

Creating Drivers for Green Development

Evonik Industries AG

I. China

i. Green development is a new driver for economic growth.

The transformation of old and new growth drivers of the economy is an important way to guarantee the high-quality development of China in the new era. Green development can become an important driving force for economic growth by overcoming resource and environmental constraints.

Investment, consumption and foreign trade continue to be the growth engines of China's economy, while becoming more sustainable, innovative and intelligent. The return on green investment is a triple surplus, with economic, social and ecological benefits. China's awareness of sustainable consumption has begun to increase. Enterprises carry out the ecological footprint assessment on a regular basis, which forces suppliers, manufacturers and logistics providers to place high demands on green management. The emergence of green barriers to international trade also puts higher demands on the supply chain management of Chinese enterprises. Technological innovation during the process of green development results in new added value and thus brings new momentum for economic growth.

ii. The green evolution is the inevitable route and the driver for sustainable growth for the petroleum and chemical industry in China.

Forming a resource-saving, environment-friendly, intrinsically safe and green development mode is an imminent must for the industry. The emergence of green chemical industry also provides enormous opportunities to drive the rapid development of China's chemical industry. The development of strategic emerging industries as new pillar industries, the conversion to new modes of manufacturing, the public's strong desire for improved ecological environment and the shift of consumer demand toward individualization and better quality all trigger the requirements for green, safe, cost-effective, differentiated, and high-end chemical products. This is win-win for both the consumers and the industrial manufacturers.

iii. The petroleum and chemical industry in China is making efforts to transform for green development and upgrade conventional drivers.

CPCIF (China Petroleum and Chemical Industry Federation) released in 2017 the *Six Action Plans for the Green Development of the Petroleum and chemical Industry (2017–2020)*. It aims at establishing a long-term mechanism for boosting the green development of the industry through reasonable layout, high-end products, resource conservation and clean production. Priorities were formulated for wastewater treatment, waste gas treatment, solid waste treatment and disposal, energy conservation and low carbon, safety management enhancement as well as the green development of petroleum and chemical industry parks.

In 2018, energy conservation in the petroleum and chemical industry in China achieved remarkable results. The energy consumption per 10,000 yuan of

industrial added value and the comprehensive energy consumption per unit of key products continued to decline. The comprehensive energy consumption of crude oil processing in 2017 decreased by 0.44% year-on-year.

However, the total consumption of the whole industry is still large, and the task of green and sustainable development is quite arduous. Driven by combined efforts, the industry's economic operations kept improving its quality and efficiency. In years 2017 and 2018, the sales revenue of China's petrochemical industry increased by 15.8% and 13.6% respectively, and the total profit achieved a year-on-year growth of 52.1 % and 32.1 % respectively. Promoting energy conservation and environmental protection remains one of the top priorities of the petroleum and chemical industry in China for 2019.

II. Germany

i. Scoring with sustainability.

For the chemical industry in Germany, this means using energy and resources efficiently and saving energy through new technologies and climate-friendly products. The chemical and pharmaceutical industry in Germany is a strong and innovation-oriented core sector with more than 450,000 employees, which has excellent long-term prospects. This is partly due to the fact that chemical companies in Germany recognized the opportunities offered by digitalization and a circular type of economy, and are implementing them. Both of these developments are current drivers for even higher sustainability in the sector.

Germany is the world's fourth largest research location for the chemicals and pharmaceuticals sector: 6 percent of worldwide R&D expenditure is made in Germany. No other country in Europe is as innovation-oriented in the chemical industry: More than 60 percent of German chemical companies are actively engaged in research. The external trade balance for research-intensive products is positive and increasing. Innovative solutions are in demand, particularly in the area of climate protection. If the global climate protection targets of the Paris Agreement are to be met, realistic pathways are needed for reducing CO₂ emissions. In the chemical sector in particular, expectations for climate protection are high: The sector is expected to make its production less CO₂-intensive and, in the long-term, even greenhouse-gas neutral. The German chemical industry has already achieved much here. While production increased by 69 percent between 1990 and 2017, CO₂ emissions declined by 48 percent. That the sector has nearly halved its greenhouse gas emissions since 1990 is a remarkable achievement, particularly in view of the fact that production volumes rose by more than two thirds over the same period. Chemical products are already saving considerably higher amounts of greenhouse gases than arise from their production. With further savings, this saving factor could be doubled by 2030 in relation to 2005. Despite rising production, since the year 2000 the chemical industry has been able to significantly reduce the volume of waste to be disposed of.

ii. The German chemical industry should contribute to resource efficiency and climate protection in customer industries.

