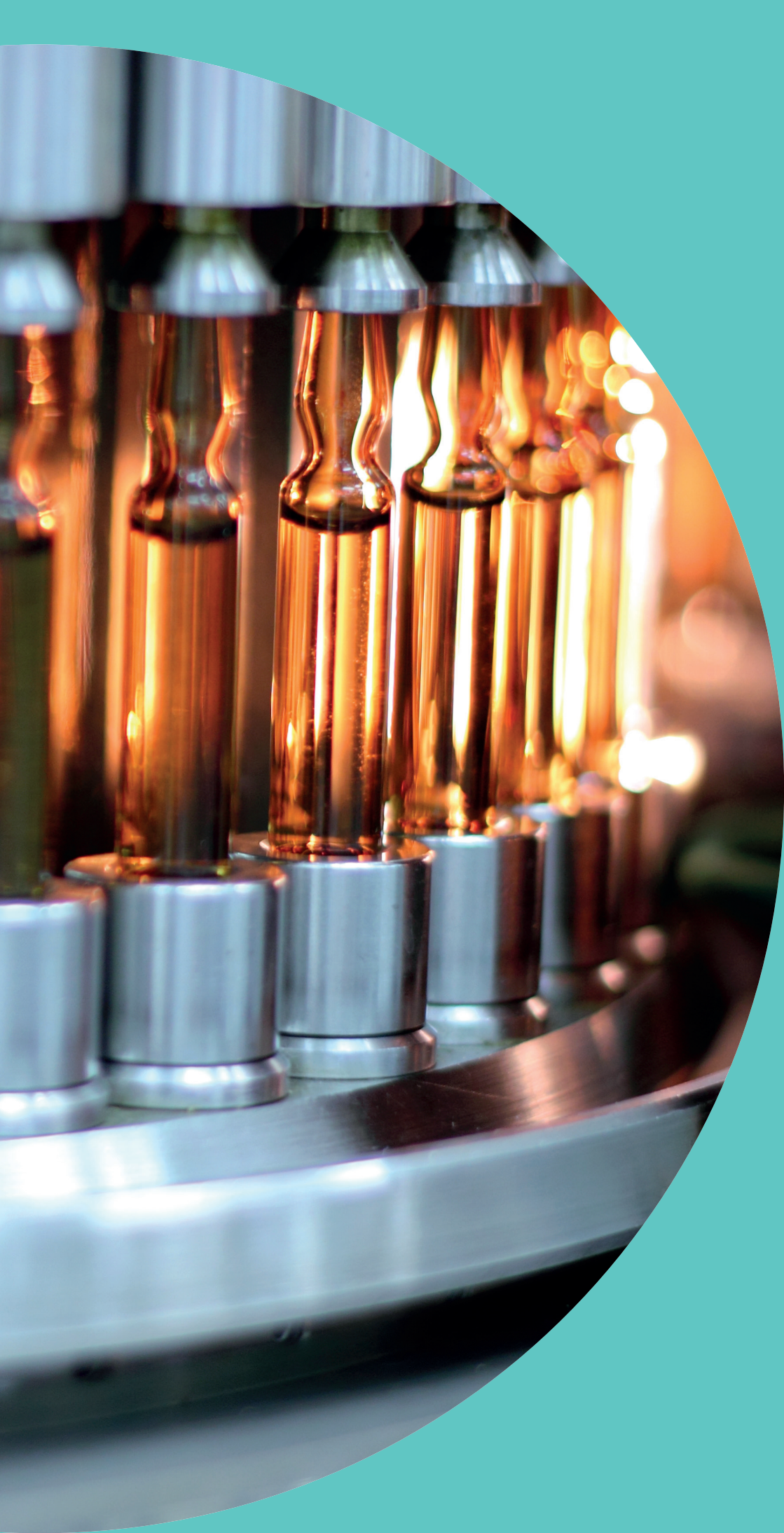




Chemical Sector

SDG Roadmap



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Foreword

There is growing appreciation across the global business community of the immense potential of the Sustainable Development Goals (SDGs) to unleash innovation, economic growth, and development at an unprecedented scale. This potential was clearly captured by the Business & Sustainable Development Commission's flagship *Better Business, Better World* report, which points to US\$12 trillion of additional market value that could be unlocked by 2030 if the SDGs are achieved.

It is also increasingly clear however, that this potential will only be unlocked through pioneering new forms of partnerships, with sector peers coming together to plot new pathways for realizing the transformative ambitions of the SDGs, rallying behind a common 2030 vision for their industries.

In April 2018, WBCSD published a set of *SDG Sector Roadmap Guidelines* detailing a step-by-step methodology for how companies within a given industry can come together and explore their collective potential to advance the SDG agenda.

We are delighted that a number of forward-thinking companies and industry associations from the chemical sector have shown leadership in piloting these guidelines and produced this important Roadmap, which provides direction and support for the sector as it looks to maximize its potential to drive positive impact across the spectrum of the SDGs.

We hope this work will serve as a platform for ongoing collaboration between chemical sector industry peers and wider stakeholder groups, as we seek to realize the unique potential of this sector to drive forward the SDG agenda on the road to 2030.



The road-mapping process that WBCSD's chemical sector members have undertaken exemplifies the type of action-focussed collaboration that will be instrumental in realizing the broad ambitions of the SDG agenda.

Peter Bakker
President and CEO, WBCSD



The SDGs are a priority for the chemical sector and this Roadmap clearly outlines where we can simultaneously unlock significant business opportunities and contribute tremendously in delivering the SDG agenda across the sector and through collaboration with other sectors.

Jean-Pierre Clamadieu
CEO, Solvay



The chemical sector is uniquely placed to drive positive impact across the full spectrum of the SDG agenda. Coming together as a sector helps us to make sure we are maximizing this potential.

Thierry Vanlancker
CEO, AkzoNobel

Contributing companies and associations

Co-chairs	Project members				
 	 	 	 	 	

Executive summary

Purpose

The SDGs present a universal framework that can be used to drive collaboration among industry peers and across sectors, on how to most effectively harness the potential of the private sector to drive sustainable development on the road to 2030. The Chemical Sector SDG Roadmap (Roadmap) is an initiative led by a selection of leading chemical companies and industry associations, convened by the World Business Council for Sustainable Development (WBCSD), to explore, articulate and help realize the potential of the chemical sector to leverage its influence and innovation to contribute to the SDG agenda.

The Roadmap offers a unique and collective vision for the sector on what the key impact opportunities to contribute to its most material SDGs and specific SDG targets are — from product innovation to process improvement through to innovative public-private partnerships. It also outlines tangible actions that the chemical sector may take to accelerate impact in the short-, medium- and long term in the run up to 2030. Finally, the Roadmap also communicates the sector’s willingness to engage with relevant stakeholder groups to promote sustainability throughout the value chain in support of the SDGs.

Audience

This Roadmap is for the chemical sector to help identify potential opportunities for collaboration to enhance SDG impact, and to inspire action from across the industry as a whole. It will also provide a window into the capacity of the chemical sector to contribute to the SDGs for interested groups of stakeholders in other sectors and potentially foster chances for cross-sectoral cooperation.

Method and approach

In the production of this Roadmap the chemical sector has piloted the three-step framework described in the WBCSD SDG Sector Roadmap Guidelines.¹ In doing so, participating companies and industry associations have come together to establish a collective understanding and position around several key factors, including: the sector’s current level of SDG interaction across the value chain; key areas where the sector can make the most transformative contribution to the SDGs; and actions that the sector can take to deliver meaningful SDG impact. The leadership shown by the chemical sector in piloting the *SDG Sector Roadmap Guidelines* has also helped WBCSD to refine this resource, making it more easily applicable and pragmatic to take up for subsequent sectors.

Priority SDGs

The chemical sector is diverse and complex, and as such interacts with a wide number of SDGs. It is also important to note that many interconnections exist across most of the SDGs themselves. Taking these complexities into account, 10 goals were identified as being priority SDGs for the sector.

Impact opportunities and pathways

The Roadmap outlines a series of 18 impact opportunities that the sector has to contribute to the 10 priority SDGs identified. These opportunities have been grouped into five key themes: food, water, people and health, energy, and infrastructure and cities. The Roadmap then proceeds to map out key pathways for how these opportunities can be realized by the sector through various collaborative efforts moving forward. Realizing these opportunities will require a commitment to innovation across:

- **Products** – to address challenges that currently lack a viable solution;
- **Processes** – to improve the way the sector operates; and
- **Partnerships** – to leverage collective resources and drive mutual value propositions.

Road to 2030

This Roadmap highlights the significant role that the chemical sector has to play in realizing the SDG agenda. It also represents an invitation for the entire sector to work together while engaging with suppliers, customers and other stakeholders to maximize SDG impact.

