Energizing industry

Generating >€200 billion per year by 2030 through European industrial decarbonization
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1. Executive summary
Industrials as an enabler of the energy transition

For the world to limit global warming during this century to 2°C above pre-industrial temperatures—the goal of the Paris Climate Agreement—a comprehensive energy transformation needs to be supported by energy-consuming industrials and energy producers.

This energy transition—from fossil fuels to clean energy—is inevitable and inexorable. How are European energy-intensive industrials supporting this decarbonization push? Most executives are acutely aware of the impacts of the energy transition, yet their industrial decarbonization efforts are falling short in delivering rapid and impactful CO₂ reductions.

Many of these leaders have lacked the evidence that decarbonization can actually create value for their companies. To provide such evidence, and to examine the implications of the energy transition for European industrials, Accenture constructed a study group of 30 companies. We conducted interviews of industry experts, analyses of patents and investments, and of press and broader documentation using natural language processing. We also developed a comprehensive modeling exercise to identify the value to be unlocked by pursuing decarbonization, and the optimal value-generating pathway by industry, along with our recommendations.
Recommendations

Our research found that industrials in Europe have the potential to unlock more than €200 billion per year by 2030. But creating an effective pathway to that value will be a challenge. As part of our discussions with executives for this paper, numerous executives commented that they are ready and able to drive change, but that they need political actors on the team who can create an environment for success. It will be important both for the leaders of industrials and for government leaders to be in sync on this complex transition and to support the transition with required predictability around future cost developments. There is no simple or single solution to decarbonization. Innovation and collaboration between the sectors will be critical, along with a multi-faceted approach. Working in partnership, the sectors can deliver an accelerated—and value-generating—industrial decarbonization.

Actions to be taken by European industrials could include

1. **Accelerate action:** Take a step-wise approach and start taking immediate action today. Focus on driving efficiency within existing operations, whilst actively exploring new business models.

2. **Adopt new technologies now:** Many energy-intensive processes have technologies with life cycles that will outlive the target years of climate neutrality aspired to by the European Union. To effectively decarbonize, companies must be adopting new technologies now as part of new CAPEX that offer long-term profitability.

3. **Understand where you are compared to the rest of your industry:** Start benchmarking against industry peers and leaders to identify areas for improvement.

4. **Adopt more expansive carbon pricing initiatives:** Most companies already consider carbon pricing as part of major investment decisions. However, this is only the first concrete step. Companies will next face two paths, either (a) allocating carbon costs to departments/business units based on emission generation; or (b) implementing an internal carbon fee which is to be applied to the procurement of any products or services.

5. **Pursue joint investments and alliances across the value chain:** Cross-value chain alliances and investments can facilitate meaningful reduction of Scope 3 end-use emissions by aligning incentives across the value chain to co-develop innovative, multi-partner solutions.

6. **Review and enhance supplier pre-qualification:** Supplier prequalification and contracting approaches must be reviewed to ensure that everyone is working with a decarbonization-minded supply base interested in driving down their carbon footprint as part of the supply chain.

7. **Self-disrupt and think beyond adjacencies:** The sale of commodity products will start to give way to a climate-neutral, usage and service-based economy. Successful navigators will be those that realize the new business models emerging out of:
   - Industry convergence—e.g., the provision of syngas and H₂ for further downstream utilization and energy storage.
   - Digitization of value chains and deploying increasingly sophisticated analytical capabilities to further understand and monetize data.
   - Demand-side management sometimes being the less expensive decarbonization measure than investing in supply-side decarbonization. Decarbonizing through a more demand-side driven approach requires a focus on helping customers design more efficient products, materials and buildings. This risks cannibalizing your market. However, carefully crafted business models not only delight your customers and help them with their decarbonization journey, but also deliver higher margins.
8. Ensure appropriate governance in enabling value-accrative innovation: Successful players have established a strong innovative intrapreneurial culture and innovation governance, enabling them to pivot to new opportunities ahead of their industry peers.

9. Adopt a customer-centric mindset: In our work with industrials, we continue to be impressed by new product innovations. However, many European industrials are still yet to adopt a key thing – a true customer-centric mindset. We often see a focus first on the revenue and operations, with the customer as an after-thought. This must change so that customer insight drives the whole process based on conversations with real customers, understanding why customers behave in a certain way, rather than taking secondary research statistics at face value. Through this, it can be understood that the unresolved needs of customers that can be solved for, without being constrained by current research definitions or market offerings.

Public and private sector collaboration: A critical success factor in decarbonization

We have described a variety of actions that the private sector should consider on this journey toward decarbonization. For successful outcomes, the public sector’s role is also critical. Without robust action from the public sector, industrials will be at competitive risk, given the twin burdens of necessary investments and the uncertainty of the pace and scope of technological innovation.

It will be important for governments and industrials to be in sync on this complex transition. At the core of the challenge: industrials need predictability on costs through thoughtful framework that will alleviate some of the transition costs and prevent “carbon leakage”—in which industrials leave the EU or lose business because the energy transition undermines their competitiveness in internationally traded goods.

Targeted public-sector intervention in the areas listed below could, on their own or in combination, help to accelerate industrial decarbonization:

- Implementing a framework that ensures companies are able to successfully internalize carbon’s hidden cost;
- Designing policies that avoid penalizing first-movers;
- Setting a precise and robust carbon price mechanism with a significant base price, increasing predictably over time as a guide to technological innovation and investment;
- Establishing a framework for emissions reporting in all three scopes (time frames) for all industries where company revenue and/or number of employees exceeds a certain threshold;
- Exploring a European product carbon-labeling standard, akin to that run by the Carbon Trust;
- Leveling the playing field through a carbon border tax to compensate against competing imports from outside the EU—that is, incorporating any hidden costs and thereby preventing carbon leakage;
- Evaluating the potential of quotas to increase the use of low-carbon cement and steel for construction and infrastructure projects, as well as to scale up chemical recycling and circular polymers;
- Stimulating the hydrogen economy on both the supply and demand side through a broad set of measures, including quotas and tax breaks;
- Consolidating and integrating national and regional funding mechanisms into a streamlined single application process.

We believe that, working collaboratively, private and public sectors can deliver an accelerated—and value-generating—industrial decarbonization.
Looking ahead

As we will discuss throughout this document, we see industrial decarbonization in Europe as a significant opportunity for both energy producers and industrial energy consumers. In this paper we will assess the dynamics at play from a technology, investment and supply chain perspective. The question of how industrials can seize upon this opportunity should be an item at the top of the CEO agenda. There has never been more public support—nor more urgency on the part of companies and governments—for an energy transition.

The time to act is now.
2. Introduction –
The time for action is now
In this report, we explore the energy transition now occurring throughout the world, and its impact on industrials—companies from the utilities, chemicals, cement, metals and energy sectors. We explore a variety of perspectives, bringing together implications and calls for action for both the private and public sectors.

We see industrial decarbonization as a significant opportunity, with many supply-side and demand-side options already in the money. The future will be shaped by those that take bold and decisive action, understanding the optimal pathway to a sustainable and profitable future. Traditional industry boundaries are being fundamentally challenged (and broken down) as companies develop new business models not only to survive, but to also thrive.

Many non-traditional players will play some role in energy generation and management as barriers to entry fall to all-time lows. But this is not a theme limited to energy. Our research and industry discussions have found evidence of significant industry convergence, and we see this trend accelerating.

However, in enabling pioneers to act, our analysis highlights just how sensitive progress is to an uncertain regulatory environment. As we will demonstrate across this series of reports, there has never been more public support for an energy transition. The time for action is now.

**What do we mean by “industrials”?**

We think of “industrials” as a category that goes beyond the typical “heavy industry” definition. Our broader perspective accounts for both those that provide the energy to the industrials (the energy producers like energy and utilities), and also those that are significant energy consumers (heavy industries like chemicals, steel, metals and cement). This enables us to consider the broader emission implications of European industrial activities, including the required energy supply. Our heavy industry selection is focused on industries where CO₂ abatement will require significant investment to redesign and change existing processes and technologies.
Industrials as an enabler of the energy transition

For the world to have any chance of limiting global warming during this century to 2º Celsius above pre-industrial temperatures—the goal of the Paris Climate Agreement—substantial changes need to be made by energy-consuming industrials and energy producers. In the European Union (EU), industrials represent 20 percent of emissions and about 25 percent of final energy consumption. Thus, they are a necessary enabler of the energy transition and decarbonization.

By “decarbonization,” we mean a transition to a low-carbon or full-carbon-recycling future. The long-term goal is to transition industries over generations not only to a state where their carbon footprint is zero, but to where they are actually “carbon positive”—an activity or industry that goes beyond achieving net-zero carbon emissions to offering an environmental benefit by removing additional carbon dioxide from the atmosphere.

A complicating factor for the decarbonization of the industrials sector is that these companies require energy for a range of purposes, with most of the energy consumption being used for process heat (See figure 1).

These processes are complex constructs, with adjustments to energy sources often seen as being technically impossible or economically unfeasible. But this is about to change.
It is somewhat reassuring to know that the current energy transition—from a system based primarily on fossil fuels to one based on renewable, CO₂-neutral energy sources—is not the first that humans have been through. In our fairly recent history, we have made several other transitions—from wood to coal, then to oil, and then to natural gas.

Yet, it is certainly true that during this fourth energy transition, energy systems are being more severely disrupted. The corporate imperative is to decarbonize, whilst rapid cost and technology advancements have created unprecedented pressure on industrials to re-invent themselves. These issues are top-of-mind in the C-suite, which needs to pursue decarbonization options and pricing approaches, and then focus on how their companies can raise capital and use it to drive value creation.

