year time frame between 2005 and 2017 industrial CO₂ emissions fell by 42% (MITECO, 2018a). While these figures permit Spain to comply with European CO₂ reduction targets in the short run, this development imposes challenges for the industrial sector in the long-

run. The least financially and energetically competitive plants closed, while new investments in the remaining infrastructure remained low. There is a significant untapped potential for energy efficiency measures, given that the energy intensity of all branches of the basic material sector has been rising since 2010 (Exhibit 2).

Exhibit 2

Energy intensity of production since the base year 2000 (%)



Source: IDAE, 2018.

Since 2012, the Spanish industry experienced a partial recovery with the value of its total production in 2017 remaining about 15% lower than in 2008 (CCOO, 2017). Especially the basic material sector has not been able to regain previously achieved output. With regard to national emission levels, the key question is whether the Spanish material sector will increase its production over the next decades, stagnate or deindustrialise further.

3. NATIONAL POLICIES: LESSONS LEARNED AND CHALLENGES AHEAD

In the past, Spanish governments have implemented multiple policies to reduce emissions and promote a more efficient use of energy. National policies,

though, fell short on promoting and encouraging far-reaching changes within the material sector.

To reduce the energy intensity of the industrial sector and as a response to the Directive 2012/37/EU on energy efficiency, the Spanish government initiated a support programme for small and medium-sized (SME) and big enterprises in 2015 (BOE-A-2015-4991). In total, 115.216.421€ of funding has been designated to co-finance the renewal of industrial installations and improve their energy management. Given the capital intensity of the basic material sector, access to these funds for the heavy industry was limited. The maximum eligible investment cost had to be below 4 M€ for each application. According to the National Energy Efficiency Action Plan 2017, 12.9% of investments from this programme have been dedicated to the basic materials sector. The main beneficiary is the food, beverages and tobacco industry accounting for more than 30% of the total investments.

Companies active in the basic material sector were also eligible to apply for funding under the PIMA² plan (Real Decreto 147/2014). This programme financed measures to fight climate change on the national level. Initiated in 2014, most measures funded by this programme have been implemented already. Of the total 93M€ budgeted, only 5M€ were dedicated to energy efficiency measures (MITECO, 2018b).

One of the main tools to fund investments in low-emission technology is the FES-CO₂ fund.³ Introduced in 2011, this mechanism is aimed at various sectors not covered by the European emission trading system (ETS). Qualifying projects receive payments of currently 9.7€/t of avoided CO₂ emissions (MAPAMA, 2018). Given that the heavy industry is participating in the EU ETS, emission reduction of production processes in the basic material sector is not remunerated by this fund. Projects are evaluated based on their environmental and economic characteristics.

2 Planes de Impulso al Medio Ambiente (Plans to Support the Environment).

3 Fondo de Carbono para una Economía Sostenible (Carbon Fund for a Sustainable Economy).

Since 1997 the Spanish government supports investments in the re-industrialisation of the economy with public loans under the REINDUS programme.⁴ Both greenfield investments and the replacement of aging infrastructure are eligible. No explicit requirements to invest in low-carbon technologies have to be fulfilled by the applying projects.

The main goal of national and regional governments has been to actively try to reduce the energy bill of the basic materials sector by means of public aid and tax exemptions, although with limited success. For example, electro-intensive industries have not been compensated for their indirect emissions as allowed by the EU (although this is expected to change this year). The Spanish heavy industry can also participate in a certain type of demand-response auctions (interruptibility). Companies are being paid for the availability to reduce their consumption at instances when the system is compromised. The focus on energy cost reduction as key element of the industrial energy policy is also reflected in a report by the Ministry of Industry published in 2014 (MINETUR, 2014). A recently published draft of a new royal decree aims to clarify the status of the energy intensive industries (MINCOTUR, 2019). In this draft the current government introduces various measures that reduce regulated fees and cost components of the electricity price for large energy intensive industries. Eligible companies need to show that annual consumption has exceeded 40 GWh/year during the last three years and they have to fulfil a given set of requirements to be certified as an energy intensive business. Eligible companies are required to implement energy efficiency measures. These measures, reduction targets and policies, though, only cover the next 3 to 4 years and only provide short-term fixes without providing a long term vision.

