2024 AICM Sustainable Development Report

Focusing Circular Economy

AICM
Chemistry Shapes the Future

Responsible Care®
OUR COMMITMENT TO SUSTAINABILITY

AGENDA

CHEMISTRY SHAPES THE FUTHRE

Board Remarks

Dear Members, Partners, and Friends,

Amidst the increasingly complex and dynamic global landscape, we are pleased to present the AICM 2024 Sustainability Development Report. As integral players in China's chemical industry, multinational chemical companies are actively addressing challenges and playing pivotal roles in fostering low-carbon innovation, facilitating trade, optimizing supply chains, and driving high-quality development.

AICM, as the representative association for multinational chemical enterprises in China, bears a profound sense of responsibility. Guided by our unwavering commitment to "Contributing to the Harmonious Society of China and the Sustainable Development of the Chemical Industry, " we strive to advocate the core principle of Responsible Care® to all stakeholders. Through close collaboration with local industry associations, government agencies, media outlets, and educational institutions, we jointly promote global chemical management systems, advocate for safe and clean manufacturing practices, endorse energy conservation and emission reduction initiatives, and share sustainability policies and plans. These efforts have not only optimized regulatory environments and enhanced law enforcement practices for our member companies but also fostered greater understanding and trust in the chemical industry among the public.

Under the guidance of the "Dual Carbon" strategic goals, China's economic and social development is accelerating towards green and low-carbon transformation. As a vital pillar of the national economy, the chemical industry's transformation and upgrading are of paramount importance. Responding to this call, AICM's member companies have continuously invested in the research and development of innovative chemical products and technologies, injecting robust momentum into the Sustainable Development of China's chemical industry through expanding renewable energy applications, developing more sustainable solutions, and expanding market access for renewable products.

This report serves as both a retrospective of our endeavors over the past year and a vision for future directions. We aim to showcase the innovations and contributions of our member companies in the realm of sustainability, thereby enabling the public to gain a more comprehensive understanding of the relentless efforts and positive contributions made by the chemical industry towards fostering a harmonious society and driving green development, ultimately shaping a favorable image for the industry.

We are acutely aware that the path to Sustainable Development necessitates collective efforts from all parties. AICM will continue to serve as a bridge between chemical enterprises operating in China and policymakers, actively facilitating communication and cooperation, assisting member companies in tackling challenges, and jointly advancing the Sustainable Development of the chemical industry. We are confident that, through our collective endeavors, the chemical industry will usher in an even brighter future.

Lastly, we extend our heartfelt gratitude to all members, partners, and friends from various sectors of society for their unwavering support and trust in AICM. Let us forge ahead together and jointly write a new chapter in the Sustainable Development of the chemical industry!

AICM Board
October 2024

About This Report

In the context of globalization, Sustainable Development has become a worldwide consensus, and the chemical industry, as an essential part of the national economy, plays a significant role in achieving this goal. AICM has released a sustainable development that provides insights into how multinational enterprises in China's chemical sector are responding to the "carbon peak" and "carbon neutrality" targets. Since the inaugural report in 2019, AICM has been conducting surveys to understand the actions and strategic directions of its member companies in carbon reduction and neutrality, with ongoing attention to a range of actions and strategies across carbon emission scopes 1, 2, and 3.

This report aims to assist member companies in fully harnessing their potential and social responsibilities, providing an insight into the practices of multinational chemical enterprises in China as they explore a Circular Economy. By constructing a circular industrial system, these enterprises aim to enhance resource efficiency, reduce waste generation, and achieve the green and Sustainable Development of the industry. The report is not a plan or blueprint, but a framework around which to present:

Our shared vision

- The efforts and contributions of AICM and its member companies to build a harmonious society and promote the Sustainable Development of China's chemical industry.