Some oil and gas companies have lost billions from their assets due to a bleaker oil outlook. In other cases, decarbonization is driving dramatic cost increases. And underneath it all, raising capital will become increasingly challenging on both the equity and debt side. Analysts from Deutsche Bank recently wrote, in a note to clients, that “Decarbonization has emerged as a key challenge facing the materials sectors. While some of the trends are long term, they matter for equity valuations today.” Larry Fink, CEO of BlackRock, Inc., recently delivered a strong warning to business leaders about the climate crisis. He said that his firm will take steps to address the issue across the thousands of companies in which it invests.

Achieving success

As we progressed through prior energy transitions, the focus was consistently on maximizing the power density (watts per square meter). This is the first energy transition that reverses that trend: renewable energy sources carry a lower power density than fossil fuels (See figure 2).

Major adoption of renewables will lead to order-of-magnitude increases in the footprint required to power the world’s energy needs. Recognizing this, it is important to develop an energy system that supports decentralized energy generation in spreading out the geographic footprint, whilst continuously innovating and developing new technologies that deliver improved power density.

“We are past the time for talking – if Germany wants to be a first mover or fast follower then the time for action is now.”

Speaker at a recent green hydrogen event in Germany
The fourth energy transition: A step-change reversal in power density driving the need for decentralized energy production.
A disruptive point to keep in mind is that this shift reduces barriers to entry for the business of energy generation—for example, fewer geographic constraints, lower CAPEX requirements, and a reduced need for specialized technical expertise. As we will demonstrate, these competitive disruptors are already leading to an acceleration of industry convergence.

However, as we know, this is not simply a regulatory challenge. Many industrials need to fundamentally shift their culture and approach to innovation, embracing a more customer-oriented, “fail fast, learn and redirect” culture. Such a culture seeks to develop new cross-industry solutions in conjunction with broader ecosystem partners—sometimes even those that were once seen as direct competitors.

Following recent dialog about the hydrogen economy and setting of long-term decarbonization targets, the world is long past the time for talk. The future (and capital markets) will reward those that took bold, decisive action in decarbonizing their business.

“We are exploring a lot of new business models and initiatives but our corporate strategy is just not set up to enable us to think and move in the agile manner that some of our industry leaders are rapidly adopting.”

Accenture Study Group Executive
3. A perfect storm of push and pull levers is emerging
The current decarbonization situation for European industrials

The energy transition is inevitable and inexorable. The primary issues that European industrials should consider are the speed of the transition, the impact it will have on their companies, and the effort and costs required to successfully deliver on the decarbonization imperative.

At the national level, European member states have united around the need for action, mandating that should any member state fail to reach its national CO₂ reduction goals for 2030, they must buy emission allocations from other member states that have surpassed their goals. This could well happen across numerous European member states unless greenhouse gas reduction is accelerated in non-ETS (Emissions Trading System) sectors.

In addition, a 2030 target for reducing energy consumption is to achieve a 32.5 percent efficiency improvement in primary energy consumption, compared to a baseline scenario with no efficiency improvements. Renewables’ share in EU-wide final energy consumption should grow to at least 32 percent by 2030. This target is binding at the EU level and is defined in the 2018 revision of the Renewable Energy Directive.⁶

With industrials representing 20 percent of EU emissions and about 25 percent of final energy consumption, they are a key enabler of the energy transition and decarbonization. However, the need to deliver a required 33% decrease in CO₂ emissions by 2030 is daunting (See figure 3), and puts unprecedented pressure on industrials, driving new levels of industry convergence.

The energy transition is inevitable and inexorable. The primary issues that European industrials should consider are the speed of the transition, the impact it will have on their companies, and the effort and costs required to successfully deliver on the decarbonization imperative.
Do-nothing scenario for European climate change

- EU energy demand may fall by 13% by 2100 due to reduced heating requirements (PESETA II Study, Ciscar et al. 2014)
- Annual total damages of at least $190bn euro per year, eroding ca. 2% of GDP (Ibid.)

European Legislation in 2014:
- CO\textsubscript{2} emissions to be reduced by 40% of 1990

European Council in 2020:
- CO\textsubscript{2} emissions to be reduced by 55% of 2019

Industrials account for 25% of Europe’s final energy consumption
- to decrease by 8% vs. 2015 by 2030
- to decrease 33% vs. 2015 by 2030

Source: Accenture Analysis
Pressure continues to build on European industrials from two sides: Entities like regulators and governments are “pushing” for change, while groups like consumers and investors are “pulling” at companies to change by altering their buying and investment plans (See figure 4).

Figure 4: Push and pull levers for decarbonization

- **Carbon taxation**: National efforts to force emitters to internalize some of the cost associated with CO₂ emissions
- **End-consumers**: Increasingly expect their products to be more sustainable, and possessing a limited carbon footprint
- **Emissions trading scheme**: Focus on Scope 1 emissions with market prices corrected as part of ongoing reform
- **Regulation and incentives**: European climate law and other emissions/energy efficiency-related regulations and incentives
- **B2B customers’ emission targets**: B2B industrial products form part of their customers’ Scope 3 emissions—a nut that their customers need to crack in delivering significant emission reductions
- **Investors and financial institutions**: Increasing focus on ESG as part of financing and insurance; capital will become more costly for heavy emitters
Push levers include:

Carbon taxation
These are national efforts to force emitters to take on some of the external cost associated with GHG emissions. Today, there is ever-growing pressure to implement a European-wide carbon taxation program as we look to deliver a more unified approach in forcing consideration of external costs into capital allocation decisions.

Emissions trading scheme
Such a scheme focuses on Scope 1 emissions with market prices corrected as part of reforms. As of late 2020, the cost for one ton of CO₂ as part of the European Emissions Trading Scheme (EU ETS) is ~4x what it was just two years ago (approximately €25/MT) with market consensus that prices must, and will, go up. It’s more a question of whether they will go up sufficiently without intervention in delivering the required decarbonization.

Other regulation
This includes the European Climate Law and other emission and energy efficiency-related regulations that are mandating change in order to help deliver on the EU’s climate goals for 2030 and beyond. Companies need support from regulators. The changeover to climate-friendly processes and products is associated with high strategic uncertainty for companies in areas such as technological progress, energy costs and regulation. This means that a robust and forward-looking regulatory framework must be created that makes the conversion of the energy system both cost-effective and predictable for industrial energy consumers.
Pull levers include:

End consumers
Corporations are seeing where consumers are putting their money—increasingly into eco-friendly products and brands—so companies are changing practices to meet new demands. Consumers are looking for products to be more sustainable and to achieve a smaller carbon footprint.

Accenture’s Buyer Value study conducted in May 2020 found that renewable energy is not only regarded as important by European consumers, but that consumers are willing to pay over 5 percent more for energy from renewable sources. Meanwhile, a 2020 study by the Carbon Trust found continued levels of support for carbon labeling on products across all countries, with two-thirds of consumers saying they think it is a good idea. Unfortunately, European industrials are underestimating the perceived value of decarbonization at consumer-facing businesses (See figure 5).

Figure 5: Industrials underestimate the importance and perceived value of their industry customers and the consumers

Perceived Value – willingness to pay, dollarized value in % – seller under / overestimate buyers’ value in %

**B2B customers’ emission targets**

Industrial sellers in the chemical and metal industry overestimate their customers’ perceived value for carbon dioxide utilization while underestimating it regarding carbon neutrality, GHG reduction and the use of renewable energy – up to a factor of 60 percent underestimation. Foresighted customers are engaging business-to-business customers in their efforts to reduce CO₂ emissions.

**Investors and financial institutions**

Industrials that wait too long to take decarbonization seriously will find that raising capital will become more challenging on both the equity and debt sides. Governments (Article 2.1 of the Paris Agreement) as well as investors (See figure 6) are focused on allocating capital in such a way that it supports European climate goals and the broader investment portfolio environment, social and governance (ESG) enhancement targets. In fact, according to a 2019 FTSE Russell survey, 82 percent of investment firms are currently implementing or evaluating ESG considerations as part of their investment strategy.⁹

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**Figure 6: Growth in investors signing up to the Principles for Responsible Investment (PRI)**

![Graph showing growth in investors signing up to the Principles for Responsible Investment (PRI).](image-url)

- **Assets under management (USD/tn)**
- ** Nº Signatories**

**Sources:** Accenture Analysis, Principles for Responsible Investment

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³ A perfect storm of push and pull levers is emerging
4. Innovation is focused on driving industrial scale and lowering cost
To examine the implications of the energy transition for European industrials, and better understand progress to date, Accenture Research constructed a study group of 30 companies that serve as the basis of our analysis throughout this report.¹⁰

Analysis of patent activities

A part of our research, we analyzed the use of emerging technologies among the industries selected for our study (see Appendix). We focused on patents filed in the US, Europe, Japan and South Korea. Through this analysis, we found that innovations in the areas of electrolysis and catalysts are increasingly focused on delivering economic advantage (See figure 7).

These technologies are not new, but they have emerged as core technologies in the face for effective and rapid industrial decarbonization. Catalysts and electrolysis play pivotal roles in creating alternative ways to create hydrogen in a way that is cost-competitive and green. These technologies substitute the CO₂-intensive steam methane reforming or by capturing CO₂ and turning emissions into valuable feedstock.

CO₂ can either react with green hydrogen, creating chemical products, or it can be transferred electrochemically to syngas and olefins. These technologies offer ideal storage and a capturing basis for the transition to a renewable energy future, and also actively reduce emitted CO₂.