So far, hence, the long term reduction of energy- and emission intensity of the Spanish basic material sector has not been in the spotlight for national policy makers. Current and past environmental policies primarily target efficiency improvements in non-ETS sectors of the economy. Both at the regional and national level, the energy policy for the energy intensive industry was more driven by the concern that high energy prices could jeopardize industrial competitiveness

⁴ www.programareindus.es

(given that electricity and gas prices are higher in Spain than in other major EU countries), rather than the need to improve its energy efficiency. This flaw of the national energy policy has been pointed out by the independent expert commission for the energy transition appointed by the previous government.⁵ In their final report presented in April 2018 they formulate five recommendations for the future energy policy of Spain in the industrial sector (Comisión de Expertos de Transición Energética, 2018). These recommendations are discussed further in the next section.

4. THE SPANISH PERSPECTIVE FOR THE 2030 AND 2050 HORIZON

In case of Spain, the future energy policy for the basic material sector will be determined by the new law of climate change and energy transition, as well as the National Energy and Climate Plan. A draft of the latter is already publicly available (MITECO, 2019a).

The aforementioned final report of the expert commission for the energy transition is one of the main inputs used within the development process of this new legislation. In the following, we briefly present the policy recommendations stated within the expert report for the industrial sector and reflect on them with regard to the elements of the policy toolbox presented by (Neuhoff *et al.*, 2018). Given that the expert report primarily focuses on the national energy policy until 2030, we then identify areas that aren't or are insufficiently addressed to achieve the required sector transformation.

- An industrial policy strategy with stronger emphasis on the sustainability of industrial energy consumption

It is recognized that the role of the state is key to provide strategic investments in infrastructure. Such infrastructure must make it economically feasible for companies to reduce their emissions. In this regard, public actors would need to take a more active role in coordinating the collaboration of private stakeholders

⁵ Comisión de Expertos sobre Escenarios de Transición Energética.

to facilitate the required innovations. The report states the need for more collaboration but gives no details about the form and type of such public-private sector engagement. Especially the risks related the uncertainty of energy prices have been identified as key elements that need to be addressed by policies supporting the transformation of the industrial sector.

- Promoting continuous improvements in the energy use of industrial processes

Policies should ensure a continuous investment in technologies that increase the energy efficiency of industrial processes. For investments to be optimal, the policy design has to foster investments in technologies that are the most efficient given undistorted energy costs. Such continuous efficiency improvements need to be monitored by an adequate system of certification and legal mandate. The report provides no further details of such monitoring mechanism but emphasises the need to extend such energy efficiency requirements to SMEs (small and medium enterprises). Policies should provide support to the implementation of innovations, which face difficulties in achieving profitability from the entrepreneurs' perspective. Besides subsidies and fiscal support schemes, the authors also mention the possibility to strengthen the role of energy service companies in the industrial sector. Such companies would provide external energy services that are currently internalized for industrial companies.

- Foster distributed generation: cogeneration and renewable thermal energy

This recommendation is especially targeting the optimal use of current and future cogeneration capacities. The authors identified a lack of knowledge with regard to the use of renewable thermal energy for the industrial sector in Spain and advise further research regarding this matter.

- Studies about corporate mobility

The authors identify companies as a possible driver to promote changes in the transport sector. Corporate strategies with regard to transport could help to reduce carbon emissions and energy use. This recommendation has little significance in the scope of this project.

- Research, development and innovation (R+D+I) as part of the industrial policy

The report recommends that cooperation between universities, research centres and the industry with regard to R+D+I of new industrial processes is to be improved and additional public funding is to be provided to foster this collaboration.