The connection between Responsible Care®, Sustainability and Circular Economy

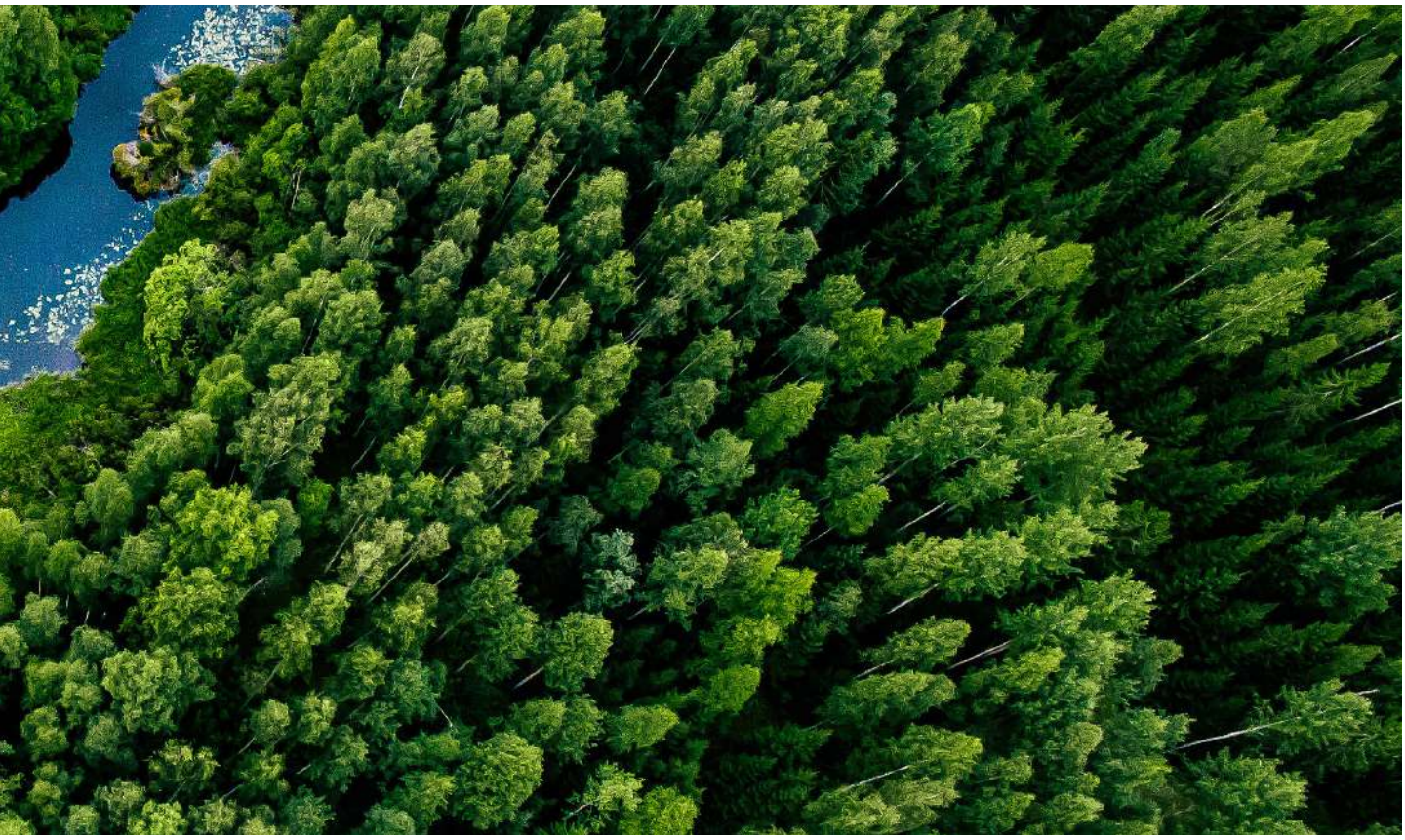
- Responsible Care® should not be confused with Sustainable Development. It is a systematic management framework and the cornerstone of the chemical industry's commitment to Sustainable Development. In contrast, the Circular Economy is a practical approach to achieving sustainability, offering a specific economic model that reduces environmental impact by recycling resources, while also promoting long-term stability and growth of the economy.

Current situation and development path of the chemical industry under the background of Circular Economy

- Through the form of survey and questionnaire, understand the actions taken by member enterprises in Circular Economy, particularly focusing on actions and strategic directions set in areas such as material innovation, green manufacturing, and recycling and reuse;
- Summarizing the development trends of member companies under the Circular Economy context.

Explore the key to chemical industry in Circular Economy

- Analyze and summarize the current situation and measures of chemical industry on Circular Economy;
- To explore the challenges and opportunities for chemical enterprises face in the Circular Economy.



About AICM

AICM has been a forerunner and leader of Responsible Care® since its founded in 1988, while AICM is the first organization to introduce the concept of Responsible Care® into China. In 2011, ICCA welcomed AICM as "OBSERVER" and ranked as "in good standing". And in 2019, AICM was granted with permanent observer status by International Council of Chemical Associations (ICCA).

Today, AICM represents nearly seventy multinational chemical companies that have invested in China. These member companies are engaged in key operations such as manufacturing, storage, transportation, distribution, application, and disposal of chemicals. They bring their advanced global operational practices and business experience to China to promote economic and industrial development. With the joint efforts of all member companies,

Cooperate with Government and Chemical Parks

- AICM actively promotes best practices to the government, stakeholders, and the public.
- It engages in policy analysis and seminars to exchange industry information.
- Through organizing Mayor Forum and panel discussions at the China International Petrochemical Conference (CPCIC) for several consecutive years, as well as organizing AICM session and releasing sustainability reports at the China Chemical Park and Industrial Development Conference (CCIP), AICM promotes its members' contributions to the chemical industry to industry partners and the public.