Priority SDGs for the sector

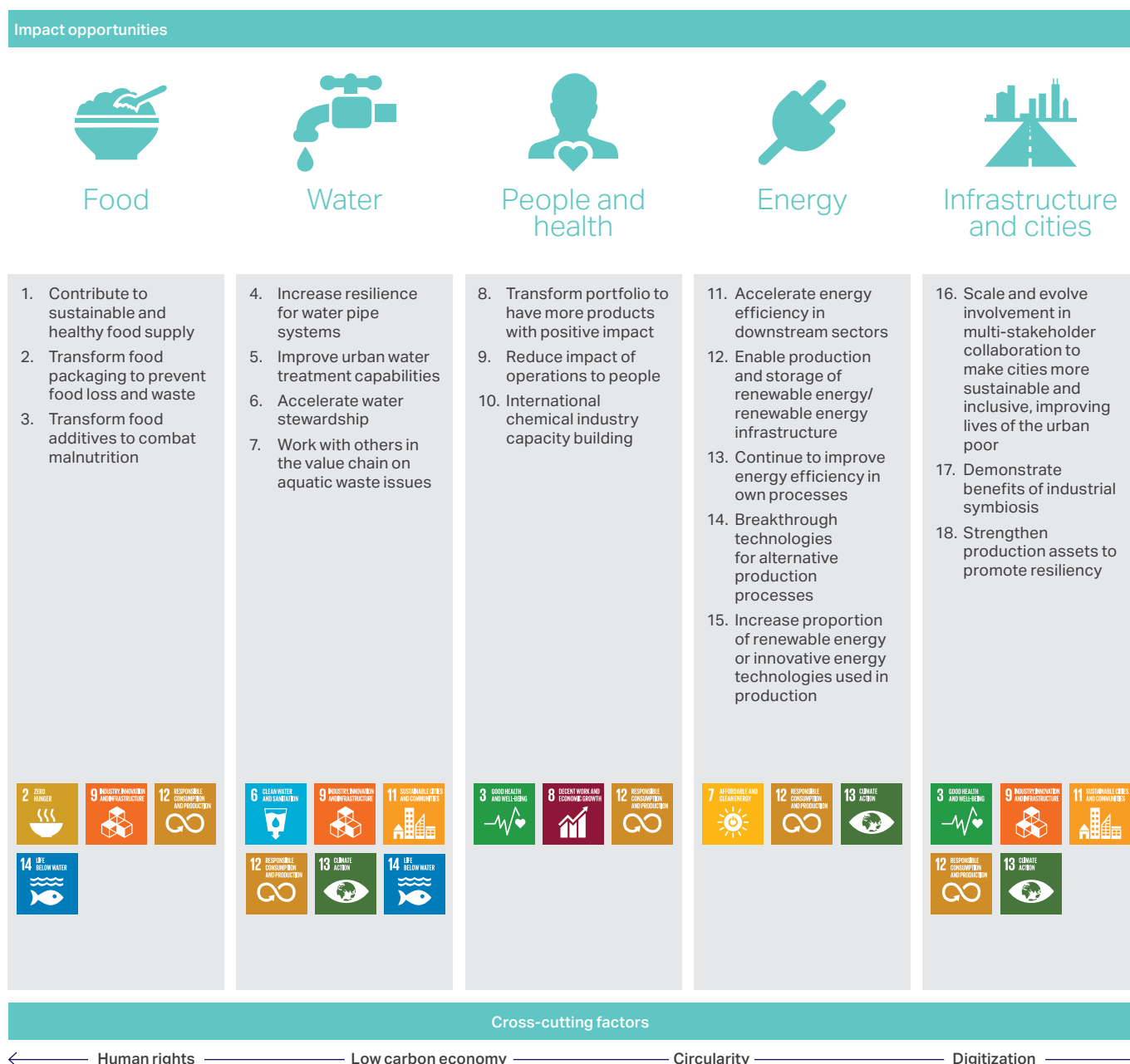
2 ZERO HUNGER	3 GOOD HEALTH AND WELL-BEING	6 CLEAN WATER AND SANITATION	7 AFFORDABLE AND CLEAN ENERGY	8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	11 SUSTAINABLE CITIES AND COMMUNITIES	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	13 CLIMATE ACTION	14 LIFE BELOW WATER

¹ <https://www.wbcsd.org/Programs/People/Sustainable-Development-Goals/SDG-Sector-Roadmaps/Resources/SDG-Sector-Roadmaps>

Moving forward the companies involved in the production of this Roadmap will seek to establish working groups to advance the various impact pathways that have been identified, and set up appropriate frameworks to track and communicate progress.

The contributors to the Roadmap also strongly encourage other companies throughout the sector, and wider stakeholder groups to reach out and get in touch with ideas on how best to align projects or strengthen partnerships that will ultimately accelerate SDG progress.

The following table summarizes the 18 impact opportunities identified across the five themes as well as associated impacts on the prioritized SDGs.





Introduction

What are the Sustainable Development Goals?

In 2015, the United Nations established a set of goals to end poverty, protect the planet, and ensure prosperity for all. Each of these 17 Sustainable Development Goals (SDGs) includes specific targets to be achieved by 2030. Achieving the SDGs requires the efforts of governments, the private sector, civil society, communities and individuals.

What do the SDGs mean for business?

Governments have been tasked with the implementation of the SDGs however, this is an agenda that fundamentally will not be realized without strong engagement by the private sector. Business has a critical role to play in helping to realize the ambitions of the SDGs; as an engine of economic growth and employment; as a source of finance; and as a driver of technology and innovation.

And there's lots to be gained for companies strategically aligning with the SDGs. The goals provide a new cross-sector global framework to translate the world's most pressing needs into business solutions. Companies that are able to deliver inclusive and sustainable products and services in line with these ambitions stand to open up significant market opportunities.

The Business & Sustainable Development Commission's flagship *Better Business, Better World* report points to US\$12 trillion of additional market value that could be unlocked by 2030 if the SDGs are successfully implemented, creating 380 million jobs in the process.

The SDGs can also help companies to analyze and address operational and regulatory risk, and to secure a strong and enduring license to operate.

Why an SDG Roadmap for the sector?

The SDG agenda is ambitious, transformative, and universal. It will not be achieved through incremental change and calls upon all actors to go beyond business as usual to tackle complex societal and environmental challenges. Realizing the ambitions of the goals and unlocking the potential they represent is beyond the reach of any one organization and so calls for innovative new forms of partnerships at scale.


From a corporate perspective, the SDGs present both opportunities and risks. Realizing SDG-related opportunities and effectively managing risks will require innovation and transformative change that incorporates efforts spanning across industry sectors, with individual organizations working together with their peers to tackle obstacles and scale solutions. In this context, the *Better Business, Better World* report underlines the importance of drawing up detailed sector "roadmaps" to guide and support specific industries in their shift towards sustainable development in line with the SDGs.

Embracing these recommendations, the *Chemical Sector SDG Roadmap* (Roadmap) is an initiative led by a selection of leading chemical companies and industry associations, convened by the World Business Council for Sustainable Development (WBCSD), to explore, articulate, and ultimately realize the potential of the sector to leverage its influence and drive innovation that will significantly contribute to the realization of the SDG agenda. The Roadmap identifies areas where the sector can have the most SDG impact and explores key opportunities and pathways to accelerate and optimize this impact on the road to 2030, while also presenting a strong business case for action. The Roadmap is also important as it will provide a means to communicate with potential partners in other sectors and relevant stakeholders on key sustainability activities and initiatives.

Method and approach

In order to develop this Roadmap, nine leading chemical companies and two industry associations formed a dedicated working group, convened by WBCSD. The group took a leadership role in piloting and refining the three-step framework described in WBCSD's *SDG Sector Roadmap Guidelines*. The group worked collaboratively with input from external experts to collectively:

- Map perspectives around the chemical sector's current level of SDG impact at the target-level across the value chain and identify priority SDGs for the sector to address;
- Conceptualize where the sector can collectively make the most transformative contribution to the SDGs, and identify key impact opportunities to drive progress towards realization of the SDGs; and
- Set out a series of key actions for the industry to pursue in the short-, medium-, and long-term with a view to making these impact opportunities a reality on the path to 2030.



Players in all sectors will benefit from developing detailed "roadmaps" to guide their sector's shift to sustainable development in line with the Global Goals.

Better Business, Better World Report
Business & Sustainable Development Commission



Part
1

The chemical sector and the SDGs

Understanding the chemical sector and how it relates to the SDGs

The chemical sector is a four trillion dollar global business, employing more than 20 million people directly and indirectly.¹ Today's world – from the food we consume, the way we travel, the clothes we wear, and the technology we harness – depends on the products of the chemical industry.

Through the responsible production, use, and management of chemicals, the chemical sector can support the SDGs through innovative products and practices that minimize negative impacts, protect the environment, promote social progress, and support economic growth. Many of these principles are already enshrined in the industry's Responsible Care® Program.²

This Roadmap sets out to explore how the chemical sector can contribute to achieving the SDGs through more effectively managing its own operational footprint, working with others to enhance capacities along the value chain, and leveraging its expertise and innovation to unlock new business opportunities that are aligned with the SDGs. This will require action to minimize any adverse aspects while maximizing positive impacts.

The chemical sector at large is a supplier of products and services into virtually every other industry. Due to this, the Roadmap is not an exhaustive overview, but instead describes areas where the chemical sector is uniquely suited to make a considerable and lasting impact.

¹ <https://www.icca-chem.org/about-us/>

² <https://www.icca-chem.org/responsible-care/>

The chemical sector

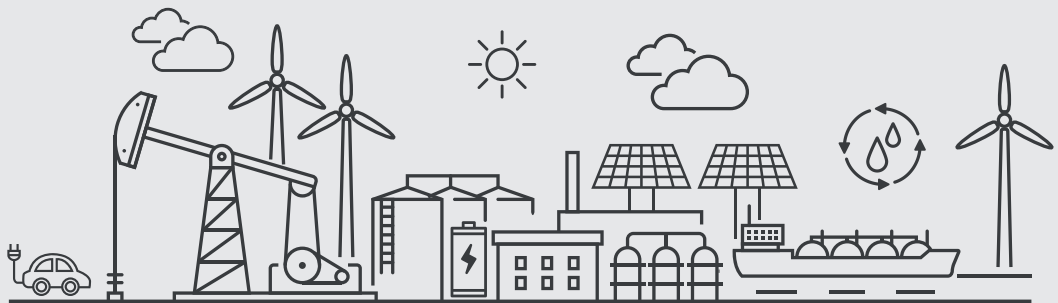
The chemical sector creates an immense variety of products which interact with virtually every aspect of our lives. While many products from the industry, such as detergents, soaps and perfumes, are purchased directly by the consumer, others are used as intermediates to support the development of other products such as foods, plastics, and pharmaceuticals. The complexities of the industry are broadly highlighted in the figure below. The industry uses a wide range of raw materials, from air and plants to minerals and oil. With increasing competition worldwide, innovation remains crucial to finding new ways for the industry to satisfy its increasingly sophisticated, demanding and environmentally-conscious market.