These recommendations are very much in line with the ones finally included in the National Energy and Climate Plan (see below), although neither of them present a detailed but a holistic view with regard to transformations along the entire value chain of the basic material sector. The focus of these recommendations remains on the utilization of primary energy rather than indirect and product-life cycle emissions. Aspects concerning the evolvement of a circular economy for basic materials are underrepresented in all these documents, although they are expected to be included in the future National Energy and Climate Strategy for 2050.

The National Energy and Climate Plan sets very ambitious decarbonisation targets for the Spanish economy, including of course industry. However, most of the emissions reductions targets are concentrated on the electricity sector and transport, therefore allowing some breathing space for the industry. The policy measures proposed for the industry include: subsidies to incorporate renewable energy in industrial processes, and energy-efficiency studies and investments for industry.

Some more measures for accompanying the decarbonisation of industry are proposed in the National Strategy for a Fair Energy Transition (MITECO, 2019b): sectoral agreements, a strategic agreement for the car industry, and a Statute for Electro-intensive Consumers. As mentioned before, a draft of this statute has already been published (MINCOTUR, 2019), and basically consists in eliminating a minor part of the electricity charges for these consumers in return for their commitment to apply energy-efficiency measures.

5. RESULTS OF THE ROUND TABLE SESSIONS

In the following, we summarize the results of the round table discussions. The main observations and concerns brought forward during the event are presented and have been reviewed by all participants.

5.1. The long term vision of the European Commission for 2050, the “Ley de Cambio Climático y Transición Energética” and the Spanish Energy Intensive Industry

Pedro Linares, professor at the Universidad Pontificia Comillas and one of the experts advising the Spanish government concerning the policies required to comply with the EU 2030 emission reduction targets, introduced the topic. Based on the ongoing consultation process, the government was at that time drafting the “Ley de Cambio Climático y Transición Energética” (Climate Change and Energy Transition Law). Although the final proposal for the law, or the National Energy and Climate Integrated Plan, had not been published when the roundtable took place, some general elements had already been circulated as drafts. Among them, the most relevant were the proposition to reduce emissions by 20% until 2030 compared to 1990, and to eliminate them until 2050. These national objectives are in line with the net-zero goal formulated by the European Commission in November 2018.

Reaching the 2030 targets should not be a major hurdle for the industry, given that the declining emission intensity in non-ETS sectors and the electricity sector can provide for the envisaged total reduction. However, it needs to be acknowledged that most of the basic materials sector is participating in the ETS and is exposed to volatile CO₂ allowance prices. Both allowance prices and price volatility might increase significantly over the next decade. Consequently, what really matters for the Spanish basic materials sector is the EU regulation. Still, many participants were worried about the apparent lack of consensus and dialogue with the affected sectors in the drafting of the national Climate Change and Energy Transition Law.

The legislative setup established between the European Union and their Member States limits the scope of action for national governments. This observation, brought forward by multiple representatives from the industrial sector, framed the national Spanish industrial policy as rather reactive towards new legislation decided at the European level. One general concern is that national policies are targeting the compliance with benchmarks and targets

without considering the consequences for businesses, employment and regional development. Participants pointed out that other European countries like Germany have a long term industrial strategy with a clear vision about the role of the sector in 2030 and 2050 (BMW, 2018). National funding of research projects and policies as subsidy schemes are aligned with these goals. Spain, on the contrary, is lacking such strategy and participants question whether parts of the industrial sector could survive a deep industrial transformation. One representative pointed out that no new energy intensive production facilities have been built in Spain over the last decades. For the manufacturing and energy intensive industry, dominated by global players, the decision for brown and green field investments is based on favourable locational factors. More favourable conditions and a legislative framework aiming at the long term support for Spain as a competitive location for heavy industries are required. Most participants requested a comprehensive industrial plan for Spain, of course compatible with state-aid guidelines. Without such long-term strategy, they expect that the reduction of emissions will be achieved by a continued deindustrialization of the Spanish basic materials sector.