Companies are increasingly making good on this commitment. Innovative products from the chemical industry are helping to boost agricultural yields to provide the growing global population (expected to reach 10 billion in 2050) with high-quality nutrition. Ever more powerful products are contributing by their use toward saving more CO₂ emissions. Examples here are materials for lightweight construction, insulating materials, and new materials for energy storage. High-performance polymers are the materials of the 21st century. They conserve resources and save energy: As lightweight construction materials they allow fuel savings in transport; they revolutionize advances in medicine because their use in medical devices allows a number of innovations; and used as thermal insulation in construction they lead to savings in energy and emissions. In addition, they have high recycling potential and can so become part of an efficient circular economy.

Not least, the chemical industry should develop alternatives to the current, largely fossil, raw-material base (oil, natural gas) to reduce also those greenhouse gas emissions arising from products at the end of their life cycle. German business, research, and industry are working jointly toward these goals. Complete relinquishment of carbon cannot be the goal for the chemical industry, whose products are overwhelmingly based on carbon-containing raw materials.

Carbon and its compounds are, and will remain, the material base for production. The aim is greenhouse gas neutrality. To approach this goal, recirculation of carbon is becoming increasingly important. This is achieved by, for example, the re-use of carbon through various recycling methods, and also by stronger focus on the use of non-fossil resources. Noteworthy in this regard

are, for example, the many and varied approaches to using renewable raw materials, particularly in biotechnological processes. Another example is the use of CO₂ as a direct carbon source for production of organic chemicals.

iii. German chemistry is also in the forefront of the digital revolution.

Digitalization is nothing new: Many companies have already automated their production by digital control. But now an increasing number of companies are also establishing digital business models. Big Data, the use of mass data, is opening up new opportunities for the chemical industry including more focused research, more efficient production, and the possibility of faster development of solutions for customers' wishes. Companies today are not restricted to merely linking up their own internal operational processes: Increasingly, they are also able to network digitally with customers to collaborate with them more successfully. This is why German chemical companies plan to invest one billion euros in digitalization projects or new digital business models over the next five years; this is in addition to the several billion euros invested annually for the development of resource-conserving innovations. Digitalization and economical use of scarce resources are closely linked and allow further advances in the circular economy. The circular economy is a focus of EU policy. It encompasses several approaches, including the establishment of material cycles. Big Data and digitalization are of help here: In the future, for example, more and more information will be collected over the entire life cycle of products. This can be utilized by recyclers of these products, for example, to recover raw materials.

Digitalization is, first and foremost, an opportunity to boost resource efficiency. Resource efficiency in production is an important factor in the competitiveness of a company: Only those who use increasingly scarce resources as economically and efficiently as possible can remain competitive over the medium term. At the same time, resource efficiency presents a challenge for the future. All over the world, the issue arises of equitable access to raw materials and, most importantly, the extent of the environmental burden that the earth can bear.

Digitalization helps companies introduce new environmentally compatible and resource-efficient production technologies, and to design their processes effectively and efficiently with the aid of intelligent control engineering. The recording and analysis of digital data streams enables predictive maintenance in large-scale industrial plants. This makes it easier to control plants optimally, monitor them in real time, and maintain them with minimal time investment. In the future predictive maintenance will be established as the technical standard in large-scale production plants.

If real-time information is available, individual production processes and entire value chains can be regulated so that capacities are optimally utilized and consumption of materials and energy reduced. The potential is vast: Experts predict an overall productivity increase of up to 50 percent in the years ahead. And needs-based production also offers more opportunities for preventing waste.