Patent analysis shows that the shift to electrolysis is a key enabler for these ways to decarbonization because it helps avoid fossil-fuel-based energy, and impacts fossil feedstock, as well. Green syngas generation will experience a revival because it is the common basis for methanization and chemical products. Catalysts play a crucial role for electrolysis itself, as well as for the subsequent chemical production, based on electrolytically generated feedstocks.

These shifts are driving sector coupling across industries, with (1) utilities generating renewable energy; (2) chemicals, industrial equipment companies, and other project developers producing green hydrogen; and (3) CO₂-emitting industries serving as a feedstock supplier.
Recent innovations are driving down unit costs while also improving the efficiency and system longevity of electrolyzers. These developments, combined with economies of scale, are a critical gateway into low-cost hydrogen production. They are a turning point in decarbonizing European industry.
5. Significant cross-industry investments in industrial decarbonization
As part of our research we wanted to better understand how industrials target decarbonization, whether through in-house R&D, or through investing in and/or even acquiring relevant technologies to speed up the process. In exploring investments we considered ventures, start up activity as well as mergers and acquisitions.
Ventures: Embracing new technologies from the beginning

A deep dive into the study group's investments over the past five years found that 40 percent of that investments were linked to decarbonization efforts – not only covered by renewables and hydrogen, but also through intelligent management, including cloud, energy management, blockchain, IoT, mobility, and consumption data (See figure 8).

Energy and utility companies are focusing investments on new transformational businesses around intelligent cloud, whilst the energy industry is moving into chemicals, hydrogen production, and biotechnology.

Utilities and chemical companies in our study group are investing in hydrogen, whilst chemical companies are starting to move beyond their core business, investing in technologies such as semi-conductors, 3D printing, and biotechnology.

Figure 8: Investment activities of analyzed European industrials in the past five years

Investment Activities

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>54%</td>
</tr>
<tr>
<td>Utilities</td>
<td>64%</td>
</tr>
<tr>
<td>Chemicals</td>
<td>73%</td>
</tr>
<tr>
<td>Natural Resources</td>
<td>83%</td>
</tr>
<tr>
<td>Utilities and Energy</td>
<td>25%</td>
</tr>
<tr>
<td>Chemicals and Energy</td>
<td>25%</td>
</tr>
<tr>
<td>Utilities and Chemicals</td>
<td>100%</td>
</tr>
<tr>
<td>Cross-Industry</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Accenture Analysis based on Quid®

26 European industrial decarbonization
Start-up scene: Decarbonization – digital and industrial support

As decarbonization becomes an increasingly attractive commercial opportunity, many start-ups are entering the market. With a significant focus on combining decarbonization with digital service offerings, these services are tightly linked to managing renewables, efficiency, mobility and consulting services.

Investments in new decarbonization start-ups are already bearing fruits, as study group companies find large-scale applications which combine new technologies from the start-ups with the market access, relationships, and other capabilities of the study group. Over the next page, we highlight some startups of the past couple of years which have particularly impressed us (See figure 10). Moreover, an increasing number of start-ups are venturing into new materials (such as metallo-ceramic compounds and bio-based), carbon-neutral solutions such as closed-loop recycling, and platforms for connected energy solutions. It’s worthwhile to note that, while unit costs in some areas are falling (e.g., LOCE) and will continue to fall, traditional business models at the same time are getting squeezed in terms of their ability to earn their capital costs. This calls for a laser-sharp focus on corporate and technology strategy to occupy new profit pools in the emerging business landscape.

Figure 9: Start-ups founded since 2005 that are focusing on decarbonization

<table>
<thead>
<tr>
<th>Digital</th>
<th>Chemicals</th>
<th>Consulting and services</th>
<th>Biotechnology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting, software solutions, fleet management, SaaS</td>
<td>Carbon black, waste, pyrolysis, rubber</td>
<td>Offset, advisory, credits, emission reductions</td>
<td>Ethanol, fermentation, biofuels, feedstocks</td>
</tr>
<tr>
<td>Intelligence, machine learning, energy data, demand response</td>
<td>Carbon fiber, nanotech</td>
<td>HR, strategy, assistance to businesses</td>
<td>Algal, microalgae, biofuels, nutrients</td>
</tr>
<tr>
<td>Renewable energy</td>
<td>Fuel cell, syngas, wastes, production of hydrogen</td>
<td>New mobility</td>
<td>Metals</td>
</tr>
<tr>
<td>PV, wind turbines, hot water, energy projects</td>
<td>Energy efficiency</td>
<td>App, car sharing, drivers, rides</td>
<td>Stainless, alloy, carbon steel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flight, drones</td>
<td>Energy storage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E-bike</td>
<td>Mineral exploration</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lithium ion, energy storage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Agro</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Crop, farming, biochar, vegetables</td>
</tr>
</tbody>
</table>

Source: Accenture Analysis
5. Significant cross-industry investments in industrial decarbonization

**Figure 10: Study group interaction with select startups**

**Solidia**
Cement and concrete technology company producing less energy-intensive, faster curing as well as CO₂ binding cement.

**Sunfire**
Production technologies for synthetic crude, fuels and hydrogen from renewables as well as off-grid power solutions.

**Adaptricity**
Software solution offering grid modelling, simulations, operations and automation on an integrated platform.

**Orcan**
Modular energy recovery units generating electricity from industrial and heavy-duty mobility waste heat.

**Akselos**
Physics-based, digital twin software solution for new asset design, operations monitoring and predictive maintenance.

**Sterblue**
Digitization of energy asset inspection using drone technology and integrated data storage and analysis.

Source: Accenture Analysis
Mergers and acquisitions: Industries are converging and positioning themselves to capture emerging value pools

Decarbonization efforts are clearly on companies’ growth agendas. Since 2015, about half of all acquisitions made by companies in the Accenture study group have focused on efficiency and solutions, renewable energy, and electric vehicles, one third are focused on decarbonization efforts. (See figure 11)⁹.

The numbers point to the industries facing the highest disruption in the next decade: energy and utilities. Interestingly, acquisitions by leading European chemical, cement, and metal companies are primarily focused on growing the core business (at 50 percent or more), whilst utilities and energy companies are targeting transformational acquisitions, focusing on communications & high-tech (including IT), as well as services primarily targeting energy efficiency (a logical move when considering demand-side management as a way to drive decarbonization).

Additionally, energy companies are pushing into the utilities business by targeting renewable energy generation. Utilities, in turn, are striving to position themselves closer to consumers by pursuing e-vehicle service and energy support or smart grid/home by extending its their focus to increase efficiency, services and renewables share.

Many questions remain. Energy companies are clearly taking steps forward with regard to decarbonization, but are they moving quickly enough, given where they need to be by 2030—less than a decade away? To help answer this question, we will now explore challenges and hurdles in accelerating the energy transition and decarbonization efforts amongst European industrials.
6. A jungle of uncertain technology options amidst some fundamental challenges
As companies and policymakers discuss how they can move at a faster pace toward decarbonization goals, several challenges and uncertainties need to be addressed:

1. A fragmented regulatory environment throughout the global, regional trading blocks and national economies
2. Infrastructure challenges to cost effectively deploy and scale new technology
3. Cost inhibitors and uncertain price development of key technologies
4. Uncertainty around development and scaling of key technologies

Fragmented regulatory environment

One of the challenges that European industrials face with regards to their decarbonization efforts is that the regulatory environment in Europe is fragmented and no unifying strategy exists to incentivise investments of small and medium businesses as well as large corporations. However, in progressing regulation, regulators do not need to work out the answers to everything now. Instead, they should work with industry to jointly find sensible solutions as the energy transition progresses, thereby enabling industry to move at a controlled pace.

A 2020 Institute of International Finance (IIF) survey recognized a number of challenges around regulatory mandates:

- The uncertainty around mandatory energy transition measures such as emissions tracking and reporting has led to corporations introducing “shadow” carbon pricing—a market-driven trend to compensate for uncertain future regulatory developments.
- Companies’ risk management frameworks increasingly include the identification and assessment of climate-related risks and opportunities.
- Progress is being made on reporting Scope 1 and 2 emissions. However, there is little consensus on how to measure Scope 3 emissions effectively.
- There is increasing concern (two-thirds among the survey) about policy fragmentation undermining future certainty and improvement as national regulators introduce a plethora of different accounting and measurement standards.
Other indicators show that regulatory and financing challenges need to be overcome:

- A potentially unifying strategy for Europe is the EU’s recently published “European Green Deal” that forms a central package of 50 individual measures and aims at a climate-neutral energy supply by 2050. It addresses, both explicitly and implicitly, various industries (e.g., power generation, transmission and distribution); as well as transportation and process industries (e.g., chemicals). The deal has come under scrutiny because its €1 trillion budget may not suffice to cover the costs of necessary future investments.

- Some countries such as Germany, France and the UK are adopting their own additional climate strategies with the aim of moving at a faster pace with the energy transition.

- Recently, in June 2020, Germany set out to become a global leader in hydrogen technology and announced a national hydrogen strategy. It’s focused on establishing hydrogen as a multi-purpose energy carrier and essential to achieve “sector coupling”—for example, in power-to-X, feedstock for chemicals, transportation by fuel cells, and fuel for heavy industry.

Infrastructure challenges

Infrastructure updates are necessary to harness efficiencies of new technologies. But these updates cannot keep up with the rapid technological progress, as it can take 10 to 15 years to build out the required power and gas infrastructure. One example is Germany’s North-South Grid expansion to supply the south with northern wind power; the costs of which are ever-increasing. A major cause of long development periods is regulation and public policy. Regional fragmentation of policies is a challenge to planning and investment, whilst less complexity and long-term regulatory/policy security is a prerequisite for enabling meaningful and timely capital investments.

“Both the European and German hydrogen strategies are underwhelming and do not commit to delivering anywhere near the hydrogen required to deliver the much needed industrial decarbonization.”