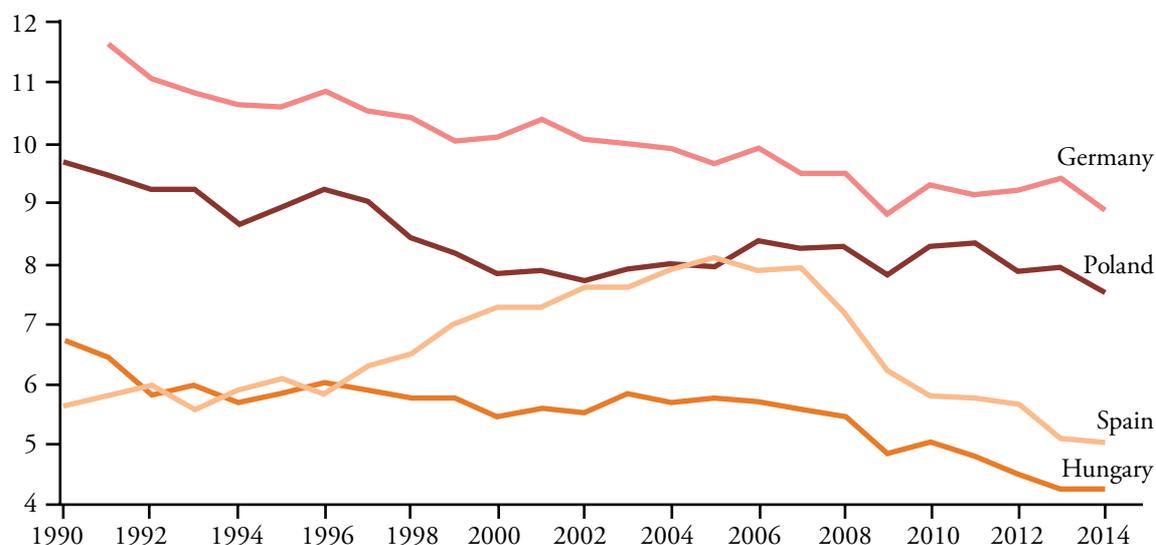
All participants were positive about complying with direct emissions and energy efficiency targets for production facilities set on European level for the 2030 horizon. Publications by the sector organizations themselves support this impression. A recent study by the Spanish Association of Petroleum Product Operators (AOP), for example, demonstrates that the industries covered by the EU ETS can fully comply with reduction targets for 2030, and in diffuse sectors by 88%, if implementing measures that are economically beneficial (Solé and Castro, 2018). All parties pointed out the importance of a stable legislative and regulatory framework to fulfil the set targets. Political uncertainty and possibly highly volatile energy and CO₂ emission prices have been mentioned as key risks for the 2030 horizon. Some participants stated that even the fulfilment of the 2030 targets could cause the reduction of industrial production in Spain and that measures to increase the industry's efficiency could have a negative impact on employment. Uncertainty, particularly in the automotive industry, is already causing job losses.

The necessity to drastically reduce emissions in Europe until 2050 is acknowledged by all parties. However, net-zero emissions, set as target by the European Union, raise concerns for industrial stakeholders, and some of them even consider these targets unrealistic. Others perceive them as achievable, as long as there are no constraints on the technologies that may be used. The credo of the different industry representatives is that a decarbonized future has to be a future with a national basic material sector, regardless of how decarbonisation is to be achieved. While participants from the national and European institutions highlighted Europe's role as a forerunner for the decarbonisation of our society towards 2050, industry representatives were concerned about their global competitiveness if emission reduction targets are not aligned with technological development.