Manufacturers in the chemical sector can be divided into five categories¹:

- **Commodity chemicals.** Companies that primarily produce industrial chemicals and basic chemicals. Including but not limited to plastics, synthetic fibers, films, commodity-based paints & pigments, explosives and petrochemicals.
- **Diversified chemicals.** Manufacturers of a diversified range of chemical products.
- **Fertilizers & agricultural chemicals.** Producers of fertilizers, pesticides, potash or other agriculture-related chemicals.
- **Industrial gases.** Manufacturers of industrial gases.
- **Specialty chemicals.** Companies that primarily produce high value-added chemicals used in the manufacture of a wide variety of products, including but not limited to fine chemicals, additives, advanced polymers, adhesives, sealants and specialty paints, pigments and coatings, and intermediates used in renewable materials and in the food, pharmaceutical and other industries.

¹ <https://www.msci.com/gics>

The chemical sector value chain



Raw materials	→ Basic chemicals	→ Chemical intermediaries	→ Formulated products and product materials	→ Customers of the chemical sector
	<ul style="list-style-type: none"> • Olefins (ethylene, propylene, butylene) • Aromatics (benzene, toluene, xylenes) • Chlor-Alkali (chlorine, caustic soda) • Methanol • Bio-based materials (e.g. sugars, starches, natural oils and acids) • Others (e.g., ammonia, phosphorous) 	<ul style="list-style-type: none"> • Commodities • Differentiated commodities • Technical specialities 	<ul style="list-style-type: none"> • Plastics and Engineering Resins • Extruded films, pipes, profiles, coatings, sheets, foams • Blow-molded parts • Injection molded parts • Composites • Synthetic Fibers • Rubber Products • Paints & Coatings • Adhesives & Sealants • Lubricants • Water Treatment Products • Cleaning Products • Industrial Chemicals • Flame Retardants • Many others... 	<ul style="list-style-type: none"> • Automotive/Transportation • Consumer Products • Packaging • Building & Construction • Recreation/sport • Industrial • Medical • Pharmaceuticals • Personal care • Textiles • Electrical/electronics • Aircraft/aerospace • Food • Bio-based materials

Facts and figures

- The global chemical industry is a

\$4 trillion

enterprise that impacts virtually every sector of the economy. Over 95% of manufactured goods are touched by chemistry.¹

- More than **20 million** people around the globe are employed directly or indirectly by the chemical industry.¹

- The energy savings enabled by chemical products are **double** those required to manufacture them.²

- In 2030 the solutions provided by the chemical industry could reduce emissions by **2.5 GtCO₂e** per year – a reduction equivalent to total emissions from France, Germany, Italy and the United Kingdom combined.³

¹ <https://www.icca-chem.org/wp-content/uploads/2015/09/2015-Responsible-Care-Status-Report.pdf>

² <https://www.icca-chem.org/energy-climate/>

³ https://www.icca-chem.org/wp-content/uploads/2017/11/Ecofys-tryptique_PP.pdf

⁴ <https://www.icca-chem.org/responsible-care/>

⁵ <https://www.icca-chem.org/global-product-strategy-gps/>

⁶ <https://tfs-initiative.com/>

⁷ <http://www.ecovadis.com/library/together-sustainability-chemical-industry-supply-chain/>

⁸ <https://www.wbcsd.org/Projects/Chemicals/Resources/Framework-for-portfolio-sustainability-assessments>

⁹ <https://www.wbcsd.org/Projects/Chemicals/Resources/Social-Life-Cycle-Metrics-for-Chemical-Products>

¹⁰ <https://www.wbcsd.org/Projects/Chemicals/Resources/Life-Cycle-Metrics-for-Chemical-Products>

¹¹ <https://www.wbcsd.org/Projects/Chemicals/Resources/Addressing-the-Avoided-Emissions-Challenge>

¹² <http://web.unep.org/chemicalsandwaste/what-we-do/science-and-knowledge/chemicals-products-cip-programme>

Highlights of innovative chemical sector sustainability initiatives

The sector's approach to sustainability is long-standing. Here are selected examples that demonstrate how the sector is collaborating to tackle sustainability issues.

- Responsible Care[®] ⁴ was first launched in 1985 and is a voluntary commitment by the global chemical industry to drive continuous improvement and achieve excellence in environmental, health and safety and security performance. Responsible Care encourages collaborative work between the domestic and international industry, government, and local authorities to help demonstrate best practices in safe chemicals management around the globe.
- The International Council of Chemical Associations (ICCA) launched the Global Product Strategy⁵ (GPS), in 2006, to advance the product stewardship performance of individual companies and the global chemical industry as a whole. Together with the Responsible Care Global Charter, GPS is the chemical industry's contribution to the Strategic Approach to International Chemicals Management (SAICM). The overall objective of this policy framework, initiated by the United Nations Environment Programme (UNEP), is that by 2020, chemicals are produced and used in ways that minimize significant adverse impacts on human health and the environment. SAICM plans for sound management of chemicals and waste beyond 2020 are now in discussion.
- The Together for Sustainability (TfS) initiative was set up in 2011 by a number of chemical companies with the purpose of developing and implementing a global auditing program to assess and improve sustainability practices within the supply chains of the chemical industry.⁶ 4,500 suppliers have been assessed and 70% of suppliers have improved scores upon evaluation.⁷
- The chemical sector, as a solutions provider, is an enabler of sustainability across value chains. In order to understand the opportunities and levers to reach scale, in 2013, WBCSD chemical sector companies established a "Reaching Full Potential" initiative, which has since published a series of guidance documents including: a framework to help companies assess the sustainability of their product portfolios⁸; guidance to support chemical companies to assess the social impact of their products⁹; and guidance for environmental footprint of products¹⁰. *Addressing the Avoided Emissions Challenge*¹¹, guidelines for accounting for and reporting greenhouse gas (GHG) emissions avoided along the value chain based on comparative studies were also published in 2013 by the ICCA and WBCSD.
- The Chemicals in Products¹² (CiP) Programme is an ongoing activity at UN Environment on the policy and practical facets of access to information on the chemicals contained in everyday products. The multi-stakeholder project developed a voluntary framework in 2015 to improve the exchange of information on chemicals contained in products and proposed cooperative actions to address gaps in the current levels of information access.

Highlights timeline



The chemical sector and the SDGs

The chemical sector is a partner, innovation enabler and solutions provider to essentially all sectors of the economy. The scale and diversity of the industry provide it with widespread opportunities to contribute to the realization of the SDGs by 2030.

The chemical sector can contribute to each of the 17 SDGs in different ways. Some of these are described over the next five pages, which also highlight a number of case studies relating to existing partnerships that are helping to advance specific SDGs. The remainder of this Roadmap will seek to dive deeper and identify the SDGs where the sector has the most potential to drive transformation and innovation focused on lasting SDG impact.



Chemical sector interactions with the SDGs



The chemical sector contributes to economic growth and improvements in the quality of life for people globally. As **responsible employers**, chemical companies provide living wages and benefits to their employees and uphold their supply chain responsibilities. Through **investments and partnerships**, chemical companies make a positive contribution to combating poverty by strengthening and revitalizing communities and improving infrastructure. **Innovative products** directly support affordable and accessible shelter and other basic goods while creating capacity for economic growth in countries most in need.



Human health and safety are among the chemical sector's highest priorities. The industry strives to **minimize negative health impacts** from the exposure to chemicals in the workplace, at home and in the community. Innovations and a commitment to **product stewardship** have increased the availability of products with health and safety benefits while reducing their environmental footprint. This includes accelerated deployment of best practices in safe production, distribution and **management of chemicals in emerging markets** through uptake of Responsible Care. In addition, **medical breakthroughs** and innovative technologies made possible by chemistry provide deeper understanding of the causes of – and better treatments for – medical diseases and ailments, enabling people to **live longer and healthier lives**.



Equitable quality education supports **economic growth**, improved **public health** and more **stable societies**. The chemical sector promotes science education through philanthropic investment and specific initiatives that target certain regions or populations, including **technical apprenticeships** and **programs** which help improve the professional skills of existing and potential employees.



The chemical sector has a key role in supporting a more sustainable food supply that meets the **basic nutritional needs** of a growing global population. Advances in chemistry help **protect plants** from pest infestations, **improve food distribution** channels, extend lifetimes of food and food packaging and maintain food quality and safety. High-yield seeds and fertilizers **increase food production** and slow soil erosion. **Fortified crops** and processed foods help combat malnutrition in areas with limited access to healthy foods.



Case study

Food Reform for Sustainability and Health (FReSH) is a joint program between the EAT Foundation and nearly 40 WBCSD companies, designed to accelerate transformation in the global food system. Through jointly created business solutions, it aims to scale new pathways to reach healthy, enjoyable diets for all, produced responsibly within planetary boundaries.

Several WBCSD chemical companies are founding members of the FReSH initiative highlighting the critical role of the sector in helping to achieve a healthy and sustainable food system.

<http://www.wbcd.org/Projects/FReSH>

The chemical sector and the SDGs continued

Chemical sector interactions with the SDGs

5 GENDER EQUALITY



The chemical sector continues to support the participation, contribution and success of **women** throughout the industry through the implementation of programs and management approaches to advance gender equality. Beyond this, the sector also has the capacity to develop and market products that address women's health and well-being, such as food fortification initiatives.



6 CLEAN WATER AND SANITATION



Access to clean water and sanitation is a global issue that must be managed at a local level and chemistry has an essential role.

Advances in chemistry include disinfectants that kill germs and prevent disease; polymer membrane filters that remove impurities; materials for desalination; and materials for pipes that protect water from its source to the tap. Chlorine-based water disinfectants maintain drinking water quality during storage and distribution.

Innovative piping solutions prevent water loss in operations and supply chains and help transform water distribution networks. Advances in chemical sector **water management** improve water quality by reducing pollution, eliminating improper disposal and minimizing release of hazardous chemicals and materials, reducing the proportion of untreated wastewater and increasing recycling and safe reuse. **Water stewardship** increases water use efficiency and ensures sustainable withdrawal of freshwater. Focused research and development improves **urban water treatment** capabilities through desalination, filters, energy efficient processes and treatment chemicals.