Accenture Study Group Executive
Cost inhibitors and development

Although European industrials are making commitments, it is unclear whether these are substantial enough to truly stimulate the required progress necessary for a large-scale energy transition. The challenge that most industrials are battling is ascertaining where to invest their capital in cost-effectively decarbonizing, while still maximizing shareholder value.

**Figure 12: Restrictive decarbonization costs today (2020)**

<table>
<thead>
<tr>
<th>Process Description</th>
<th>Marginal Abatement Cost</th>
<th>EUR/tnCO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel: Gas-fired steel DRI/Midrex</td>
<td></td>
<td>▲ 5</td>
</tr>
<tr>
<td>Steel: CCS new-build for Steel/TGR</td>
<td></td>
<td>▲ 144</td>
</tr>
<tr>
<td>Steel: DRI EAF (grid electricity)</td>
<td></td>
<td>▼ -3,633</td>
</tr>
<tr>
<td>Steel: DRI EAF (PPA)</td>
<td></td>
<td>▼ -3,523</td>
</tr>
<tr>
<td>Steel: Steel recycling EAF (grid electricity)</td>
<td></td>
<td>▲ 111</td>
</tr>
<tr>
<td>Steel: Steel recycling EAF (PPA)</td>
<td></td>
<td>▼ -550</td>
</tr>
<tr>
<td>Steel: Iron reduction - H2 based (in the iron blast furnace)</td>
<td></td>
<td>▲ 47</td>
</tr>
<tr>
<td>Steel: Iron reduction with Biomass*</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>Syngas: Catalytic steam reforming – optimized catalysts (digital/AI)</td>
<td></td>
<td>▼ -68</td>
</tr>
<tr>
<td>Syngas: Dry reforming of methane with CO₂ to CO-rich syngas*</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>Hydrogen: Electrolysis to replace SMR (grid electricity)*</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>Hydrogen: Electrolysis to replace SMR (PPA)</td>
<td></td>
<td>▲ 261</td>
</tr>
<tr>
<td>Hydrogen: SMR + CCS for blue hydrogen production</td>
<td></td>
<td>▲ 16</td>
</tr>
<tr>
<td>Methanol: Methanol with Electroylsis (grid electricity)</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>Methanol: Methanol with Electroylsis (PPA)</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>Olefins/ethylene: Steam crackers with E-furnace (grid electricity)</td>
<td></td>
<td>▲ 2,779</td>
</tr>
<tr>
<td>Olefins/ethylene: Steam crackers with E-furnace (PPA)</td>
<td></td>
<td>▲ 452</td>
</tr>
<tr>
<td>Olefins/ethylene: MTO Ethylene/propyl. via methanol from syngas*</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>Olefins/ethylene: MTO Ethylene/propyl. via electrolytic syngas*</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>Chlor-Alkali: Chlor-Alkali Electrolysis – PPA</td>
<td></td>
<td>▼ -550</td>
</tr>
<tr>
<td>Cement: Clinker production (gas-fired, calcin. without CCS)</td>
<td></td>
<td>▲ 36</td>
</tr>
<tr>
<td>Cement: Clinker production (gas-fired, calcin. with CCS)</td>
<td></td>
<td>▲ 110</td>
</tr>
<tr>
<td>Cement: Clinker production efficiency</td>
<td></td>
<td>▲ 20</td>
</tr>
<tr>
<td>Cement: Clinker-to-cement with electricity (grid) + material conversion efficiency</td>
<td></td>
<td>▼ -1</td>
</tr>
<tr>
<td>Cement: Clinker-to-cement with electricity (grid) + energy efficiency</td>
<td></td>
<td>▼ -104</td>
</tr>
<tr>
<td>Cement: Clinker-to-cement with electricity (PPA)</td>
<td></td>
<td>▼ -554</td>
</tr>
<tr>
<td>Cement: Cement-to-concrete injecting liquid CO₂*</td>
<td></td>
<td>n.a.</td>
</tr>
</tbody>
</table>

*No direct reduction of level 1 / level 2 CO₂ emissions

**Source:** Accenture Analysis
Important cost inhibitors currently still stand in the way of full industrialization of certain key technologies such as green hydrogen, although costs in that area are dramatically decreasing:

- Large, fossil-fuel-based investments at the beginning of their lifecycle have to pay off before green/renewable replacements can be found. For certain technologies—e.g., blast furnaces in steel manufacturing—conventional fuels can already be replaced partially by hydrogen to produce clean(er) steel and contribute to emissions reduction.
- The pace of efficiency gains achieved during the fourth energy transition is unparalleled: prices of wind power and PV have dropped significantly with PV prices falling 80 percent in the last 10 years alone. In 2015, wind power undercut coal for the first time and turbines have nearly tripled in power output since then (largest turbine in 2015: 5GW; largest in 2020: 14GW). Such investment opportunities should not be missed again as we continue the current energy transition into the hydrogen economy, e-fuels and energy storage.
- Projections show that the levelized cost of energy (LCOE) of hydrogen will drop by more than 60 percent over the next 10 years, making hydrogen use cases increasingly competitive versus incumbent solutions (See figure 13).

**Figure 13: Hydrogen production costs from solar and wind vs. fossil fuels**

![Graph showing hydrogen production costs](image)

**Note:** Remaining CO₂ emissions are from fossil fuel hydrogen production with CCS. Electrolyser costs: 770 USD/kW (2020), 540 USD/kW (2030), 435 USD/kW (2040) and 370 USD/kW (2050). CO₂ prices: 50 USD/tn (2030), 100 USD/tn (2040) and 200 USD/tn (2050).

**Source:** IRENA
Uncertainty around new technologies has always contributed to the phase-in and phase-out of energy sources. We can learn from previous energy transitions (e.g., from coal to oil) and show that changes in demand and consumption reduce uncertainty around technology and further accelerate learning curves around technologies. In the meantime, uncertainty around the future of coal is increasing, signaling its phase-out. Wind power and hydrogen are becoming established cornerstones in energy supply, and uncertainty around hydrogen should be lower with cost reduction projections on the horizon (See figure 14).
7. Significant value to be unlocked for European industrials by 2030
Massive value can be unlocked through decarbonizing the heavy industries in Europe.

Despite the uncertainty of future prices for CO₂ emissions and green electricity, Accenture analysis supports the position that, with most realistic scenarios, the annual net value of industrial decarbonization will nearly double between 2020 and 2030 (from €98bn to €202bn), and then stabilize by 2040 (See figure 15).

**Figure 15: Total net value evolution by solution**

Total net value evolution by solution (best in class*) in bn EUR

- **Efficiency**
  - Switch to Gas: +107%
  - CCS/CCU: -18%

- **Renewables**
  - Hydrogen (scenario 1): +278%

- **Hydrogen**
  - CCS/CCU: +327%

*Including best-in-class solutions with positive value only

Source: Accenture Analysis
Accenture’s industrial decarbonization model

However, the value to be unlocked will strongly depend on what technology options are chosen to replace the incumbent solutions. To compare the different new technology options—each with its own pros and cons—Accenture developed an industrial decarbonization model quantifying the net value of each new technology option in comparison to the incumbent solution. The net value consists of multiple components:

- **Levelized added cost (EUR)** of the new technology compared with the incumbent solution (including annualized capex over the asset lifetime, as well as the annual costs for material/feedstock, O&M and energy/fuel costs).
- **Non-energy related CO₂ emission reduction** potential (tn CO₂) versus the incumbent solutions—e.g., emissions from production processes.
- **Energy-related CO₂ emission reduction** potential (tn CO₂) compared with the incumbent solution.
- **CO₂ price** (EUR/tn CO₂) from fuel combustion or CO₂ intensity of the generation mix behind the used electricity.

As a result, the total levelized cost increase or levelized cost savings (EUR) are compared with the avoided CO₂ costs (EUR), resulting either positive net value in a given year (e.g., the new technology is more valuable than the incumbent technology, suggesting a rationale to switch) or negative net value (the new technology is less valuable than the incumbent).

In the next step, we then ranked the new technology solutions by their net value for each of the individual incumbent solutions and selected the “best in class” by case. Finally, the best-in-class solutions were aggregated into a mutually exclusive annual total net value across the industries to depict the total value at stake.

Different scenarios depicting total net value are based on two key scenario variables:
- CO₂ price: varying between 35 and 50 EUR/tn CO₂
- Green electricity price: wholesale electricity price from wind or solar, varying between 15 and 30 EUR/MWh

**Methodology details**

Accenture’s decarbonization value modeling, based on more than 3,000 input datapoints, analyzes the cost reduction potential from applying new energy technologies in selected heavy industrial sectors in Europe. The model addresses expected changes in industrial sector supply and demand (tons of steel, cement and chemicals; tkm of industrial road freight; m² of building heating) and the impacts in energy consumption (coal, oil, gas, heat, electricity) while comparing selected technology solutions (e.g., hydrogen-powered iron reduction) based on the production costs, energy costs and emission costs to estimate the most attractive alternative to incumbent energy technologies (e.g., coal-fired steel production).
Best-in-class technologies

To better understand the emerging trends, Accenture then categorized the best-in-class technologies with similar characteristics, moving ahead in two steps.

Step 1: “No regrets” solutions
Today’s leading solutions in industrial decarbonization, with proven financial value in multiple sectors, will continue to play a major role over the next decade.