The supply chain also benefits from digitalization, which allows comprehensive networking of material, energy, and information streams and

promotes sustainable business even beyond the boundaries of the company. Digital sales platforms allow for simple, transparent transactions and so improve operational procedures.

III. At Evonik, sustainability is closely tied up with operational business.

For us as a globally active specialty chemicals company, responsibility and long-term business success are two sides of the same coin. Evonik's products and solutions have for many years contributed to sustainable development. In this way we're helping to meet increasing demands for sustainability from the markets.

At the same time, we're further developing our business opportunities in these markets, because at Evonik sustainability has long since developed into a driver of innovation and growth. This is why Evonik is beginning to evaluate in monetary terms the impacts of its business activities along the entire value chain. We've set ourselves an ambitious goal: We want to be the best specialty chemicals company in the world. To achieve that, we will measure ourselves against the best—in all our businesses, and in all areas where we're not yet right at the top. That applies to our goal of achieving above-average earnings margins in our markets, but it applies equally to our claim of being a sustainable solutions provider for a wide range of important future issues.

Over the years Evonik has continuously developed the sustainability analysis of its portfolio. The aim is to render visible, and reliably quantify, the efficiency gains, relative reductions in emissions, and other improvements along the value chain that are made possible by the use of Evonik products.

The result confirms that Evonik today already generates about 50 percent of its sales revenues from products that have been proven in application to contribute to improved resource efficiency. These include, for example, materials for lightweight construction in vehicles, system solutions for wind and solar energy plants, amino acids for animal nutrition, oil additives for hydraulic oils, and functional silanes for surface protection of buildings.

To further reduce Evonik's ecological footprint, we're continuously optimizing our processes along the entire value chain. We give importance to using alternative raw materials and biotechnological processes where this is possible and meaningful.

Evonik has set itself ambitious environmental targets for the period up to 2025: reduction of greenhouse gas emissions by 50 percent relative to base year 2008, and reduction of greenhouse gas emissions from the upstream value chain by 15 percent relative to base year 2020. Already by 2016, Evonik had achieved the target, envisaged for the period 2013–2020, of a 12 percent reduction in greenhouse gas emissions. With the setting of a revised and absolute reduction target, Evonik is reaffirming its commitment to the resolutions of the Paris Climate Agreement. The relatively short period up to 2025 reflects the fact that any additional technological and political developments cannot be foreseen today. To reduce carbon footprint in the upstream value chain, Evonik is relying particularly on continuous improvement in the carbon footprint of its raw material base. In addition, Evonik is introducing an internal CO₂ price of €50/t CO₂ as a relevant indicator for economic assessment of investments. The aim is to be able to globally model developments in CO₂-intensive investments

with durations of 10 or more years more reliably, and in a standardized way, for all investment proposals.

Evonik reports on its sustainability activities openly and transparently and is successfully assessed in international ratings and rankings.

IV. Evonik is a founding member of the Together for Sustainability initiative.

Good sustainability management does not begin only with our own products and production processes: Through our purchase volume alone, we have considerable impact on our social and ecological environment. Harmonization of global standards in the supply chain creates transparency and makes it easier for suppliers as well as customers to estimate and assess sustainability performance. For this purpose, the chemical industry established the Together for Sustainability (TfS) initiative in the year 2011. The other founding members, apart from Evonik, were BASF, Bayer, Henkel, Lanxess, and Solvay. Since then, Akzo Nobel, Arkema, Brenntag, Borealis, Clariant, covestro, DSM, DuPont, Eastman, IFF, Merck, Sanofi, syngenta, UPM, and Wacker have also joined the initiative.

The goal of TfS is the joint development and implementation of a global assessment and audit program for responsible procurement of goods and services. In this context TfS contributes toward making environmental and social standards in supply chains evaluable and systematically improving them. In the year 2017 the member companies initiated 441 audits and about 1,800 assessments

worldwide. As a member of the initiative, Evonik itself undergoes Tfs reviews; in 2017 it received a “gold” rating, placing it among the top-rated suppliers.

In 2016 Tfs and CPCIF signed a framework agreement to jointly promote and improve the sustainability of supply chains in China. Thanks to intensive cooperation between Tfs and CPCIF, Yantai Wanhua Chemicals becomes the first Tfs member in China in the beginning of 2019.