Case study

The WBCSD Pledge for Access to Safe Water, Sanitation and Hygiene (WASH) at the Workplace is an opportunity for companies to contribute concretely to the implementation of SDG 6. A number of leading chemical companies have committed to the WASH Pledge and recognize the business value of investing in a healthier and more productive workforce.

<https://www.wbcd.org/Clusters/Water/WASH-access-to-water-sanitation-and-hygiene/WASH-at-the-workplace-Pledge>

7 AFFORDABLE AND CLEAN ENERGY



The chemical sector is continuously improving energy efficiency in its facilities, and its companies manufacture products that help to improve efficiency for downstream customers and users as well. The chemical sector helps enable **production and storage of renewable energy and renewable energy infrastructure** through the supply of key materials for wind turbines and solar PV panels. Chemistry is also a key component of innovations in carbon capture and storage/utilization technology. Working in partnership with others, the sector is also collaborating on efforts to validate and scale hydrogen cell technologies as a **new chemical carrier for energy** and battery technology, which will help to improve access to new sustainable energy sources.



Case study

To improve consistency on how the chemical sector can assess avoided GHG emissions from chemical processes and products, the ICCA and the WBCSD Chemical Sector project, Reaching Full Potential, formed a taskforce to develop practical guidelines to measure carbon savings. Building on

this work, ICCA completed a study on the maximum potential for annual GHG emissions reduction enabled by the chemical industry using the avoided emissions methodology.

<https://www.icca-chem.org/wp-content/uploads/2015/08/Addressing-the-Avoided-Emissions-Challenge.pdf>

Chemical sector interactions with the SDGs



The **safe production and management of chemicals** is crucial to economic growth and enhancing quality of life for people globally. Innovation provides business opportunities and a sustainable foundation for global growth. Furthermore, **upholding labour standards and respecting human rights** throughout the chemical sector's operations and the entire value chain represents a substantial opportunity to advance human development globally.



The global chemical industry is a USD \$4 trillion business affecting virtually every sector of the economy. Worldwide, more than 20 million people are employed directly or indirectly by the sector. Chemical manufacturers can **advocate for equality** in developed countries that the sector operates in, and provide investment into emerging and developing countries to encourage development that reduces inequality. Many companies have adopted global policies that support issues such as **fair wages, safety and ethical standards, and social protections**.



Not only do chemical products help **improve buildings, transport and infrastructure**, they also help **strengthen community resilience**. As the rate of population growth in urban areas increases there is tremendous pressure for cities to scale implementation of sustainable solutions that meet the needs of the local communities. The chemical sector is working to increase its involvement in multi-stakeholder collaboration to make cities more sustainable and inclusive, improving the lives of the urban poor.



The chemical sector is strengthening its production assets to **promote resiliency**. **Frameworks that promote industrial symbiosis** for chemical sector companies and their value chains help address environmental and resource concerns, reduce raw material and waste disposal costs, earn new revenue from residues and by-products, support circular business models, and develop new business opportunities. Chemical products play an important role in enabling and building resilient infrastructure solutions and by engaging with other sectors, chemical companies can further **enable open-innovation and manufacturing advancements** to encourage development of integrated and end-to-end models.



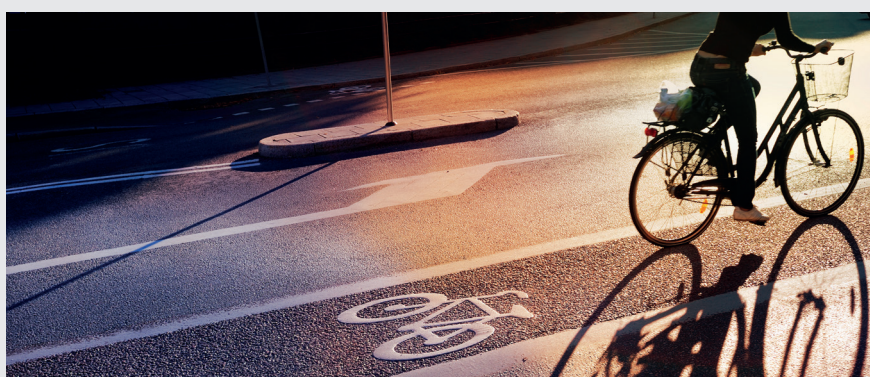
Case study

Sustainable chemical hubs and eco-industrial parks have been in place since the 1960's to enable sustainable economic growth for the sector. The SDGs offer a new universal framework for chemical parks to challenge current sustainability strategies to meet local community and greater societal needs. Two examples of chemical industry hubs that are contributing the SDGs are listed below:

- Grangemouth's chemicals sciences cluster has developed a vision to be a key European hub for sustainable high value chemical manufacturing, which anticipates creating an additional 3,591 jobs and £206 million generated annually in the local area.
- The Korea Industrial Complex Corporation (KICOX) is leading the development of South Korea's Eco-Industrial Park Program to promote cleaner production and industrial symbiosis, which has resulted in 56 new patents, 6.48m tCO₂e savings and collective financial benefits of US\$1,680 million.

<http://www.chemicalsciencesscotland.com/content/uploads/2017/11/Future-Grangemouth-Vision-2025.pdf>

<http://www.greengrowthknowledge.org/case-studies/greening-industrial-parks-%E2%80%94-case-study-south-korea%E2%80%99s-eco-industrial-park-program>



Case study

Founded in 2016, the Human Cities Coalition is focused on contributing to SDG 11. This public-private partnership was driven forward by a leading representative of the chemical sector and brings together a unique coalition

of global and local partners from business, governments, academia and civil society to help make megacities in the emerging world more liveable and prosperous places for all.

<https://www.humancities.co/>

The chemical sector and the SDGs continued

Chemical sector interactions with the SDGs



Chemical products help improve the quality and efficiency of production processes across industries. Through chemistry, operations in a wide range of sectors and geographies have improved their water stewardship efforts and accelerated energy efficiency. From food packaging and additives to prevent food loss and waste, to innovations in waste management systems, the chemical sector is helping to transform production and reduce the life cycle impacts of consumption. Through Responsible Care and the Global Product Strategy, the chemical industry is committed to advancing sustainable management of materials in all its phases, and achieving greater transparency in environmental, health, and safety performance.

Case study

In 2018 a number of WBCSD member companies from the chemical sector collaborated in the publication of a Chemical Industry Methodology for Portfolio Sustainability Assessments. This comprehensive resource provides specific guidance for chemical companies to assess sustainability “signals” across their entire product portfolio, and then steer their portfolio towards improved sustainability outcomes. This includes efforts to advance sustainability across various functions – including research and development, mergers and acquisitions, innovation, marketing, communication and design.

<https://www.wbcd.org/Programs/Energy-Circular-Economy/Factor-10/Sector-Deep-Dives/Resources/Chemical-Industry-Methodology-for-Portfolio-Sustainability-Assessments>



Many chemical companies are taking concerted action to address the issue of climate change through a variety of initiatives including: energy efficiency, reducing the footprint of their products and the development of innovative solutions to avoid downstream emissions.

In addition, chemical companies are working together to **build resilience and adaptive capacity for the sector and its supply chain in response to the impacts of climate change.** The sector also plays a key role in the development of solutions that will enable other sectors to strengthen their resilience to climate related risks.

Case study

The Low Carbon Technology Partnerships initiative (LCTPI) is an action-oriented program that brings together companies and partners to accelerate the development and deployment of low-carbon technology solutions to stay below the 2°C ceiling.

Launched at COP21 in Paris, LCTPI incorporates a chemicals workstream, which is comprised of companies working together on options and pathway scenarios to deliver a low-carbon, sustainable chemical industry.

<http://lctpi.wbcd.org/>



Chemical sector interactions with the SDGs



The chemical sector **works with others in the value chain to reduce marine pollution of all kinds**, including nutrient pollution and the prevention and reduction of **ocean plastic waste**.



Case study

Operation Clean Sweep (OCS), coordinated by the American Chemistry Council, the Plastics Industry Initiative and Plastics Europe, supports plastic resin handling operations to work towards achieving zero pellet, flake, and powder loss in order to keep plastics out of the marine environment. Many chemical companies have taken the OCS pledge and the program has now developed beyond its origins in the USA and established a significant global reach.

www.opcleansweep.org

The Gulf Petrochemicals and Chemicals Association (GPCA) established its Waste Free Environment campaign in 2013. It has evolved from being a clean-up activity to an advocacy initiative and in 2017 it had 29 companies participating in initiatives to change people's attitude and mind-sets towards litter disposal.

www.wastefreeenvironment.com



The chemical sector measures and manages its environmental impacts and dependencies. This includes efforts to mitigate negative impacts that some products can have on ecosystems and biodiversity by **improving product formulations and design** as well as **managing such products further downstream**. The sector directly reduces its impacts on land and other natural resources through improving **operational management**, and amplifies **philanthropic efforts** to halt environmental degradation and protect critical ecosystems.



The sector is focused on **maintaining standards of ethical business conduct throughout the value chain**. This can be achieved through partnerships that allow industry to reduce corruption wherever it may exist in the supply chain. The sector can also engage with local, regional, national and international bodies on societal structures and laws to promote responsible business practices (including anti-bribery and corruption).



Partnerships are a key enabler to **accelerate sustainable development and advance the SDGs**.

The chemical sector has opportunities to:

- Develop multi-stakeholder and cross border partnerships and agreements to achieve sustainable development;
- Collaborate with downstream partners, government organizations, NGO groups and other involved stakeholders working towards sustainable development;
- Contribute to improving environmental and safety performance in emerging countries through capacity building;
- Incorporate collaboration as a critical pillar of sustainability efforts/programs, and share technologies/science with partners to enhance sustainable development globally; and
- Encourage open innovation initiatives for the sector.

Case study

ICCA and the United Nations Environment Programme (UNEP) partnered on a large-scale, 24-month initiative to promote chemicals safety management in East and West Africa. The two organizations hosted workshops focused on basic training in dangerous goods handling and capacity building for emergency preparedness and emergency response.

ICCA has also worked collaboratively with other regional associations to deliver capacity building programs in Eastern Europe, Central Asia and Asia-Pacific.

