Energy-intensive industries are part of the solution, not the problem

Deep decarbonisation is challenging but possible

European energy-intensive industries (EIIs), i.e. steel, non-ferrous metals, cement, chemicals, fertilisers, refineries, pulp and paper, ceramics or glass are of strategic importance for Europe's value chains. The goods they produce are vital to almost all other sectors of the economy. The EIIs are also a big employer as altogether they provide quality jobs to 6,6m employees (although 1,6m less than in 1990). As these jobs are mainly for semi-skilled workers, they contribute to correcting the ongoing trend of polarisation on labour markets.

Because the EIIs have their origin in the coal-based first industrial and the petrol-based second industrial revolution, they are often considered obsolete and outdated. Indeed, the current third (or even fourth) industrial revolution will probably put an end to two centuries of economic development based on fossil fuels in order to move to a digitalised and sustainable economy. In this respect it is however often forgotten that the EIIs are also part of this evolution and even at the forefront to support the transition to a low-carbon economy. Indeed, they provide the materials for producing solar panels, windmills, and electric vehicles. Moreover, they played a positive and constructive role in meeting the European climate objectives as they were able to significantly reduce their emissions. Their final energy consumption dropped by 20% between 1990 and 2015 (against a 1% increase in total final energy consumption). As a result, the EEIs reduced their emissions by 36% between 1990 and 2015 while improving energy intensity by 39%.

Pathways to deep decarbonisation.[1]

Industry represents 21% of total greenhouse gas emissions in the EU, 60 to 80% of them originating from EIIs. Decarbonising EIIs thus implies a near total decarbonisation of the whole industry. This sounds very ambitious but today a myriad of low carbon technologies and production processes already exist, although there is no silver bullet yet and their technological readiness level remains low.

Besides the technological challenge there is also an important economic challenge. Indeed, zero-carbon technologies will entail huge investment and operational costs (without any added value for the customer as the final product will be the same). Typical for the EIIs are also their long investment cycles (20 to 40 years). Delivering on our commitments from the Paris Agreement (to limit global warming to 2° by becoming net zero after 2050) means the right decisions must now be taken. New cross-sectoral technologies are probably the most important pathway to the deep

[1] Wyns Tomas, A Bridge Towards a Carbon Neutral Europe, Europe's Energy-Intensive Industries contribution to the EU strategy for long-term EU greenhouse gas emissions reductions, Sept. 2018, https://www.ies.be/files/Industrial_Value_Chain_25sept_0.pdf

decarbonisation of the EIIs. Their development should be a shared concern for all EIIs. They include:

- Further improvement of energy efficiency e.g. by the digitalisation of production processes to reduce waste and improve energy efficiency
- Electrification of heat to produce steel (electrolysis), glass, ceramics
- Use of green hydrogen to produce steel, ammonia or synthetic fuels
- Better valorisation of waste streams and materials efficiency as production on basis of secondary materials is less energy-intensive than transformation of primary resources
- (sustainably produced) Biomass can be used to replace fossil fuel to generate electricity or in biorefining to replace conventional feedstock
- Finally, carbon capture, carbon storage, (and -utilisation) will be key for the deep decarbonisation of the EIIs as 41% of their emissions are originating from industrial processes (transformation of materials). These emissions are much more difficult to abate than the emissions from fossil fuels being burned during the production process.

Furthermore, there is a need for new sectoral breakthrough technologies such as direct reduction (Hisarna) or top gas recycling in the steel sector or low-carbon binders for producing cement. In all EIIs new sector-specific technologies towards significant CO2-reductions are developed and deserve to be supported.

Another important pathway for the deep decarbonisation of the EIIs is the development of new low carbon substitutes/variants for traditional products e.g. carbon fibres, nanomaterials, new high strength and lightweight steel products, e-fuels, bio-based chemicals, and wood to replace cement.
But technological progress will not suffice to achieve the objective of becoming net-zero. Deep decarbonisation also needs to be supported by new business models such as industrial symbiosis (clustering of industrial activities) where by-products from one process are used beneficially in another process (e.g. waste heat for district heating or waste gases from steel as feedstock for chemicals). Also, the organisation of industrial demand response is promising: EIIs acting as a battery which consumes more electricity when plenty of renewables feed into the grid and reduces consumption at times of high demand and low renewable energy generation. Demand response could drastically reduce the investment costs in energy infrastructure as the capacity of the grid has to be based on peak demand.