V. Policy recommendations

i. China

Undoubtedly, green has become the main color of the 13th Five-Year period and China’s economy will follow the path to a green, intelligent and high-end future. To promote the smooth and efficient economic development, we shall elaborate on the combined effects of various favorable factors such as policies, capital, and technology, as well as joint efforts from the government, academia, enterprises and the public.

The enforcement of laws needs to fall into place to encourage better environmental legal compliance.

China’s environmental laws and regulations system is increasingly sound and complete, and the organizational structure keep reforming toward optimization. The state has issued a series of environmental supervision, inspection and accountability systems.

More efforts should be made to ensure that related regulations, various measures and obligatory standards are effectively implemented. This is an important aspect to create a fair business environment for competition.

A classified environmental supervision system could be established based on the environmental credits of enterprises. Punishment for environmental violations needs to be even more intensified. When legal compliance and corporate integrity become the common practice, the pressure on environmental supervision could be better relieved, and environmental protection and economic growth can complement each other.

Strong incentives need to be provided for supporting green transformation.

Instead of administrative measures, economic instruments might play a better role in environmental management and regulating responsible behavior. The price of the traditional energy resources does not fully reflect the social costs of resource scarcity and environmental impact. The price-forming mechanism needs to be rationalized in order to create a fair market for promoting the development of new energy. China should further facilitate market mechanism for ecological protection such as trading systems for energy conservation, carbon and pollutants emission rights, and should promote third-party governance of environmental protection. Local administrations should be given more appropriate authority to formulate flexible fiscal and taxation policies that suit local conditions, in order to balance between long-term environmental goals and short-term local economic impacts. For instance, the establishment of green development funds by governments at all levels will increase

investment in green industries. Green financing incentives might be effective catalysts to motivate industrial leaders in improving energy efficiency and reducing emission. Incentives should be established to encourage adopting environmental friendly production processes, technologies and green innovations. A green economy will yield tangible returns and achieve the transition to a healthier and more sustainable growth model.

Accelerate the green transformation in key areas, such as agriculture and traditional industries.

The green development of agriculture, e.g. vigorous development of biogas, replacement of chemical fertilizers, recycling of agricultural membrane, making good use of feed additives, etc., could leverage considerable green investment and improvement in the ecological environment. For traditional manufacturing industries such as petroleum and chemicals, there is huge space for technological transformation gradually moving toward green.

Close cooperation across industries and the long-term vision and guidance of the government will be essential to reshape the industrial chain, supply chain and value chain.

Enterprises should actively promote a variety of technological progress to accelerate the pace of green transformation while seizing the opportunities of green development. Corporate environmental responsibility needs to be further strengthened. More resources and preferential policies should be allocated to increase support for green products, green factories and green industry parks. An industrial system of green, circular and low-carbon development should be

fostered in a wider range where green value-added could be generated along the entire industrial chain from up- to downstream and covering all fields of end applications.

When investment in environmental protection is truly linked to economic benefits, enterprises with comprehensive advantages in green technology, capital and business models will stand out in competition. Prioritizing the ecological environment will force industrial transformation and upgrading and achieve high-quality development with improved efficiency and new vitality.

Participation by the general public needs to be further improved.

Despite increasing awareness of ecological protection, it has not yet been translated into effective environmental protection actions of the public. For instance, even in the capital Beijing, although the city was among the first group of pilot cities for garbage sorting and processing in China 16 years ago, its current garbage classification status is not yet satisfying.

The country should strengthen the capacity building of environmental groups and civil organizations, and use well-designed policies, proactive technical support, innovative operation modes and educational measures to inspire the spirit of self-discipline, volunteer initiatives and environmental ethics.