<https://www.icca-chem.org/wp-content/uploads/2017/02/Global-Chemical-Industry-Contributions-to-the-UN-Sustainable-Development-Goals.pdf>





Key goals for the sector

As already described, the chemical sector has the capacity to help advance each of the 17 SDGs in a range of different ways and should remain alert to emerging opportunities to contribute across the full spectrum of the goals. However, in order to advance its interaction with this crucial agenda, it is also important for the sector to prioritize the SDGs where it has the most influence or the most ability to drive innovation, transformation and impact through leveraging its role in the value chain. With this in mind a key component of the road-mapping exercise was for parties involved to establish a common view of which are the priority SDGs for the sector.

Method and approach to prioritization

This is the first collective initiative by the chemical sector to extensively map and prioritize the 17 SDGs and their 169 targets in the context of the sector as a whole. This prioritization was conducted in order to narrow the wide playing field that the SDGs represent and identify the most critical focus areas for the sector in view of maximizing its capacity for SDG impact. This exercise was completed collaboratively with involvement from participating chemical sector companies and industry associations, WBCSD and external experts. The following four activities were undertaken:

- Exploration of how the chemical sector value chain interacts with each SDG;
- Identification of the sector's current level of positive and negative impact on the goals;
- Assessment of the sector's untapped potential to impact each goal and the potential for accompanying opportunities to create business value; and
- Mapping of SDGs in a materiality matrix to understand sector priorities.

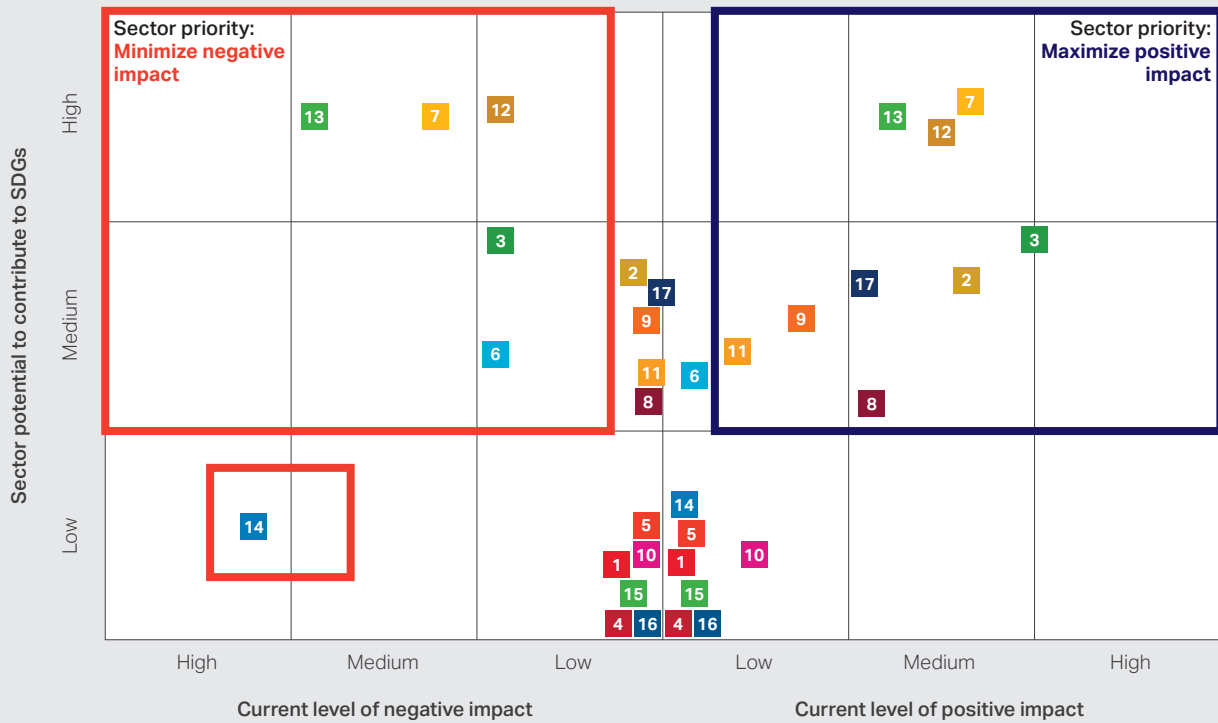
The first three activities were completed at SDG target level, based on participants' knowledge of the sector, and third-party industry expertise, alongside published literature. A number of workshops were then held to assess and explore the level of potential the sector has to drive change for each of the mapped SDGs, during which representatives considered how current programs could be scaled or replicated, or where innovation and new partnerships could be leveraged to address sustainability challenges. Anticipated changes in technology, new products, business models and sector dynamics through the SDG time horizon of 2030 were also factored into discussions.

Through mapping the sector's current level of impact (positive and negative) against the opportunities where the sector has the most potential to contribute towards the SDGs, it was possible to establish priority areas of focus, as shown opposite.

Goals where the sector can have the greatest impact

10 goals were identified by the working group as being priority areas of engagement for the sector. These have been identified with the understanding that interdependencies exist across all the SDGs, and specific contributions related to one goal can have potentially positive or negative contributions to other goals. This is something that the sector should remain conscious of and alert to moving forward. Although SDG 17 (Partnerships for the goals) was not identified as a priority goal, it is recognized that the spirit of partnership and collaboration that it embodies is a recurring theme throughout this Roadmap and indeed is central to the exercise of undertaking a sector roadmap itself.

Prioritization of SDGs



Priority SDGs



2 ZERO HUNGER
End hunger, achieve food security and improved nutrition and promote sustainable agriculture



3 GOOD HEALTH AND WELL-BEING
Ensure healthy lives and promote well-being for all at all ages



6 CLEAN WATER AND SANITATION
Ensure access to water and sanitation for all



7 AFFORDABLE AND CLEAN ENERGY
Ensure access to affordable, reliable, sustainable and modern energy for all



8 DECENT WORK AND ECONOMIC GROWTH
Promote inclusive and sustainable economic growth, employment and decent work for all



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
Build resilient infrastructure, promote sustainable industrialization and foster innovation



11 SUSTAINABLE CITIES AND COMMUNITIES
Make cities inclusive, safe, resilient and sustainable



12 RESPONSIBLE CONSUMPTION AND PRODUCTION
Ensure sustainable consumption and production patterns



13 CLIMATE ACTION
Take urgent action to combat climate change and its impacts



14 LIFE BELOW WATER
Conserve and sustainably use the oceans, seas and marine resources

* SDG 17 (Partnerships for the Goals) has not been specifically identified as a priority goal, however the spirit of collaboration that it embodies cuts across the sector's interaction with the entire SDG agenda.



Part
2

Impact opportunities

Identifying where the chemical sector can make the most transformative impact to contribute to the SDGs

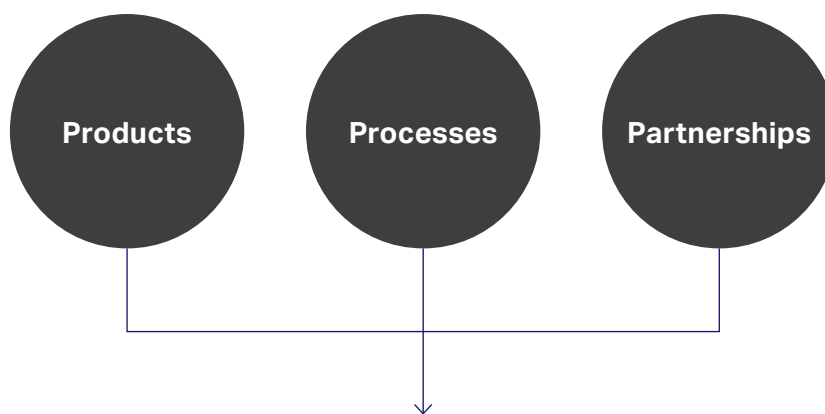
Having established a common understanding of the key SDGs to which the chemical sector is well placed to make substantial contributions, a structured process was used to identify the most significant opportunities to generate impact (referred to hereafter as impact opportunities) across the spectrum of these goals.

The impact opportunities identified fall into five main systemic themes: food, water, people and health, energy, and infrastructure and cities, again underlining the wide-ranging reach of the sector's influence. Cross-cutting factors have also been identified that relate to a number of impact opportunities. These are human rights, the low carbon economy, circularity, and digitization.

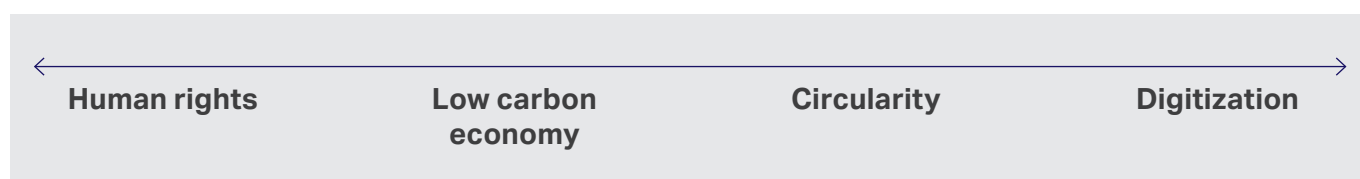
Each of the impact opportunities can be broadly categorized as relating to either product, process, or partnership innovation.



Areas for sector innovation



Key themes and cross-cutting factors



Impact opportunities across key SDGs for the sector





Description of cross-cutting factors

While this Roadmap sets out to identify a series of detailed impact opportunities for the chemical sector in the context of the SDGs, it is also important to note that there are several cross-cutting factors that will be central to these efforts. Four of the factors that will be most critical to the sector's capacity to generate impact across a broad selection of SDGs are introduced below.

Human rights

It is important to underline the critical role that corporate respect for human rights has to play in the realization of the ambitions of the SDGs. The 2030 Agenda for Sustainable Development is explicitly grounded in the Universal Declaration of Human Rights, as well as other international instruments.