Efficiency: Midsize and maturing.
Efficiency improvements in industrial processes can make an impressive difference in both costs and emission reductions, but are likely to reach limits in the long term, with the processes starting to reach an optimized level of efficiency. Continued focus on increasing interoperability between industrial processes and collaboration across internal functions will facilitate further unlocking of value.*

Switch to gas: Valuable but stagnating.
The move to natural gas from more carbon-intensive technologies is especially prominent in power generation (from coal-fired to modern gas-fired baseload generation) and steel production (gas-fired facilities using, e.g., Midrex technology provide competitive options especially with potentially increasing CO₂ prices. However as a fossil fuel, natural gas may not see long-term growth in comparison to zero-carbon solutions, which enjoy the advantage of decreasing technology costs while being decoupled from the increasing CO₂ prices.

Definitions of solutions

• **Efficiency**: reducing consumption (e.g., energy or materials).
• **Switch to gas**: for example, replacing coal, oil or petrol with natural gas (as material or feedstock).
• **CCU/CCS**: capturing and storing CO₂ emissions underground, or using them as feedstock for materials.
• **Basic electrification without decarbonisation**: replacing industrial processes requiring physical combustion of fossil fuel (e.g., coal, natural gas or oil) with processes using electricity from the grid based on the average power generation mix.
• **Renewable power**: electrification using electricity from renewable sources (e.g., wind or solar through PPAs), or replacing average grid electricity with electricity from renewable sources for existing electrified processes.
• **Hydrogen**: Replacing industrial fossil-fuel feedstock (e.g., oil with hydrogen), or replacing fossil-fuel-based hydrogen production processes with green electrolysis based on renewable energy sources.

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* *Together Makes Better – How To Drive Cross-Function Collaboration* (Accenture Industry X.0, 2019/2020)
Step 2: “Next-frontier disruption” solutions
Emerging technologies which have mostly not yet reached their break-even point of financial attractiveness depending on multiple factors including CO₂ prices and energy prices.

Carbon capture and utilization (CCU) and carbon capture and storage (CCS): Selective technology.
Reaching positive net value by 2030, carbon capture utilities and storage are losing in competitive advantage in multiple industries to renewable power and hydrogen when considering both cost and emissions reduction advantage. However, relevance remains in selected areas such as cement clinker production where an integrated CCS facility not only captures carbon from the fuel combustion but also in the calcination process.

Basic electrification without decarbonisation – Limited Net Value.
Simply electrifying processes may reduce the direct fossil-fuel combustion, but will ultimately increase emissions without a shift to renewable power (given share and CO₂ intensity of fossil fuels within the current energy-source mix). Especially in higher process heat use-cases, the total avoided final CO₂ costs may not justify the switch to relatively cost-intensive electrification only – but will require a direct switch to fully renewable electrification (see next solutions).

Renewable power: Big and maturing.
There is significant potential, because of sheer scale, for renewable power (Basic electrification without decarbonisation + renewable power supply) to replace fossil-fuel-powered processes with zero-carbon electricity—including also those using CCU/CCS—providing in the future both absolute cost advantage and emissions reduction.

Hydrogen: The next big thing.
In industrial operations alone, the move to hydrogen presents a major opportunity, with potential scale of CO₂ reduction similar to switching to gas by 2040, while providing more value in the market. In an extended hydrogen scenario 2, including non-industrial buildings replacing 10 percent of the natural gas-based heating needs with hydrogen by 2030 to 2040, both value and CO₂ reduction potential are huge.

By comparing the solutions over the timeframe of 2020 to 2040 for both their net value and their potential CO₂ emission reduction, we observed multiple patterns for scaling and growth (See figure 16).
Figure 16: Overview by solutions (best in class)

Notes:
- Hydrogen scenarios:
  - Scenario 1: building heating only including industrial sector (CO₂ savings from replacing natural gas)
  - Scenario 2: building heating also including residential and commercial sectors
- Only best in class technology alternatives (to remain MECE), including positive business cases only

Source: Accenture Analysis

European industrial decarbonization
Winning technologies

Looking into the best-in-class solutions by industrial process in more detail sheds light on the actual technologies behind these (See figures 18/19.) Checking the most likely winning technologies for 2030 by industrial processes, the dominant solution “renewable power” demonstrates the high value of low-cost, zero-emission wind and solar energy.

- **Switching the source of electricity** in already electrified industrial processes from traditional average grid electricity into zero-carbon electricity is particularly attractive. These processes include steel manufacturing (Electric Arc Furnace, or EAF) used in areas such as direct reduction iron (DRI) and steel recycling, supplied by a power purchase agreement (PPA) with wind- or solar-park operators. The switch is also possible for chlor-alkali electrolysis, where the current process is still largely based on electricity from the average power generation mix.

- **A full green electrification** through a leapfrog from fully non-electrified processes to electrification of processes with green power may mean no major disadvantage in net value—for example, replacing incumbent gas-/oil steam crackers for olefins production with a steam cracker with an e-furnace powered by green electricity.

- Finally, **greenifying power generation** itself plays a critical role in the move to renewable energy. While replacing the bulk of baseload coal generation will continue to require gas-fired power plants, a substantial part could be replaced by for instance offshore wind combined with battery storage. This could come with no financial disadvantage, considering the avoided costs of CO₂ emissions. Also, during most times of the year, traditional gas-fired peaker power plants can face stiff competition from offshore wind combined with local battery storage, driven by rapidly decreasing costs for these technologies.

A key winning technology area involves **green hydrogen**, which can unlock major business value by replacing steam methane reforming in the hydrogen production process itself, whilst unlocking reductions in energy and process-related CO₂ emissions for a range of applications, including:

- Heavy road transport of industrial goods is likely to profit from FCEV (fuel cell electric vehicle) technology by replacing diesel and natural gas with engines powered by hydrogen.
- Hydrogen for heating promises emissions reduction with hydrogen replacing part of natural gas used in heating industrial buildings alongside process heat.
- Also, in the iron reduction during steel manufacturing, H₂ can replace coal as the reducing agent, compared to the established coke/coal-based reduction blast furnace in the alternative route producing direct reduced iron (DRI).
- Finally, hydrogen provides an attractive long-term power storage option for large-scale renewables (thereby avoiding current production losses), reducing curtailment beyond what can be enabled by battery storage that is limited to just four to five hours.

In addition to generating value in each segment, decarbonization can also reduce the exposure to mostly imported fossil-fuel commodities by 35 percent (Coal, 81%; natural gas, 12%; oil, 100%).
Green hydrogen — a cornerstone of industrial decarbonization

Accenture’s research shows, that all carbon-neutral strategies of heavy industrials are closely tied to green hydrogen.

Although the production of green hydrogen has historically been seen as a bottleneck, significant technical, commercial and regulatory progress is being made. At a recent European hydrogen event, the CEO of a world-leading electrolyser company made the comment that if people are still concerned about green hydrogen CAPEX costs, then they clearly need to update their financial models.

Through our work with green hydrogen players across the world, we would strongly agree. Commercial applications are rapidly emerging on the global stage, and many industrial-scale projects have been initiated in the past year, targeting significant scale in the next decade (See figure 17).

“Although we have never historically engaged in our own supply of commodities for our production, we are considering entering the hydrogen supply business, producing in low production cost countries (e.g., Africa/Middle East) for transport into Southern Europe.”

Accenture Study Group Executive
Figure 17: Examples of European green hydrogen projects significantly scaling over the next decade

**Port of Rotterdam**

Several cross-industry partnerships/initiatives focused on replacing the production of grey hydrogen at the Port of Rotterdam

**Project #1 partners:** Port of Rotterdam, TKI Energy & Industry. Others include Nouryon, Shell, Yara, OCI Nitrogen, Gasunie, DOW Chemical, Ørsted, Frames, ECN, the University of Utrecht and Imperial College London

**Project #2 partners:** Port of Rotterdam, Nouryon, BP

**Target produced renewable fuel per annum**

-4x

>1.000MW

2025 2030

**Source:** Company and project websites, press releases

**Norsk e-fuel**

Europe’s first commercial plant for hydrogen-based renewable aviation fuel

**Project partners:** Sunfire GmbH; Climeworks AG; Paul Wurth SA and Valinor

-10x

10m litres

100m litres

2023 2026

**Westküste 100**

Cross-industry partnership to develop the hydrogen economy on the west coast of Schleswig-Holstein in Germany

**Project partners:** EDF Germany, Holcim Germany, OGE, Ørsted, Raffinerie Heide, Stadtwerke Heide, thyssenkrupp Industrial Solutions, Thüga, Region Heide development agency and the Westküste University of Applied Science

-23x

700MW

30MW

2025 2030

**Sidebar // Green hydrogen as a critical enabler of industrial decarbonization**
## Figure 18: Best-in-class alternative technologies, 2030