European legislation needs to be in line with global efforts to avoid that the European industry becomes the "Don Quixote" of mitigating climate change, highlighting the first mover problematics. Targeting net-zero emissions in 2050, legislators should ensure that emissions are always reduced in the most cost-efficient way, while European and national policies need to ensure the global competitiveness of the industry. In this regard, one participant highlighted that the EU vision 2050 is partial towards certain technology options, which *e.g.* in case of CCS face serious acceptance problems within the Spanish society and makes even the research and development of such technologies a challenging venture.

A general consensus of the round table was the perceived unfairness of the European emissions reduction strategy over the entire transition period. While the net-zero target for 2050 is the same for all EU member states, the progress along the transition is benchmarked against the national emission intensity in the year 1990. As can be seen in Exhibit 3, Spanish emissions per capita in 1990 were about half compared to the exhibit for Germany and have risen sharply due to the economic development in the following two decades (as allowed by the EU). Applying only the 1990 benchmark, absolute per capita emissions have to decrease much more dramatically in Spain and Hungary during the early phases of the transition than in countries like Germany or Poland, which can result in unrealistic national reduction targets.

Exhibit 3

CO₂ emissions (metric tons per capita) 1990 to 2014

Source: World Bank, 2019.

5.2. Carbon leakage in the national and European context

The second session was opened with a short presentation by Juan Carlos Císcar from the Joint Research Centre of the European Commission (JRC-EU) about the projections of economic impacts caused by climate change in sectors of the EU (PESETA). The PESETA III Project also evaluates the impact of climate change on the industrial sector and the role of the European emission trading system (EU ETS) and the consequences of carbon leakage.

Recent changes to the EU ETS and benchmarks for free emission allocations are a primary concern for all industries represented in this session. Several industry representatives pointed out that benchmarks for free emission allocation are already close to the minimum that can be achieved with best available technologies (BATs). As a result, entire industrial subsectors would be fully exposed to volatile emission allowance prices. In the case of cement production, for which CO₂ emissions originate from the chemical transformation processes within the cement kiln, industry representatives expect benchmarks to surpass

the theoretically achievable minima before 2030. CCS would remain the only reliable alternative to reduce emissions further.

Industry representatives pointed out that the additional costs of meeting these benchmarks weaken their competitive position on the global scale and increase the already strong competition they are facing from non-EU imports. Different taxation and laxer national environmental legislation already foster imports of certain chemical products from China. While some participants argued that a revision of the EU ETS might be sufficient to protect the EU industry, other participants brought forward serious concerns about the suitability of the emission trading system to ensure competitiveness and provide the right incentives for investors on the long run. One participant considered that compensation schemes are just rent transfers, but do not solve the real economic cost of the system, and instead create competition for the subsidy among different industrial sectors, without resulting in new investments. In the case of the automotive industry, it was pointed out that EU targets set in terms of vehicle emissions are already very challenging. Most participants called for border tax adjustments of some sort, and also for a similar effort from other global regions.⁶ It was also highlighted that overregulation in Europe is already driving R&D away.

However, most participants also agreed that the bigger driver regarding leakage is not the carbon emission price, but energy prices and their uncertain character in Europe. Indeed, high energy prices in Europe are responsible for the high efficiency of the European energy-intensive industry, but ensuring competitiveness by process efficiency may have its limits and low gas prices in the US are already harming many industries in Europe. In this regard, it was pointed out that the focus of the energy transition is on the electrification of demand, but electricity prices are still very high. A reform is needed to ensure affordable prices.

Many round-table participants favoured a shift from producer responsibility with regard to the emission intensity of basic materials to an approach that considers the use and consumption of materials with a high carbon footprint. Green labelling for products sold in the EU, similar to the CE label, was seen

⁶ Although large multinationals prefer compensation schemes rather than border taxes, which would increase the price of their products globally.

as a viable way to implement such consumer responsibility. Such approach would mean that manufacturers in the countries of origin would have to prove the emission intensity of their production processes and have them certified. Concerns about the higher complexity of such mechanism were discussed, but regarded as negligible. One participant, who was representing the manufacturing sector, noted that the complexity of the introduction of such labelling system is often overrated. Non-European suppliers already need to comply with a vast set of norms and regulations regarding product safety and certain environmental standards. Required tests and additional certification could be done by the same accredited registry and classification societies active all over the globe, today. Given the size and importance of the European market on a global scale, such certification requirements could push non-European industries to implement low emission technologies independently from their own national legislative requirements.