Sustainable consumption patterns need to be vigorously promoted to encourage the purchase of renewable and eco-friendly alternatives. The consumption upgrading will create more space for development, stimulate the formation of green production methods and lifestyles, and become a sustained source in

cultivating new growth drivers for building a resource-saving and environment-friendly society.

ii. Germany and Europe

Under the Paris Agreement, the German chemical industry supports an ambitious global climate protection program. The industry also supports the EU target of an 80-95 percent reduction in greenhouse gas emissions by the year 2050—which contributes toward attainment of the internationally agreed long-term Paris goals. The chemical industry is working toward attaining national, European, and international climate-protection targets by developing innovative technologies and products and continuously improving its own methods and processes. Climate policy must be consistent and reliable so as not to undermine these achievements of the companies, and also to allow the greatest possible flexibility in the means by which the long-term targets are achieved.

The German Climate Protection Plan 2050 defines target ranges for reductions in greenhouse gases in all sectors, including those already regulated by EU emissions trading. In the past decade, the greatest CO₂ reductions have come from industry and power generation: In Europe, these two sectors were able to reduce their greenhouse gas emissions by 24 percent between 2005 and 2016. Sectors such as the chemical industry have been covered since 2005 by EU emissions trading, which is leading to steady further reductions. Sectors like transport, construction, and agriculture, on the other hand, still have a long way to go: Here, emissions decreased by only 8 percent over the period 2005-2016, which is ascribed mainly to inadequate progress in the transport sector. In the

future, these sectors as well should make a stronger contribution toward attaining climate targets. It is exactly in these areas that the use of chemical products could help reduce CO₂ emissions.

The withdrawal from coal-based power generation in Germany is a consequence of the German government's long-term climate protection goals. Even if implemented in stages, it poses a huge challenge to industry. Power plants that currently assure power supply will be out of use by 2022, without adequate grids and storage facilities for renewable energies being available.

In conjunction with other energy-intensive industries, the German Chemical Industry Association (VCI) is lobbying for security of supply and competitive power prices to be given equal consideration: The withdrawal from coal must not lead to higher power prices for industry.

Climate targets can be sustainably implemented only if ecological, economic, and social aspects are all given due weight, that is, the most cost-effective measures are chosen in each case.

The base for this is provided by the market mechanisms proposed in the Paris Agreement, which enable emissions trading between countries and regions and the use of international greenhouse gas emission allowances. These tools should be treated as equivalent options at the national and EU level. Moreover, the G20 nations should work together more intensively toward a global emissions trading system.

The Paris Agreement has not yet created any comparable competitive conditions at the global level. Effective measures against “carbon leakage”—the relocation of production and thus of emissions to regions outside the EU—continue to be imperative, both for EU emissions trading and at the national level.

The challenge of climate change cannot be met by each nation going it alone. For the chemical industry, this means that an industry operating so as to be climate neutral can be envisaged only on the global scale. It is important that other regions of the world also take more concrete steps toward reducing emissions. Climate protection must be organized as efficiently and cost effectively as possible, worldwide. And it must continue to allow growth and increased prosperity.

In the area of education policy as well, there is a need for action—because only the well-educated will find answers for the challenges of the future. The chemical industry in Germany has for many years been lobbying for better science education and for attracting more young people to chemistry.

Good education is important, and not only to stay competitive. It is also an essential requirement for sustainable development: Ecofriendly and efficient handling of natural resources is a key competence of sustainable societies. To create greater awareness in society of resource conservation and resource efficiency and to instill the appropriate culture, these topics need to be more firmly established in schools and universities.

VI. Conclusion

Chemical products and innovations are indispensable at the present time and will continue to be so in the future, indispensable for meeting the global challenges of our time: population growth, climate change, and the legitimate aspiration of all people for prosperity and wellbeing. But the world's natural resources are limited, and we must apply our creativity and innovative power here to be able to meet the challenges with new products. The key competency for the 21st century is sustainability. With its innovative solutions, the chemical industry is particularly well placed to help create a sustainable, climate-friendly future. This means that, as a reliable partner, we complete the tasks we have set ourselves and honor our promises to others. For us, sustainability also always means monitoring how we fulfil our obligations to customers and suppliers, employees and neighbors, politics and society. On this basis Evonik works every day toward becoming even better and more efficient. Because, for Evonik, business success has long gone hand in hand with sustainability. It is an obligation with which we secure not only our own future but also socially, ecologically, and economically balanced progress in our markets.