<table>
<thead>
<tr>
<th>Technology tradition</th>
<th>Technology alternative “winner”</th>
<th>Emission reduction in mn tn CO₂ (%)</th>
<th>Marginal abatement cost (Eur/tnCO₂) Excl. avoided cost of CO₂</th>
<th>Net value (bnEUR) Incl. avoided cost of CO₂ (Eur/tn CO₂)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transport</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry ICE road heavy duty (diesel)</td>
<td>Industry FCEV/hydrogen fueled road heavy duty</td>
<td>77  100%</td>
<td>-743</td>
<td>61</td>
</tr>
<tr>
<td>Coal-fired generation – existing</td>
<td>Gas-fired baseload generation – new</td>
<td>365  80%</td>
<td>-36</td>
<td>31</td>
</tr>
<tr>
<td>Coal-fired gen. – existing (replaceable by offshorewind + battery)</td>
<td>Wind offshore + battery storage to replace part of coal</td>
<td>445  100%</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Coal-fired gen. – existing (replaceable by utility-scale solar + battery)</td>
<td>Solar utility-scale + battery storage to replace part of coal</td>
<td>159  100%</td>
<td>26</td>
<td>4</td>
</tr>
<tr>
<td>Gas-fired baseload generation – existing</td>
<td>Wind onshore gen. (no storage) to replace gas</td>
<td>161  100%</td>
<td>-58</td>
<td>17</td>
</tr>
<tr>
<td>Gas fired peaker generation</td>
<td>Wind offshore gen. + battery storage</td>
<td>18  100%</td>
<td>-776</td>
<td>10</td>
</tr>
<tr>
<td>Gas fired peaker generation (seasonal storage needs)</td>
<td>Wind offshore gen. + hydrogen storage (seasonal storage use only)</td>
<td>0  100%</td>
<td>-326</td>
<td>0</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal-fired generation – existing</td>
<td>Gas-fired baseload generation – new</td>
<td>365  80%</td>
<td>-36</td>
<td>31</td>
</tr>
<tr>
<td>Coal-fired generation – existing</td>
<td>Gas-fired baseload generation – new</td>
<td>445  100%</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Coal-fired generation – existing</td>
<td>Gas-fired baseload generation – new</td>
<td>159  100%</td>
<td>26</td>
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</tr>
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</tr>
<tr>
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<td>-776</td>
<td>10</td>
</tr>
<tr>
<td>Gas fired peaker generation (seasonal storage needs)</td>
<td>Wind offshore gen. + hydrogen storage (seasonal storage use only)</td>
<td>0  100%</td>
<td>-326</td>
<td>0</td>
</tr>
<tr>
<td><strong>Building heating and lighting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry building heating with gas/process heat</td>
<td>Industry building heating recovery in ventilation/aircon</td>
<td>37  25%</td>
<td>-82</td>
<td>5</td>
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<tr>
<td>Industry building heating with gas after best efficiency</td>
<td>Industry building heating with gas with 10% H₂ incl. best efficiency</td>
<td>15  10%</td>
<td>69</td>
<td>0</td>
</tr>
<tr>
<td>Industry building lighting – power conventional</td>
<td>Industry building lighting – modernized</td>
<td>0  15%</td>
<td>-713</td>
<td>0</td>
</tr>
<tr>
<td><strong>Steel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal-fired steel production (BFO)</td>
<td>Steel recycling EAF (grid electricity)</td>
<td>84  50%</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Steel production from iron (BOF)</td>
<td>DRI EAF (PPA)</td>
<td>0  0%</td>
<td>-3523</td>
<td>6</td>
</tr>
<tr>
<td>Steel production before efficiency</td>
<td>DRI EAF (PPA)</td>
<td>0  0%</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Coal-fired steel recycling</td>
<td>Steel recycling EAF (grid electricity)</td>
<td>90  95%</td>
<td>121</td>
<td>-6</td>
</tr>
<tr>
<td>Coal-fired steel recycling (grid electricity)</td>
<td>Steel recycling EAF (PPA)</td>
<td>5  67%</td>
<td>-550</td>
<td>3</td>
</tr>
<tr>
<td>Coal-fired steel DRI (coal reduced)</td>
<td>Iron reduction – H₂ based (in the iron blast furnace)</td>
<td>54  52%</td>
<td>47</td>
<td>0</td>
</tr>
<tr>
<td><strong>Chemicals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMR – catalytic (syngas production)</td>
<td>Catalytic steam reforming – optimized catalysts (digital/AI)</td>
<td>30  15%</td>
<td>-68</td>
<td>4</td>
</tr>
<tr>
<td>SMR – catalytic (hydrogen production)</td>
<td>Electrification to replace SMR (PPA)</td>
<td>100  100%</td>
<td>-13</td>
<td>100</td>
</tr>
<tr>
<td>Methanol production with Syngas + catalyst</td>
<td>Methanol with Electrolysis (PPA)</td>
<td>0  0%</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Steam cracker – oil-fired (olefins)</td>
<td>Steam crackers with E-furnace</td>
<td>4  100%</td>
<td>452</td>
<td>-2</td>
</tr>
<tr>
<td>Steam cracker – oil-fired (ethylene)</td>
<td>MTO Ethylene/propyl. via methanol from electrolytic syngas (PPA)</td>
<td>0  100%</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Chlor-Alkali Electrolysis (grid electricity)</td>
<td>Chlor-Alkali Electrolysis – PPA</td>
<td>23  100%</td>
<td>-550</td>
<td>14</td>
</tr>
<tr>
<td><strong>Cement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinker production without efficiency</td>
<td>Clinker production (coal-fired), calcine with CCS</td>
<td>109  69%</td>
<td>51</td>
<td>0</td>
</tr>
<tr>
<td>Clinker production</td>
<td>Clinker production efficiency</td>
<td>0  1%</td>
<td>-467</td>
<td>0</td>
</tr>
<tr>
<td>Clinker production</td>
<td>Clinker-to-cement with electricity (PPA)</td>
<td>4  100%</td>
<td>-554</td>
<td>2</td>
</tr>
<tr>
<td>Cement-to-concrete traditional</td>
<td>Cement-to-concrete injecting liquid CO₂</td>
<td>1  27%</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Key lever**
- Renewable power
- Efficiency
- Hydrogen
- Switch to Gas
- CCU/CCS

**Source:** Accenture Analysis

**Total FOSSIL-FUEL DEPENDENCE**
-35%

**Total Value at Stake**
+202 bn EUR
Figure 19: Tipping points by technology alternatives

Year in which net value of alternative technology exceeds incumbent technology

Based on Net Value considering levelised production and energy costs, and an assumed CO2 price of 50 EUR/tnCO2 for 2030 and 2040. Estimated averages for Europe, while likely variance between individual countries.

Source: Accenture Analysis
Sensitivity to external factors

Indeed, it is important to note that the overall net value of industrial decarbonization is sensitive to external market drivers. According to Accenture scenario modeling, a change in CO₂ emission prices has an overall strong proportional impact on the total net value. The net value is also highly sensitive to changes in oil prices and industrial production volumes while, on the other hand, price changes for natural gas do not seem to have an impact on the total net value in the same proportions. Further decreases vs. currently projected prices for green electricity also have only a minor impact, while higher-than-expected prices for green power will disproportionately influence the business case for green hydrogen production, and accordingly the overall net value associated with industrial decarbonization (See figure 20).

Demand-side decarbonization: The need for business model innovation

A fundamental drop in process output is one of the most effective levers for net value, indicating a significant role for demand-side decarbonization. This presents both a threat and an opportunity. Reducing demand is inherently cannibalizing current value pools. However, astute energy transition navigators recognize that managing the sensitivity of value calls for business model innovation in enabling the following:

- Expanded participation in the circular economy.
- Shift toward service-orientated business models where commercial models are not primarily driven by quantity consumed, but instead are also focused on helping customers drive efficiency and building an ecosystem of services around their products.
- Downward integration into activities of value for end-customers.

Figure 20: Sensitivity of decarbonization value to external factors

Impact on 2030 total Net Value (bn EUR impact) from 20% increase/decrease in selected factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Increase (20%)</th>
<th>Decrease (20%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ price (EUR/tnCO₂)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green electricity price (EUR/MWh)</td>
<td>-34%</td>
<td>6%</td>
</tr>
<tr>
<td>Oil price (USD/barrel)</td>
<td>-12%</td>
<td>12%</td>
</tr>
<tr>
<td>Natural gas price (EUR/mmbtu)</td>
<td>-3%</td>
<td>3%</td>
</tr>
<tr>
<td>Industrial transportation demand (tkm)</td>
<td>-5%</td>
<td>5%</td>
</tr>
<tr>
<td>Industrial process output (tn*)</td>
<td>-9%</td>
<td>9%</td>
</tr>
</tbody>
</table>

* steel/cement/chemicals production output, also affecting parts of power generation

Source: Accenture Analysis
8. Impact of industrial decarbonization on European industrials’ supply chains
As we continue supporting our clients with industrial decarbonization and the broader energy transition, we will explore the implications across a variety of topics.

In a subsequent paper, we will explore the broader strategic implications across threats and opportunities, and what this means for the future of European industry’s business models. We will do this based on our experiences and inside perspectives from discussions with industrial executives. As part of this first report, however, we will focus on the implications for supply chains and the implications of this initial modeling exercise.

Supply chain emissions are on average 5.5 times higher than a corporation’s direct emissions (See figure 21). Reducing this will be key to achieving a meaningful industrial decarbonization effort.

From our interviews of leading industrial executives, we identified two key decarbonization themes related to supply chains:
• Driving transparency around supply chain emissions
• Working with supply chains to reduce emissions
Driving transparency around supply chain emissions

Currently, mandatory reporting requirements are limited, and focused only on scope 1 emissions, with no mandatory reporting of scope 2 and 3 emissions (See figure 22). Instead, companies may choose to voluntarily disclose such emissions.