The participants also evaluated advantages and disadvantages of a European-wide tax on basic materials. Both imported and locally produced materials could be taxed at the same rate, while tax credits would be given to such producers who use low-carbon production technologies. Importers could apply for tax reductions as well, given their production processes are certified to be of low emissions. Exporters would be exempted from the tax. Certificates of origin have already been introduced for biofuels, but according to the European Court of Auditors (2016) current legislation is not fully reliable. Another approach brought up by the round table participants was the possibility to continue using offsets such as the Clean Development Mechanism initially proposed in the Kyoto protocol.

Some stakeholders were concerned about overcomplicating regulations, while one participant noted that new low emission policies should be in line with increased spending in European innovation and research. Being the forerunner in emission reduction should mean that the European business would provide the required technologies and expertise. The European Battery Alliance was mentioned as an example of such initiative (European Commission, 2018b).

Additionally to the more drastic effects of climate change expected for the southern European countries compared to the northern European region (PESETA III),

participants perceive a general imbalance between the emission reduction efforts required from different EU Member States. Some participants argued that the efforts should be based on achieving similar final per capita emission levels among countries, as an indicator of fairness.

5.3. New materials, technologies and production processes

The reduction of emissions requires new technologies that enable the basic material sector to reduce their emissions. A brief presentation by Timo Gerres about the recent research results published by the organizers of the roundtable served as an introduction to this topic (Gerres *et al.*, 2019).

As mentioned before, there was a general consensus between all participants that no ground-breaking new technologies and processes are needed to achieve the 2030 targets. Furthermore, different stakeholders confirmed that the electrification of all heating applications below 200 °C will be the expected decarbonisation measure for non-energy intensive industries. Participants expressed two different points of view with regard to the implementation and development of new technologies, summarized towards the end of the discussion as a market controlled and a state controlled innovation process.

From the Spanish perspective, several participants from the industry questioned whether the Spanish industry needs to be a forerunner for implementing new low emission technologies. With most technology providers based within the blue banana belt, stretching from the UK to northern Italy, and other north and central European regions, national industries are repelled towards being the “guinea pig” for the transformations required to decarbonize the European industrial sector. The question was asked whether Spain wants to be the leader of the industrial transition or not. Such question should be defined by a national industry vision in consensus between all stakeholders. One participant pointed out that Spain has already been a catalyst for the transformation of European electricity markets by heavily supporting renewable energy technologies in the 2000s. This resulted in a heavy deficit of the Spanish electricity system and a bill still being paid by the consumers today (Linden *et al.*, 2014). New technologies would be implemented by the global and national companies as soon as having

been brought to market readiness elsewhere in Europe. In this context, some participants criticized the path-dependency of the long-term vision of the European Union on specific technologies, stating that innovations do not emerge by a rigid planification process. On the other hand, one participant pointed out that the European energy intensive industries recently published their joint road map, stating the technologies they consider as key for enabling the decarbonisation of the industrial sector (Wyns, Khandekar and Robson, 2018).

Fostering innovations and the implementation of new technologies by public support schemes was briefly discussed during this round table session. While some industry players noted that a lack of a clear national strategy for Spain and overlapping competences between ministries don't make it attractive for industrial players to apply to available public funding options, they acknowledged that public funding is essential for the industrial transformation. Given comparable costs of energy for different technology options, companies would especially need financial support to cover the higher initial CAPEX of the investment. One of the industry representatives brought one alternative approach towards innovation funding forward. Guaranteed long-term highly discounted electricity price contracts for low emission technologies could push for the electrification of entire industrial subsectors. Without directing funding only to a specific technology, the European Union could ensure that the transition leads to the electrification of energy demand. This approach would also require public-private partnerships, since only the industry has the know-how to bring technologies to the market. Industrial clusters, such as those created by the Basque government, were also mentioned by many participants as an essential element for innovation.