This Roadmap recognizes that a robust commitment by the chemical sector to respect human rights throughout its operations and the entire value chain represents a substantial opportunity to advance human development globally. By proactively implementing the tenets of the UN Guiding Principles on Business and Human Rights and engaging in collaborative initiatives to tackle systemic challenges, companies have the potential to break down significant barriers to development and positively impact the lives of millions of some of the most vulnerable individuals in society – helping to fulfil the central commitment of the SDGs of leaving no one behind.

Low carbon economy

Combating climate change and transforming the energy system are core challenges on the path to a sustainable future for business, society and the environment. The Paris Agreement has sent a decisive and global signal that the start of the transition to a thriving, clean economy is inevitable and irreversible. SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action) are clearly linked to a low carbon economy; however, the success of many other goals will require this transformative shift as well.

The chemical sector is a major energy user but has also made significant progress to decouple economic growth from carbon emissions. Additional efficiency gains are becoming more difficult to realize, but the sector has the potential to thrive in an economy based on low carbon power sources that minimize carbon dioxide emissions.

The chemical sector is also a critical low carbon solutions provider, serving as a catalyst for helping to improve energy efficiency and reduce greenhouse gas emissions across multiple value chains. Chemical products are a building block in fully realizing the potential of renewable and innovative energy sources to enable all industry sectors to drive towards a low carbon economy.



Circularity

If current trends continue, global demand for resources is expected to reach 130 billion tons by 2050, up from 50 billion in 2014, representing an overuse of the Earth's total capacity by more than 400%.¹ The global economy is only 9% circular.² Closing the gap will help to prevent further and accelerated environmental degradation, as well as safeguarding against future resource scarcity. Circular business models can help decouple growth from resource use, allowing economic development to continue within planetary boundaries.

The chemical sector will play a central role in enabling the circular economy by developing new products, encouraging eco-efficient use of materials and resources and through collaboration with others in researching effective raw materials recovery from waste streams to facilitate the cycling of molecules. Carbon is often the focus of circular conversations, but nitrogen and phosphorous also require fundamental changes to overcome the status quo in order to be more sustainable. Achieving circularity is challenging and reliant on sufficient clean and renewable power being available as well as on a supporting policy environment which helps to reduce the costs of reusing and recovering waste.

Digitization

Chemicals 4.0 – the sector-specific reference to the fourth industrial revolution – describes how the chemical sector is being transformed at all stages of the value chain to integrate and optimize digital, physical and biological advancements. This includes a broad range of concepts based on having a deep understanding of how to meet customer needs in a world that is digitally connected across the value chain, from raw materials to operations, customers and communities.

With the emergence of Chemicals 4.0 come threats to and opportunities for achieving the SDGs. If significant jobs are lost through technological innovations, it could hamper efforts to reduce poverty, hunger and inequality as well as finance improvements to the environment, healthcare and infrastructure. At the same time, innovations may create new types of jobs while providing technical solutions to some of the most critical social, environmental and economic issues facing the planet. The challenge for the chemicals sector is to identify, understand and leverage technological transformation in a manner that mitigates negative consequences and optimizes society's ability to achieve the SDGs.



¹ https://www.accenture.com/t20150523T053139__w_/us-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Strategy_6/Accenture-Circular-Advantage-Innovative-Business-Models-Technologies-Value-Growth.pdf

² <https://www.circle-economy.com/the-circularity-gap-report-our-world-is-only-9-circular/#.WuZCT8gw2w>



Food

Some 795 million people in the world – about one in nine – do not have enough food to lead a healthy active life. The vast majority of the world’s hungry live in developing countries, where some 13% of the population is undernourished.¹ Food insecurity, famine, and nutrient deficiency co-exist with obesity, rising food-related lifestyle diseases (including diabetes) and food waste. Food production suffers from – and also contributes to – climate change, water stress, and many interrelated socio-economic issues.

The SDGs aim to end hunger and malnutrition by 2030, making sure all people have access to sufficient and nutritious food. The chemical sector has the technological expertise to help transform sustainable agricultural practices, develop innovative solutions to improve agricultural productivity and yields, preserve natural resources, minimize food loss and waste, and improve the livelihoods of small-scale farmers across the globe.

Key SDGs impacted



Impact opportunity 1:

Contribute to sustainable and healthy food supply

Chemistry is fundamental to the global food value chain, enabling higher yields, longer shelf lives, and improved nutrition. The chemical sector will innovate, invest, and share knowledge to help increase the productivity of farmers in its supply chain and wider communities. Companies can also lead by improving access to healthy foods where they are needed most and by developing fortified crops and processed foods that are compatible with development goals for human and environmental health.

Prioritized SDGs: 2, 12

Targets:

- 2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round
 - 2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality
 - 12.2 By 2030, achieve the sustainable management and efficient use of natural resources
 - 12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses
-



¹ <http://www.foodaidfoundation.org/world-hunger-statistics.html> (retrieved 18 January 2018).

Impact opportunity 2:
 Transform food packaging to prevent food loss and waste

To combat the significant global food waste problem, the chemical sector is leading the development of technologies and products to transform food packaging to reduce food waste and enable better food availability to communities around the world. Opportunities to scale solutions and further innovate offer tremendous potential to substantially reduce food waste, as well as reduce plastic packaging waste; a significant cause of marine pollution. Innovative partnerships to transform consumer behavior and advance waste management infrastructure will be key.



Prioritized SDGs: 2, 9, 12, 14

Targets:

- 2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round
 - 2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries
 - 9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
 - 12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses
 - 12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse
 - 14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
-

Impact opportunity 3:
 Transform food additives to combat malnutrition

The chemical sector has a long track record of being an innovative solution provider for societal challenges related to health and nutrition, where safety is of paramount importance. Food additives rely on chemistry to maintain or enhance nutrient composition, as well as to improve food shelf life and taste/texture. The opportunity to understand different nutrition gaps at a regional level and how chemistry can help fill those through innovative food solutions has the potential to make a significant impact towards ending malnutrition.

Prioritized SDGs: 2

Targets:

- 2.2 By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons
-



Water

The SDGs call for universal access to safe and affordable drinking water for all by 2030. According to the World Health Organization, 2.1 billion people lacked access to safely managed drinking-water services in 2015.

The chemical sector offers innovative solutions that can help achieve universal access to water, by improving water treatment technology, preventing loss in distribution systems, and sharing best practices for water stewardship and wastewater management.

The SDGs also aim to protect and sustainably manage marine and coastal ecosystems. Protecting the world’s ocean system is essential, with more than three billion people depending on oceans for their primary source of protein, and over 200 million people employed directly or indirectly by marine fisheries. By working to tackle the critical issue of marine pollution through product innovation, the chemical sector can play an important role in protecting our oceans.

Key SDGs impacted



Impact opportunity 4: Increase resilience for water pipes and systems

The chemical sector offers innovative piping solutions to improve resilience and reduce water loss through transport, which is one of most common ways water is lost from a system. This is an opportunity for the sector to utilize its own products to prevent water loss in operations and supply chains as well as scale efforts to transform water and wastewater distribution networks.

Prioritized SDGs: 6, 9

Targets:

- 6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all
 - 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
 - 9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
 - 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities
-



Impact opportunity 5:

Improve urban water treatment capabilities through focused research and innovation to accelerate breakthrough technology development

Water use and demand is growing rapidly. Common treatment technologies for reusing and recycling water include biological processes, membrane filtration and separation, and chemical oxidation processes – mostly continuous electrodeionization (CEDI), ultra-violet (UV) and ozone-based systems. The chemical sector plays an important role in scaling current technologies and working in partnerships to make the technology more accessible and affordable to the markets that need them most.

Prioritized SDGs: 6, 9, 11, 13

Targets:

- 6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
 - 6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
 - 9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
 - 9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending
 - 11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums
 - 11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations
 - 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
-





Water continued

Impact opportunity 6: Accelerate water stewardship

The chemical sector is a large water user and has the opportunity to have impact by sharing best practices and consistently applying catchment area management concepts to water stewardship. Water scarcity and competition for water resources is a business risk for the chemical sector. Increased water demand from people, agriculture, energy and industry endangers water supply security and has the potential to disrupt business operations.

Prioritized SDGs: 6, 9, 11, 12, 14

Targets:

- 6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
 - 6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate
 - 9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
 - 11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries
 - 12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle
 - 14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
 - 14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans
-



Impact opportunity 7:

Work with others in the value chain on aquatic waste issues (including ocean plastic)

The chemical sector's role in addressing the issue of ocean pollution is imperative. Managing and reducing ocean waste will require a multitude of actions and involvement of the entire value chain. The sector can provide leadership in product design and work with governments and stakeholders for on-land solutions that incentivize proper collection and enable a circular economy.

Prioritized SDGs: 6, 14

Targets:

- 6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
 - 6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
 - 14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
 - 14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans
-





People and health

Nearly all the SDGs directly or indirectly contribute to human health. The World Health Organization estimates that the benefits of investing in health systems to achieve the SDG health-related targets by 2030 include up to 8.4 additional years of life expectancy and the prevention of 97 million premature deaths.¹

Chemistry makes significant contributions to advancing human health benefits as a key enabler in the development of medicines, clean water, and more efficient agriculture. The sector is well positioned to make health contributions through product innovation in these and other areas, as well as through continued efforts to reduce potential negative health impacts of the sector's own operations through improvement and capacity building at an international scale.

Key SDGs impacted



Impact opportunity 8:

Transform portfolios to have more products with positive impacts on health and people

There are three explicit references to chemicals in the SDGs: target 3.9 related to reducing the number of deaths and illnesses from hazardous chemicals; 6.3 related to improving water quality and eliminating dumping of hazardous chemicals; and 12.4 achieving environmentally sound management of chemicals throughout their lifecycle. Successfully managing the risks derived from the misuse of chemicals is the fundamental health, safety and environmental mission of the industry. However, the chemical sector can also leverage its expertise, resources and knowledge in product innovation to better understand, monitor, mitigate, and remediate negative impacts on health and transform business models to focus on growth of product portfolios that provide benefits to people and health.