As Peter Drucker once wrote, “If you can’t measure it, you can’t improve it.” Mandatory emissions reporting has proven to be an effective measure for forcing emission measurement and, in reverse, providing the transparency to industrials about where to most effectively work on their emissions footprint. Consider, for example, the US’s Environmental Protection Agency’s GHGRP program, which mandated emissions reporting for carbon-intensive factories. As Figure 23 shows, the program led to a meaningful drop in emissions vs. unregulated firms.\(^{16}\)

---

**Figure 22: Overview of current European emissions reporting requirements**

<table>
<thead>
<tr>
<th>Category</th>
<th>Name</th>
<th>Industry</th>
<th>Direct</th>
<th>Indirect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voluntary</td>
<td>CDP</td>
<td>All</td>
<td>•</td>
<td>optional</td>
</tr>
<tr>
<td></td>
<td>TCFD</td>
<td>All</td>
<td>•</td>
<td>optional</td>
</tr>
<tr>
<td>Mandatory</td>
<td>EU ETS</td>
<td>Utilities, industry, aviation, etc.</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-Financial Reporting Directive</td>
<td>All large public-interest companies with more than 500 FTE(^{18})</td>
<td>optional</td>
<td>optional</td>
</tr>
</tbody>
</table>

**Figure 23: Introduction of EPA GHGRP**

![Graph showing drop in emissions](image-url)
Although the EU has its Non-Financial Reporting Directive (NFRD), it too loosely defines reporting requirements in its current form. A European Securities and Market Authority study found that out of 1,000 EU companies, a third did not report GHG emissions (See figure 24).\(^\text{17}\)

A consultation of the NFRD is underway. We believe that reporting of Scope 1-3 emissions must be mandated. From our conversations with industry, many executives are focused on significantly increasing visibility into their supply chain emissions over the next five years.

In delivering on this, Accenture sees a clear need to drive transparency and make emissions reporting easier in supporting:
- Transparency around progress of companies in decarbonizing their products/services relative to the rest of the industry.
- Development of carbon taxation and incentive systems that reward industrials actively pursuing decarbonization, both in terms of operations and supply chains.
- Companies’ voluntary and/or mandatory disclosures across scope 1-3 emissions.
- Development and adoption of an admin-light European-wide carbon disclosure labelling initiative.

Current methods to calculate Scope 2 and Scope 3 emissions rely upon assumptions made using estimated data or relying on each company reporting their emissions in a consistent manner for the data to be useful.

---

**Figure 24: Alliance for Corporate Transparency results on GHG emissions disclosure (in %)**

<table>
<thead>
<tr>
<th>Scope 1</th>
<th>GHG emission total</th>
<th>GHG emission intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>31</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td>59</td>
<td>5.8</td>
</tr>
<tr>
<td></td>
<td>66.3</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>28.4</td>
<td>1.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scope 2</th>
<th>GHG emission total</th>
<th>GHG emission intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>42.7</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>48.8</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>83.8</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>12.8</td>
<td>0.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scope 3</th>
<th>GHG emission total</th>
<th>GHG emission intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>65</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>26.5</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>92.7</td>
<td>2.34</td>
</tr>
</tbody>
</table>

- No information
- KPI aggregated
- Isolated examples / Qualitative description
- KPI disaggregated for country
A limiting factor is that this data is not maintained by any central authority or on any central repository. Today’s supply chains are operating in the dark just as businesses, consumers and regulators are demanding greater oversight into supply chains—from ethically sourced goods to low-carbon products. Far greater information is sought to enable businesses and consumers to make informed choices about where they source their products.

Being able to store this data in a secure and auditable central repository—whilst simultaneously maintaining its openness for inspection by business, consumers and regulators—will be key to ensuring that the data contained within is used effectively to drive businesses forward to a lower-carbon future (See figure 25 on page 55).

Such a system would enable manufacturers to map end-to-end supply chain journeys to share with customers to demonstrate the origin, transportation and processing that has occurred for the end-product, as well as its associated carbon cost. Consumer-facing web or mobile applications can be created to allow customers to quickly and easily visualize the data on offer. This additional information unlocks new possibilities for manufacturers to market goods created from low-carbon supply chains as premium products in the market.

Conveying this data in an easy-to-understand format is key, and we strongly believe that efforts should be made to create a simple and universal carbon-labeling initiative that provides an at-a-glance view of the carbon produced, whilst minimizing the data collection and analysis efforts of each individual company.

### Working with supply chains to reduce emissions

As industrials increasingly face pressure to reduce scope 3 emissions, industrials are working with their supply chains to reduce their carbon footprint. In driving a meaningful decarbonization, efforts must be accelerated, both across the existing supplier base, and for new suppliers.

#### New suppliers

New suppliers can be screened and incentivized appropriately using two key measures:

1. **Supplier pre-qualification**
   In managing supplier risk, pre-qualification is a procurement norm. However, only a small number of supplier pre-qualifications adequately assess the carbon footprint of potential suppliers. We see a clear role for the adoption of the ISO 14020 series in helping suppliers signal a meaningful commitment to sustainability, in helping industrials manage their sustainability risk.

2. **Appropriate commercial model with KPIs**
   We see it as important to establish a commercial model from the outset which incentivizes not only continuous cost improvement and innovation, but also penalizes suppliers who fail to reduce the carbon footprint associated with their product/service supply (per mutually agreed-upon scaling).
Existing suppliers
Although it is relatively easy to adjust vetting of new suppliers, partnering with existing suppliers to drive down Scope 3 emissions brings a unique set of challenges. Often there are long-term supply agreements, where driving down carbon emissions would not be mutually accepted without price renegotiation.

As and when supply agreements come up for renewal or renegotiation, we believe that companies will need to:

- Add in renegotiation triggers should CO\(_2\) prices vary outside of a pre-defined range/scale.
- Incorporate carbon footprint as part of the negotiations, agreeing upon baseline and then an annual scope 3 CO\(_2\) reduction target for the product that must be met.

Prior to this, we believe that government will need to play another meaningful, but temporary, role in correcting for the current market failure which enables companies to not internalize the cost of their carbon footprint. The form of this is clearly in the purview of policy makers, although our thoughts are that companies would be forced to report on their CO\(_2\) emissions per unit of product/service, being incentivized to deliver reductions against this baseline over the subsequent three to five years.

The challenge will be that in certain industries, this incentivization will not be enough, requiring either cost absorption, or pass-through of cost to customers. In the buyers’ value survey referenced earlier, consumers are willing to pay a slight premium for a low carbon footprint. We are a strong advocate of carbon product-labeling initiatives in supporting partial pass-through.

However, we also feel that efforts are currently too fragmented, leading to confusion and significant duplication of effort (failing to leverage economies of scale). Moreover, there are often complaints that the certifications criteria are being diluted, leading to increasing criticism of the value of obtaining certain certifications. There are 231 European eco-labeling initiatives being tracked by Ecolabel Index as of October 2020.

In addition to working with suppliers to decarbonize, we also predict an increase in the use of corporate carbon offsetting activities to simply offset supply chain emissions. Energy companies such as BP, Shell, and Eni have made significant commitments, with Shell investing about $300 million in forestry over the next three years. Shell sees this as not only a way to meet climate targets, but also as a new business opportunity.

“We believe that, over time, we will be building a business, because these carbon credits will become more valuable as carbon becomes more constrained.”

Maarten Wetselaar, Shell’s director of gas and new energy

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8. Impact of industrial decarbonization on European industrials’ supply chains

53 European industrial decarbonization
Figure 25: A potential blockchain-based ecosystem for total carbon management
9. Recommendations
In the previous chapters we looked at the impacts of decarbonization on European industrials, not only from a value perspective, but also from a supply chain point of view. In this chapter, we’ll look at what companies can do in response.

As part of our discussions with executives for this paper, numerous executives commented that they are ready and able to drive change, but that they need political actors on the team who can create an environment for success.

It will be important both for the leaders of industrials and for government leaders to be in sync on this complex transition and to support the transition with required predictability around future cost developments.

There is no simple or single solution to decarbonization. Innovation and collaboration between the sectors will be critical, along with a multi-faceted approach. Working in partnership, the sectors can deliver an accelerated—and value-generating—industrial decarbonization.

**Actions to be taken by European industrials could include**

1. **Accelerate action:** Take a step-wise approach and start taking immediate action today. Focus on driving efficiency within existing operations, whilst actively exploring new business models (See figure 26).

**Figure 26: Accenture’s step-wise industrial decarbonization approach**

**STEP 1:**
No regrets (2020)
Invest in today’s leading industrial decarbonization solutions to free up cash-flow for investment in next frontier disruption

**STEP 2A:**
Pivot to next frontier disruption (2020–2030)
Make first moves into emerging technologies through cross-industry collaboration and learning through new ventures

**STEP 2B:**
Scale the next frontier disruption (>2030)
Mass-scale adoption of next frontier technologies to unlock the full $200BN per year opportunity

Source: Accenture Analysis
2. **Adopt new technologies now:** Many energy-intensive processes have technologies with lifecycles that will outlive the target years of climate neutrality aspired to by the European Union. To effectively decarbonize, companies must be adopting new technologies now as part of new CAPEX that offers long-term profitability (See figure 27).

3. **Understand where you are compared to the rest of your industry:** Start benchmarking against industry peers and leaders to identify areas for improvement.

4. **Adopt more expansive carbon pricing initiatives:** Most companies already consider carbon pricing as part of major investment decisions. However, this is only the first concrete step. Companies will next face two paths, either (a) allocating carbon costs to departments/business units based on emission generation; or (b) implementing an internal carbon fee which is to be applied to the procurement of any products or services.

Regarding carbon fees, several key principles and considerations should be kept in mind:
- Revenues will be ring-fenced for a decarbonization investment fund. Also consider a potential allocation into some form of ‘strategic supplier decarbonization fund’ whereby select suppliers receive reimbursement for emission reductions.
- The carbon fee may be used as a basis for negotiations with suppliers. Regardless of the contract value decrease that may be negotiated, the full carbon fee must be passed through into the decarbonization investment fund.
- Such an initiative will need to be phased in over time because prospective suppliers will need to start calculating emission footprints for their products and/or services.

5. **Pursue joint investments and alliances across the value chain:** Cross-value chain alliances and investments can facilitate meaningful reduction of Scope 3 end-use emissions by aligning incentives across the value chain to co-develop innovative, multi-partner solutions.