5.4. Recycling, re-use and the circular economy

The Basque Country is one of the forerunners on environmental policies in Spain. Ignacio Quintana from IHOBE, the Environmental Management Agency of the Basque Country, introduced the last session with a presentation about past, ongoing and future regional initiatives to move towards a circular economy. Results from previous research demonstrate that currently 10% of the industrial through-put in the Basque Country ends up as waste. Up to 7% of costs can be

saved in the regional industrial sector, if low cost measures for a circular economy are implemented rigidly.

The different industrial stakeholders acknowledged the necessity to move towards a higher utilisation of waste and recycling within industrial processes. Many representatives, though, mentioned the increasing difficulties of impurities and quality of recycled materials. Feedstock has to be of certain purities, which often cannot be provided for. Participants stated that the current approach towards handling waste does not permit its optimal use as a resource. The current approach to shred, separate and sort the waste needs to change. It should be possible to separate waste into its components without mixing it with other waste, first. This requires a new approach and thinking on how to design different products and use basic materials. Some representatives mentioned that the current legislation does not support an efficient use of currently available resources. Different types of organic waste could be utilized within the industrial sector, but the legal framework is not prepared to increase utilization rates. The recycling industry faces additional challenges by the recycling of “legacy” waste of, *e.g.* household appliances manufactured 30 years ago. Such waste has to be recycled using today's norms and standards, while products and materials brought into circulation, today, will be the wastes of tomorrow.

The emergence of a circular economy requires a new understanding of how materials are brought to market, sold and used, while increasing the product's design life and use. Possibilities are the redefinition of the added value provided by a product, *e.g.* paint sold as corrosion protection, or that a service is sold instead of a product (laundry services instead of a washing machine). Participants acknowledge that such approaches are not universally applicable. One participant mentioned that current legislation hampers the introduction of circular approaches. Working groups have been formed at the national level to support the emergence of a circular economy.

6. CONCLUSIONS

The Spanish round table event on the 21st of January 2019 brought together various industrial stakeholders, governmental and non-governmental participants

to discuss the transition of the Spanish basic materials sector towards a low carbon economy. Since such transition needs to be inclusive, it will require a joint effort of all stakeholders in order to reduce industrial emissions while maintaining industrial competitiveness and ensuring a just distribution of costs and efforts.

While all stakeholders acknowledge the need to drastically reduce carbon emissions in Spain and Europe until 2050, the question on how to achieve these reductions remains unanswered. In order to prevent that decarbonisation is achieved by deindustrialization, industrial stakeholders emphasize on the need for a national long-term strategy with a stable regulatory framework. Such framework, though, must be robust against carbon-leakage and the discrimination of certain technological solutions.

These risks have been identified especially with regard to the post-2030 period, for which new innovative technologies and processes will be required to comply with European emission reduction targets. An inclusive transformation requires an enhanced consumer responsibility with regard to the carbon intensity and recyclability of products brought onto the market and must encompass both the domestic production and imports. In this regard, energy cost (un)certainty is key for the Spanish industry and a new approach and thinking on how we design different products and use basic materials is necessary.

Based on the discussion during the round-table event, it remains unclear, though, how the post-2030 transition of the Spanish industry can be realized. While a “wait and see” approach, as suggested during the round-table event, increases the risk of further industrial deindustrialisation, a clear concept on how to enable the inclusive transition towards a low-emission basic material sector within a circular economy is essential. New European legislation to foster a decarbonized basic material market will need to be designed carefully taking into the account the concerns of national stakeholders in Spain and other European countries such as how to handle the carbon leakage threats.

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