Prioritized SDGs: 3, 12

Targets:

- 3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
 - 12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment
 - 12.a Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production
-

¹ <http://www.who.int/sdg/en/>

Impact opportunity 9:
Reduce impact of operations to people

The sector’s own operations and supply chain can have direct negative impacts on people; from labor issues through to pollution in local communities, to health and safety standards on the work floor. Sector leaders and industry associations have an important role to play in promoting the adoption of practices that protect the safety and human rights of workers throughout the value chain as well as local communities and society as a whole. Ensuring corporate respect for human rights, founded on robust due diligence processes, is critical for achieving the vision of the inclusive future that sits at the heart of the SDG agenda.



Prioritized SDGs: 3, 8

Targets:

- 3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
- 8.7 Take immediate and effective measures to eradicate forced labor, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labor, including recruitment and use of child soldiers, and by 2025 end child labor in all its forms
- 8.8 Protect labor rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment

Impact opportunity 10:
International chemical industry scientific and technological capacity building

The global chemical sector has a long history of promoting sustainable development in the communities in which it operates around the world. There is scope however for the sector to make a significant contribution towards the SDGs by enhancing capacity building efforts in developing markets in relation to promoting awareness of chemical hazards, managing the risks associated with manufacturing and use of chemicals and developing the necessary national infrastructure and capacities for regulatory and voluntary approaches on chemicals management.

Prioritized SDGs: 3, 8, 12

Targets:

- 3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
 - 8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavor to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead
 - 12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycles, in accordance with agreed international frameworks, and significantly reduce their releases to air, water and soil in order to minimize their adverse impacts on human health and the environment
 - 12.a Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production
-



Energy

SDG 7 calls for access to affordable, reliable, sustainable and modern energy for all by 2030. Yet today one in five people lack access to modern electricity, posing a significant barrier to development and hindering progress across a wide range of SDG goals and targets.

The chemical sector has an important role to play in the transition towards a low carbon society as a provider of products and technologies used in energy saving and renewable energy applications.¹ These include applications for fuel cells, solar cells, batteries, nanostructured materials, and carbon capture, among others. Nearly all renewable energy

sources and technologies depend on innovations in chemistry to become more efficient, affordable and scalable.

To fulfill this energy-saving role and to reduce the sector's own energy use, the focus of the sector should include: identifying new catalysts and process-related opportunities; accelerating R&D and capital investments that improve energy efficiency; facilitating the advancement of game-changing innovations with partners by lowering barriers and operating costs; and promoting global and regional cooperation on reducing energy use and emissions.²

Key SDGs impacted



Impact opportunity 11: Accelerate energy efficiency in downstream sectors

Chemical products and technologies are used in a wide array of energy saving applications and the industry plays an important role in enabling the savings of GHG emissions through its application in many sectors (e.g. insulation, efficient lighting, lighter materials for automobiles and advanced materials for renewable technologies). Close collaboration with customers to identify needs and innovate products will help accelerate energy efficiency in downstream sectors.

Prioritized SDGs: 7, 12, 13

Targets:

- 7.3 By 2030, double the global rate of improvement in energy efficiency
 - 12.2 By 2030, achieve the sustainable management and efficient use of natural resources
 - 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
-



^{1,2} <https://www.iea.org/publications/freepublications/publication/TechnologyRoadmapEnergyandGHGReductionsInTheChemicalIndustryviaCatalyticProcesses.pdf> (retrieved 23 January 2018).

Impact opportunity 12:
 Enable production and storage of renewable energy/renewable energy infrastructure

The chemical sector has an important role to play in the energy transition beyond 2030. It provides key materials to renewable power generation systems, including gear oils for wind turbine gearboxes, resins for blades and coating materials for wind turbines, and silicon ingots, semiconductor gas and sealant for solar PV panels. The sector should continue to push the boundaries of innovation and support research to develop new products that will make renewable energy more affordable, reliable and accessible.

Prioritized SDGs: 7, 13

Targets:

- 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix
 - 7.3 By 2030, double the global rate of improvement in energy efficiency
 - 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
-



Impact opportunity 13:
 Continue to improve energy efficiency in own processes

The chemical and petrochemical sector is the largest industrial energy user, accounting for approximately 10% of total worldwide final energy demand and 7% of global GHG emissions.¹ Basic chemicals are among the most energy-intensive manufacturing industries in the world.² Continuous improvement to realize energy efficiency is normal business practice in the chemical sector, but the sector can collaborate to make best practice more affordable and accessible to all companies including SMEs and chemical companies in emerging and developing markets.

Prioritized SDGs: 7, 12, 13

Targets:

- 7.3 By 2030, double the global rate of improvement in energy efficiency
 - 7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
 - 12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment
 - 12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle
 - 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
-

^{1,2} <https://www.iea.org/publications/freepublications/publication/TechnologyRoadmapEnergyandGHGReductionsInTheChemicalIndustryviaCatalyticProcesses.pdf> (retrieved 24 January 2018).

Energy continued

Impact opportunity 14: Breakthrough technologies for alternative production processes

The climate and energy efficiency ambitions of the SDGs require a significant change in current business models. Research programs should focus on achieving improvements to further the commercial viability of proven breakthrough technologies. Key implementation barriers of availability of low carbon energy, availability of alternative feedstock, and the significant CAPEX and lead times involved in new manufacturing infrastructure will need to be considered and addressed through innovative public-private partnerships. The chemical sector is a critical actor in this process and has the potential to drive ground-breaking innovation.



Prioritized SDGs: 7, 13

Targets:

- 7.3 By 2030, double the global rate of improvement in energy efficiency
 - 7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
 - 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
-

Impact opportunity 15: Increase proportion of renewable energy or innovative energy technologies used in production

The production of chemical sector products is energy intensive. Even small shifts in energy mixes can have significant impact given the scale of the industry. The sector has the potential to generate significant SDG impacts through collaborative efforts to address region-specific barriers slowing the advancement and uptake of renewable energy use.

Prioritized SDGs: 7, 13

Targets:

- 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix
 - 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
-



Infrastructure and cities

Quality infrastructure goes hand-in-hand with achieving the SDGs. Without adequate infrastructure, people lack access to markets, jobs, information, health care, training, and education.¹ The chemical sector contributes to infrastructure improvements in several ways: through innovations integral to the life cycle of products used in buildings, power, water, sewer, communications, and transportation; and in collaborating with others to help improve living standards.

The chemical sector has a strong history of working together and with others. This spirit of collaboration provides opportunities for more innovative and resilient infrastructure development. Chemical companies can collaborate with governments and others to develop public private partnerships for infrastructure investment, implement local procurement and employment initiatives, support education and community-based programs, and incorporate sustainability features across the life cycle of capital projects.

Key SDGs impacted



Impact opportunity 16:

Scale and evolve involvement in multi-stakeholder collaboration to make cities more sustainable and inclusive, improving lives of the urban poor

Today, more than half of the world's population live in cities and more than two-thirds will do so by 2050. The chemical sector has an opportunity to scale the use of products that support more sustainable buildings and lifestyles while also exploring business opportunities around the development of more inclusive markets. It is estimated that affordable housing solutions alone could open up market opportunities in excess of one trillion US dollars per year by 2030², representing a significant opportunity for the chemical sector as a key solutions provider.

Prioritized SDGs: 3, 11

Targets:

- 3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
 - 11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management
 - 11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials
-



¹ <http://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-9-industry-innovation-and-infrastructure/targets/TechnologyRoadmapEnergyandGHGReductionsIntheChemicalIndustryviaCatalyticProcesses.pdf>

² http://report.businesscommission.org/uploads/BetterBiz-BetterWorld_170215_012417.pdf



Infrastructure and cities continued

Impact opportunity 17:

Demonstrate benefits of industrial symbiosis

Chemical hubs are a well-established concept in many regions and provide opportunity by helping reduce raw material and waste disposal costs, earning new revenue from residues and by-products, supporting circular business models, and developing new business opportunities. Best practice principles that enable industrial symbiosis in the chemical sector – and with peers in other sectors – can be deployed at a far greater scale to help address feedstock availability issues and improve resource management in a cost-effective manner.

Prioritized SDGs: 9, 11, 12, 13

Targets:

- 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities
 - 11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries
 - 11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management
 - 12.2 By 2030, achieve the sustainable management and efficient use of natural resources
 - 12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment
 - 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
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Impact opportunity 18:
Strengthen production assets to promote resiliency

The chemical sector is known for its ability to adapt, but there is a need to improve approaches to promote resiliency for the industry’s own assets and supply chains. Many chemical companies do not yet have strategies to understand and manage climate risks, which can create enormous financial and operational exposures. Best practices to assess and manage resiliency already exist and leading chemical companies are well versed in their application. The opportunity for the sector is to share, build capacity and encourage more consistent application of these methods to adapt and improve resiliency.



Prioritized SDGs: 9, 11, 13

Targets:

- 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities
 - 11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management
 - 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
-





Part
3

Pathways to 2030

Inspiring the sector to action and engaging with partners to deliver impact

The impact opportunities identified in Part two will only be realized at the scale necessary to make a significant contribution to the SDGs through timely, continued and combined efforts by leading players within the chemical sector. With a view to advancing these impact opportunities and fulfilling the potential that they represent, this Roadmap also identifies a series of short-, medium- and long-term actions, making up so-called “impact pathways” to deliver each opportunity and to inspire the chemical sector and other sectors it works with to enable or deliver tangible SDG progress.

These impact pathways were developed through a series of deep-dive working sessions for each of the five themes with subject matter experts from participating chemical sector companies and associations. They take into account known barriers to implementation and/or deployment, potential solutions and ways to accelerate SDG impact. Draft plans for action went through rigorous screening to ensure they had the potential to have a step-change impact – beyond business as usual – to one or more prioritized SDGs and that the action could either be led by the chemical sector or that it would not happen at the same pace or scale without the chemical sector as a key stakeholder.

The final pathways for each thematic area are highlighted in a series of tables across the following pages. Each action is linked to the SDGs and targets with which it most closely corresponds. Each table also contains a qualitative analysis of the potential level of impact that the action stands to have on the SDG agenda and the level of collective effort it will require from the sector in order to be realized.