- In driving pressure for adoption across existing and prospective suppliers, cross-industry leaders should commit to adopting internal carbon fees along the same timelines.
6. Review and enhance supplier pre-qualification: Supplier prequalification and contracting approaches must be reviewed to ensure that everyone is working with a decarbonization-minded supply base interested in driving down their carbon footprint as part of the supply chain.

7. Self-disrupt and think beyond adjacencies: The sale of commodity products will start to give way to a climate-neutral, usage and service-based economy. Successful navigators will be those that realize the new business models emerging out of:
   - Industry convergence—e.g., the provision of syngas and H₂ for further downstream utilization and energy storage.
   - Digitization of value chains and deploying increasingly sophisticated analytical capabilities to further understand and monetize data.
   - Demand-side management sometimes being the less expensive decarbonization measure than investing in supply-side decarbonization. Decarbonizing through a more demand-side driven approach requires a focus on helping customers design more efficient products, materials and buildings. Naturally, this risks cannibalizing your market. However, carefully crafted business models not only delight your customers and help them with their decarbonization journey, but also deliver higher margins.

As and when supply agreements come up for renewal or renegotiation, companies will need to:
- Add in renegotiation triggers should CO₂ prices vary outside of a pre-defined range/scale.
- Incorporate carbon footprint as part of the negotiations, agreeing upon baseline and then an annual Scope 3 CO₂ reduction target for the product that must be met.

Many companies are committing to increasing their ESG supplier audits. Rather than focusing on conducting internal audits of their suppliers, we recommend cross-industry collaboration in developing public/private sector cross-industry signaling mechanisms to avoid having each company duplicate efforts. We recommend the development and adoption of a single European-wide carbon labeling initiative with a standardized audit process.

### Figure 27: Operating lifetimes of individual goods and technologies built in 2020

<table>
<thead>
<tr>
<th>2030 sector targets</th>
<th>Climate neutrality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential house</td>
<td>June 2050</td>
</tr>
<tr>
<td>Heating system</td>
<td>July 2050</td>
</tr>
<tr>
<td>White goods</td>
<td>October 2050</td>
</tr>
<tr>
<td>Natural gas network</td>
<td>November 2050</td>
</tr>
<tr>
<td>District heating</td>
<td>December 2050</td>
</tr>
<tr>
<td>CHP plant</td>
<td>January 2060</td>
</tr>
<tr>
<td>Steam cracker</td>
<td>February 2060</td>
</tr>
<tr>
<td>Blast furnace</td>
<td>March 2060</td>
</tr>
<tr>
<td>Steam boiler</td>
<td>April 2060</td>
</tr>
<tr>
<td>Private car</td>
<td>May 2060</td>
</tr>
<tr>
<td>Utility vehicle</td>
<td>June 2060</td>
</tr>
<tr>
<td>Truck</td>
<td>July 2060</td>
</tr>
</tbody>
</table>

Source: Agora Energiewende, 2020
8. **Ensure appropriate governance in enabling value-acc cretive innovation:** Successful players have established a strong innovative intrapreneurial culture and innovation governance, enabling them to pivot to new opportunities ahead of their industry peers.

9. **Adopt a customer-centric mindset:** In our work with industrials, we continue to be impressed by new product innovations. However, many European industrials are still yet to adopt a key thing – a true customer-centric mindset. We often see a focus first on the revenue and operations, with the customer as an after-thought. This must change so that customer insight drives the whole process based on conversations with real customers, understanding why customers behave in a certain way, rather than taking secondary research statistics at face value. Through this, it can be understood that the unresolved needs of customers that can be solved for, without being constrained by current research definitions or market offerings.

**Public and private sector collaboration: A critical success factor in decarbonization**

We have described a variety of actions that the private sector should consider on this journey toward decarbonization. For successful outcomes, the public sector’s role is also critical. Without robust action from the public sector, industrials will be at competitive risk, given the twin burdens of necessary investments and the uncertainty of the pace and scope of technological innovation.

It will be important for governments and industrials to be in sync on this complex transition. At the core of the challenge: industrials need predictability on costs through thoughtful framework that will alleviate some of the transition costs and prevent “carbon leakage”—in which industrials leave the EU or lose business because the energy transition undermines their competitiveness in internationally traded goods.

Targeted public-sector intervention in the areas listed below could, on their own or in combination, help to accelerate industrial decarbonization:

- Implementing a framework that ensures companies are able to successfully internalize carbon’s hidden cost;
- Designing policies that avoid penalizing first-movers;
- Setting a precise and robust carbon price mechanism with a significant base price, increasing predictably over time as a guide to technological innovation and investment;
- Establishing a framework for emissions reporting in all three scopes for all industries where company revenue and/or number of employees exceeds a certain threshold;
- Exploring a European product carbon-labeling standard, akin to that run by the Carbon Trust;
- Leveling the playing field through a carbon border tax to compensate against competing imports from outside the EU—that is, incorporating any hidden costs and thereby preventing carbon leakage;
9. Recommendations

- Evaluating the potential of quotas to increase the use of low-carbon cement and steel for construction and infrastructure projects, as well as to scale up chemical recycling and circular polymers;
- Stimulating the hydrogen economy on both the supply and demand side through a broad set of measures, including quotas and tax breaks;
- Consolidating and integrating national and regional funding mechanisms into a streamlined single application process.

We believe the private and public sectors, working collaboratively, can deliver an accelerated—and value-generating—industrial decarbonization

“There is a competitive advantage in Germany, where industrials pursue intertwined innovations across value chains (given physical proximity of industry). To take advantage of this, both German and European regulators need to take urgent action.”

Study Group Executive

“We see the US as a highly competitive country for green steel production. Unless European regulators take rapid action, we fear that Europe will lose its competitive advantage.”

Study Group Executive
10. Looking ahead
As we’ve advocated throughout this document, we see industrial decarbonization in Europe as a significant opportunity for both energy producers and industrial energy consumers. In this paper we have assessed the dynamics at play from a technology, investment and supply chain perspective.

The question of how industrials can seize upon this opportunity should be an item at the top of the CEO agenda. There has never been more public support—nor more urgency on the part of companies and governments—for an energy transition.

The time to act is now.
### Table 1: Industry study group

<table>
<thead>
<tr>
<th>Industry</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cement HeidelbergCement</td>
</tr>
<tr>
<td>2</td>
<td>Cement LafargeHolcim</td>
</tr>
<tr>
<td>3</td>
<td>Chemicals Air Liquide</td>
</tr>
<tr>
<td>4</td>
<td>Chemicals Borealis</td>
</tr>
<tr>
<td>5</td>
<td>Chemicals Covestro</td>
</tr>
<tr>
<td>6</td>
<td>Chemicals Evonik</td>
</tr>
<tr>
<td>7</td>
<td>Chemicals INEOS Group Holdings</td>
</tr>
<tr>
<td>8</td>
<td>Chemicals Johnson Matthey</td>
</tr>
<tr>
<td>9</td>
<td>Chemicals Linde AG</td>
</tr>
<tr>
<td>10</td>
<td>Chemicals LyondellBasell Industries</td>
</tr>
<tr>
<td>11</td>
<td>Chemicals / Energy BASF &amp; Wintershall Dea</td>
</tr>
<tr>
<td>12</td>
<td>Energy Royal Dutch Shell</td>
</tr>
<tr>
<td>13</td>
<td>Energy BP</td>
</tr>
<tr>
<td>14</td>
<td>Energy Eni</td>
</tr>
<tr>
<td>15</td>
<td>Energy Equinor</td>
</tr>
<tr>
<td>16</td>
<td>Energy OMV</td>
</tr>
<tr>
<td>17</td>
<td>Energy Repsol</td>
</tr>
<tr>
<td>18</td>
<td>Energy Total</td>
</tr>
<tr>
<td>19</td>
<td>Steel ArcelorMittal</td>
</tr>
<tr>
<td>20</td>
<td>Steel Norsk Hydro</td>
</tr>
<tr>
<td>21</td>
<td>Steel Salzgitter AG</td>
</tr>
<tr>
<td>22</td>
<td>Steel ThyssenKrupp</td>
</tr>
<tr>
<td>23</td>
<td>Steel Voestalpine</td>
</tr>
<tr>
<td>24</td>
<td>Utilities E.ON</td>
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<td>25</td>
<td>Utilities Electricité de France</td>
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<td>Utilities Enel</td>
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<td>Utilities Engie</td>
</tr>
<tr>
<td>28</td>
<td>Utilities RWE</td>
</tr>
<tr>
<td>29</td>
<td>Utilities Uniper</td>
</tr>
<tr>
<td>30</td>
<td>Utilities Vattenfall AB</td>
</tr>
</tbody>
</table>
Accenture assessed the implications of a carbon tax on European industries, estimating that a carbon-price floor of about 30 EUR/MT on European industrial emissions could be an effective starting point.

IEA (2020). Final energy consumption includes all energy used in end-use sectors. It excludes energy industries themselves as well as energy transformation. Industry sub-category includes all industry consumption excluding energy used for industrial transport or non-energy uses (e.g. in the chemical industry).


https://www.energy.eu/publications/a07.pdf


See Appendix Table 1: Industry study group for entire list of companies


https://www.cleanenergywire.org/factsheets/germanys-national-hydrogen-strategy


EU rules on non-financial reporting only apply to large public-interest companies with more than 500 employees. This covers approximately 6,000 large companies and groups across the EU, including listed companies, banks, insurance companies and other companies designated by national authorities as public-interest entities (https://ec.europa.eu/info/business-economy-euro/company-reporting-and-auditing/company-reporting/non-financial-reporting_en)


Accenture assessed the implications of a carbon tax on European industries, estimating that a carbon-price floor of about 30 EUR/MT on European industrial emissions could be an effective starting point.
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