Industrial processes will also have to be deeply embedded in the circular economy by closing and narrowing material and energy loops. Indeed, the organisation of the circular economy will contribute to the reduction of energy needs throughout recycling, re-using and re-manufacturing of goods. The circular economy could also lead to a completely new societal/economic paradigm by putting an end to the throw-away culture and by providing products 'as a service'. A recent study from Material Economics[2] focused on EIIs and estimated that the circular economy model could reduce European emissions by 56%

Making it happen by connecting industrial and environmental policy.

in order to create the right framework conditions for the uptake of low-carbon solutions in the EIIs, active public intervention will be needed to create strong synergies between climate and industrial policies. The long-term challenges will have to be made operational and turned into achievable short-term action plans for sectors/value chains with realistic objectives.
R&D funding will have to be provided at all stages of development (R&D, early-stage pilots in labs, demonstration projects, upscaling to commercial projects). An EU flagship 'Mission for low-CO2 technologies' in the Horizon Europe programme is highly welcome in this respect.
Investment support will be needed not only to develop the new low-carbon technologies but also to integrate them in existing production systems. EIIs

[2] Material Economics (2018), The Circular Economy, http://materialeconomics.com/latest-updates/the-cirular-economy

are large and complex industrial systems that are difficult to change while the innovative technologies are often rarely suited to retrofitting. Significant and costly changes to the design of plants and processes will be required.
Access to finance should also be guaranteed as the investments required are very risk- and capital-intensive with long-term pay back periods. De-risking these investments by smart combinations of grants, equity financing, loans and loan guarantees, tax breaks will be necessary. Innovative long-term financing mechanisms, including green bonds and energy-performance contracting schemes can address existing market failures.
Furthermore, initiatives are needed regarding:

- organisation of platforms for cooperation such as shared infrastructure for collection, transport and storage of CO2 or public-private partnerships for the development and market introduction of bio-chemicals, green hydrogen, sustainable process technologies, organisation of industrial symbiosis
- steer consumer/producer behaviour to low-carbon products/services (financial incentives, eco-labelling) and make use of public procurement to promote the uptake of low-carbon steel, cement, chemicals
- promote industrial collaboration, strategic alliances as a means to support companies to move up to the value chains of the future and to share costs of R&D and investment. This will require a review of state aid rules.
- special efforts will be needed to support re-adjustment programmes for SMEs in the EIIs value chains that are specialised in conventional technologies, in order to help them to redefine their value chain positioning and to redirect their core competencies to other fields of business
- introduction of schemes for accelerated depreciation (and other incentives) of obsolete installations
- monitoring will have to ensure a fair distribution of costs throughout the supply chain

Finally, decarbonisation will also sharply increase the economy-wide electricity consumption both directly (electrification of processes) and indirectly (producing hydrogen by electrolysis). The EIIs demand for electricity could increase by a factor between 5 to 8, leading to more than doubling the total demand for electricity. This will require huge investments in renewables and infrastructure (smart grids as well as energy storage). The strong increase of electricity demand could have a negative impact on energy security and electricity prices. Guaranteeing sufficient, reliable and affordable electricity will become important framework conditions for the deployment of low-CO2 processes.

Reinventing production processes to become zero carbon is only possible when the EIIs maintain their production footprint inside the EU and continue investing. If they relocate because of less stringent rules elsewhere, deep decarbonisation will simply not take place. In order to maintain a global level playing field international cooperation in support of the uptake of low-carbon technologies will be key. Furthermore, to avoid carbon leakage compensation for the indirect costs of the European ETS must be provided while the EIIs must continue to receive free emission rights at the level of the top 10% performers. Equal efforts around the world are required otherwise serious competitiveness problems will emerge.

The often-forgotten social dimension

The preamble of the Paris Agreement includes a commitment to the 'imperative of just transition'. So far only lip service has been paid to this principle. Deep decarbonisation of the EIIs will have a deep impact on the structure of the workforce and will only be possible when employees are behind it. New jobs will indeed be created, but often somewhere else with timing and skillsets other than those of the jobs disappearing. Organising a fair transition creates huge challenges about making disruptive economic/technological change socially linear/progressive, whereby avoiding mass redundancies. Therefore, employment policies should focus on maintaining/ increasing employability of the workforce e.g. by means of lifelong learning. The internal mobility of workers in companies should be promoted by up- and re-skilling. For those having to leave the company a smooth transition to another job should be organised (by means of group outplacement, employment cells, tailor-made training programmes, job search assistance while maintaining a labour

contract). Income security should be guaranteed. New job opportunities need to be created in the circular economy connected to the EIIs (recycling, re-manufacturing, re-use), in renewables, energy-efficiency and modernising the grids. Care must be taken of regions that are expected to decline or will have to transform by supporting redevelopment plans for vulnerable regions with a view to creating new industrial dynamics. Finally, establishing a culture of social dialogue at all levels (company, sector, regional, national) will be a key element for timely anticipating change and avoiding social disputes.

All these are key requirements for a successful transition and for ensuring its social acceptance. Implementation of ambitious decarbonisation plans can only be possible if they are broadly supported by the population. Deep decarbonisation risks having a negative impact on workers and communities which will weaken public support for climate policies. The transition must be carefully monitored to ensure nobody is left behind. The social implications of this transformation must be considered from the outset and all relevant policy tools be developed and deployed to mitigate the impact on workers and regions. But the EIIs have started their challenging journey to ensure their long-term future which will be low-carbon. Deep emissions reductions will not be easy but are possible and will offer a springboard to boost the long-term competitiveness of Europe's 'old' industrial sectors. As industrial investments made in the next 10 years will still be in place in 2050, it is important to take the right decisions as early as today.