Food impact pathways

Impact opportunity	Category	Key action points	Key partners	Low, medium, high level of input from sector	Short-, medium-, long-term timeframe	Associated SDGs	Associated SDG targets and level of potential impact
1. Contribute to sustainable and healthy food supply	Product innovation	i - Scale existing programs aimed at driving step changes in the sustainable production of food and drink products, the reduction of waste, and helping people to eat healthily and sustainably	Farmers, suppliers, downstream customers, food brands, NGOs, WBCSD FReSH program	M	M	2	M 2.1
							H 2.4
							H 12.2
		ii - Increase adoption of circular, low carbon technologies that use unavoidable waste from agri, bio, food and food packaging value chains to be used as chemical feedstocks	Waste collectors, recycling companies, food companies	M	M	12	H 12.3
							H 12.2
							H 12.3
	iii - Accelerate knowledge transfer and best practice regarding fertilizer and pesticide chemistry performance against socio-economic, environmental and health criteria for different seeds and plants to meet regional needs	Farmers, WBCSD Climate Smart and GAA Group	M	S	2	H 2.1	
						H 2.4	
						H 12.2	
2. Transform food packaging to prevent food loss and waste	Product & process innovation	i - Increase implementation of high performance packaging to improve food safety, shelf life and nutrition while also improving recyclability	Government and value chain	L	M	2	H 2.1
							H 12.3
							M 12.5
		ii - Collaborate with multi-stakeholder platforms to ensure the right infrastructure is in place to manage food package waste (incl. reverse logistics)	Government and value chain	M	M	14	M 14.1
							M 2.a
							M 9.1
	iii - Collaborate with multi-stakeholder platforms to ensure the right infrastructure is in place to manage food package waste (incl. reverse logistics)	Government and value chain	M	M	12	H 12.3	
						M 12.5	
						M 14.1	
3. Transform food additives to combat malnutrition	Product & partnership innovation	i - Scale multi-stakeholder platforms to improve efforts to combat micronutrient deficiencies while meeting regional societal needs	Financial services, governments, food brands	L - M	M - L	2	H 2.2



Water impact pathways

Impact opportunity	Category	Key action points	Key partners	Low, medium, high level of input from sector	Short-, medium-, long-term timeframe	Associated SDGs	Associated SDG targets and level of potential impact
4. Increase resilience for water pipes and systems	Product innovation	i - Increase use of innovative piping solutions through collaboration with sustainable cities initiatives focusing on local needs related to access to drinking water and reduced water pollution	Water utilities, local government, building code/standard organizations	M	M	6	M 6.1
							M 6.2
						9	H 9.1
							H 9.4
5. Improve urban water treatment capabilities through focused research and innovation to accelerate breakthrough technology development	Product innovation	i - Engage with water companies and other stakeholders to co-develop treatment solutions that are more affordable and accessible	Downstream customers, water utilities, local governments	H	L	6	M 6.3
							M 6.a
						9	H 9.1
							H 9.5
						11	H 11.1
							H 11.5
13	M 13.1						
6. Accelerate water stewardship	Process innovation	i - Apply best practices for circular water management and watershed-level risk assessment, including water valuation	Water NGOs, government, peers	H	M	6	M 6.4
							M 6.5
						9	M 9.1
							11
						12	
						14	H 14.1
H 14.2							
7. Work with others in the value chain on aquatic waste issues (including ocean plastic)	Partnership innovation	i - Collaborate to develop circular design solutions to address root causes of improper disposal and enhance understanding of waste infrastructure requirements to manage plastic	Local governments, water agencies, downstream customers and stakeholders	M	M	6	M 6.3
							M 6.a
						14	H 14.1
							H 14.2



People and health impact pathways

Impact opportunity	Category	Key action points	Key partners	Low, medium, high level of input from sector	Short-, medium-, long-term timeframe	Associated SDGs	Associated SDG targets and level of potential impact
8. Transform portfolios to have more products with positive impacts on health and people	Product innovation	i - Identify regional societal health and safety needs and gaps to 1) scale deployment of current chemical sector products that enable positive impact and 2) scale R&D and innovation on issues where there are lack of affordable solutions	Sector peers, local governments, NGOs, financial, value chain (consumer product manufacturers), start-ups	M	M	3	H 3.9
						12	H 12.4 M 12.a
		ii - Encourage use of sustainable portfolio management techniques (in line with those published by WBCSD) to assess impact and communicate best practise	WBCSD members, industry associations, reporting frameworks, value chain, NGOs	H	S - M	3	H 3.9
						12	H 12.4 M 12.a
9. Reduce impact of operations to people	Process innovation	i - Operationalize the United Nations Guiding Principles on Business and Human Rights (UNGPs) throughout the chemical sector and its value chain. Establish a forum for engagement and collaboration around advancing human rights due diligence in the context of the sector	Sector peers and value chain, human rights community, governments, WBCSD	M	L	3	H 3.9
						8	M 8.7 M 8.8
10. International chemical industry scientific and technological capacity building	Partnership innovation	i - Leverage resources devoted to ICCA engagement to develop thought leadership and industry/regional mentors that will accelerate the international roll out of Responsible Care based on regional needs and where the most SDG impact can be achieved	Industry associations	M	S	3	H 3.9
						8	H 8.4
							12
		ii - Enhance support of UN's Strategic Approach to International Chemicals Management (SAICM) plans for sound management of chemicals and waste beyond 2020	Industry associations	M	S	3	H 3.9
						8	H 8.4
							12

Energy impact pathways

Impact opportunity	Category	Key action points	Key partners	Low, medium, high level of input from sector	Short-, medium-, long-term timeframe	Associated SDGs	Associated SDG targets and level of potential impact
11. Accelerate energy efficiency in downstream sectors	Product innovation	i - Collaborate with customers - with a particular focus on transport, construction and packaging sectors - to increase deployment of technologies and products with the most potential to scale downstream energy savings	Customers, peers, local governments	H	M	7	M 7.3
						12	M 12.2
						13	L 13.1
12. Enable production and storage of renewable energy/ renewable energy infrastructure	Product innovation	i - Accelerate the deployment of innovative materials to improve the efficiency of solar, wind and other sources of renewable power and energy storage	Government, research institutes, green building associations and product manufacturers	L	M	7	H 7.2 M 7.3
						13	L 13.1
13. Continue to improve energy efficiency in own processes	Process innovation	i - Scale efforts to improve energy efficiency of technologies, processes and products over their life cycles so as to avoid harm to people and the environment through more open reporting on performance, achievements and shortcomings; more engagement with peers, governments and organizations to tackle barriers; and by providing greater knowledge transfer of best practices along the value chain	Peers	L	M	7	M 7.3 M 7.a
						12	H 12.4 M 12.6
						13	M 13.1
14. Breakthrough technologies for alternative production processes	Process innovation	i - Demonstrate nascent technologies by leveraging public-private partnerships and other models to tackle CAPEX barriers with a focus on areas including: CCU & CCS, electrification of processes that can benefit from the power sector energy transition, low-carbon hydrogen production and geothermal power	Chemical sector peers, start-ups, energy sector, government	H	M	7	M 7.3 M 7.a
						13	H 13.1
15. Increase proportion of renewable energy or innovative energy technologies used in production	Process innovation	i - Increase proportion of renewable energy or innovative energy technologies used in chemical processes and supply chains by removal of barriers (price, physical stability, regulatory framework, availability, capacity, public acceptance, etc.).	Government, peers, start-ups	H	S	7	H 7.2
						13	M 13.1



Infrastructure and cities impact pathways

Impact opportunity	Category	Key action points	Key partners	Low, medium, high level of input from sector	Short-, medium-, long-term timeframe	Associated SDGs	Associated SDG targets and level of potential impact
16. Scale and evolve involvement in multi-stakeholder collaboration to make cities more sustainable and inclusive, improving lives of the urban poor	Partnership innovation	i - Scale involvement in and development of public-private partnerships to pioneer viable chemical sector products and business models that are inclusive and serve the needs of the urban poor	Various industry, local government, NGOs, finance organizations, local communities	H	M	3	M 3.9
						11	M 11.6
							M 11.c
17. Demonstrate benefits of industrial symbiosis	Partnership & Process innovation	i - Define conditions for favourable cross-sector industrial symbiosis to support the development of relevant legislation and institutional settings that will support proliferation of industrial hubs	Government, industry associations	M	M	9	L 9.4
						11	M 11.3
							L 11.6
						12	M 12.2
							L 12.4
13	M 13.1						
18. Strengthen production assets to promote resiliency	Process innovation	i - Assess production assets and value chain climate change-related resilience risk and share best practices	Chemical sector, value chain partners, WBCSD working groups on water and climate & energy	M	M	9	M 9.4
						11	L 11.6
						13	M 13.1



The road to 2030

This Roadmap underlines the unique and important role of the chemical sector in the context of sustainable development. It confirms that the SDGs are a priority for the chemical sector and plots a series of tangible pathways towards maximizing the sector's potential to contribute to them.

The articulation of the key impact opportunities and actions highlighted in this report is just the first step on the road to continued SDG engagement. Leading chemical sector representatives from within WBCSD's membership will now look to evolve this work from ambition to implementation. This will include ongoing efforts to:

- Develop targeted working groups to advance the different action points identified in the Roadmap, convening the most relevant expertise to deliver progress;
- Leverage this Roadmap to reach out to potential collaborators both from within the chemical sector and beyond; and
- Establish appropriate mechanisms and frameworks to regularly report on progress against the Roadmap and to keep stakeholders updated.

This Roadmap is intended to serve as an invitation to industry peers as well as other public and private sector stakeholders to collaborate around efforts for SDG action moving forward. Contributors to the Roadmap strongly encourage interested parties to contact the group at sdgchemicals@wbcsd.org with ideas on how to align projects or strengthen partnerships to accelerate SDG impact.

Updates on progress regarding the implementation of the Roadmap will be made available on a continuing basis via a dedicated microsite: www.sdgroadmaps.wbcsd.org/chemicals







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