Open-to-Public Day (OTP)

- AICM first introduced the Open-to-Public Day (OTP) campaign in China in 2008. Over the past 15 years, AICM and its members have been strong advocates of OTP, hosting a series of events annually to establish a positive image and reputation within the chemical industry.
- As a flagship program and a key component of AICM's Responsible Care® initiative, OTP serves as a communication platform to promote the concept of a sustainable chemical industry. It provides a transparent and open channel for dialogue between the industry and its stakeholders.
- The significance of OTP has been widely acknowledged by chemical companies and stakeholders globally. This signature event has helped local governments, associations, and other stakeholders to gain a better understanding of the constructive role that the chemical industry plays in supporting the country's Sustainable Development.

RC Journey within Chemical Park

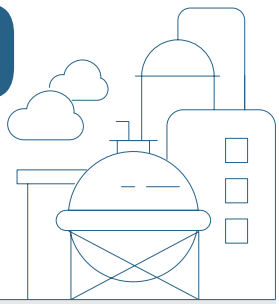
- We collaborate closely with Chemical Parks to maintain strong ties with local enterprises and cultivate a local culture of Responsible Care®.
- Since 2019, AICM has initiated the RC Journey program and has been co-organizing a series of Safety Salons with local chemical parks. These salons are designed to enhance chemical safety management by sharing best practices and introducing effective methodologies tailored to address the specific challenges and operational weaknesses of local companies. Overall, these initiatives have been met with great enthusiasm and have garnered consistent recognition from the local community.

AICM actively advocates for science-based, risk-controlled, and cost-effective chemical management strategies, enhances public awareness of the chemical industry, and contributes wisdom and strength to the harmony of Chinese society and the healthy development of the chemical industry.

As a pioneer of Responsible Care®, AICM was the first to introduce the concept of Responsible Care® to China. It has engaged in in-depth exchanges with all industry stakeholders, jointly deepening the understanding of the philosophy of Responsible Care® and working together to put it into practice. Together, they are creating a sustainable future for the chemical industry.

AICM represents nearly 70 major multinational companies in the chemical industry of China

70



Responsible Care® Walks into Campus

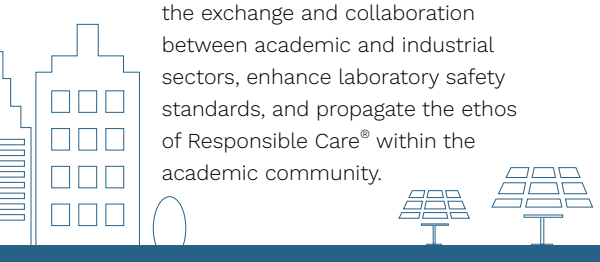
- Safety education is paramount, particularly for securing the future of China. We are committed to enhancing campus safety by engaging with the younger generation.
- We have extended our efforts into academic institutions, conducting the Responsible Care® E-learning course in collaboration with East China University of Science and Technology (ECUST). This initiative aims to instill the principles of Responsible Care® in students, familiarize them with safety management systems and operational models, and thereby develop their EHS competencies and consciousness. The course materials, including synchronized recordings, are made accessible online as a public educational resource.
- In a similar vein, we have ventured into university laboratories, formalizing our commitment through a MOU with Fudan University. This partnership is designed to bolster the exchange and collaboration between academic and industrial sectors, enhance laboratory safety standards, and propagate the ethos of Responsible Care® within the academic community.

AICM International Exchange and Cooperation

- AICM fosters robust communication and collaboration with a range of international associations, including ICCA, ACC, Cefic, JCIA, and others. We serve as a conduit for dialogue between domestic and international entities, establishing a platform for dialogue between governments and businesses, and advancing the scientific and sustainable evolution of regulatory frameworks within the global chemical industry.
- Since 2014, AICM has been convening regulatory seminars in partnership with international chemical industry organizations such as ICCA, ACC, Cefic, and JCIA. These seminars are designed to advocate for a regulatory system grounded in science and risk management, to encourage the establishment of industry standards and regulations, and to embody and champion the principles of green development. Key topics include the EU Green Deal, the EU Chemicals Sustainability Strategy, microplastics, and green certification systems, among others. These initiatives have earned significant recognition from Chinese governmental departments, enterprises, and fellow industry associations.

Introduce of International Good Practices

- The Safety and Quality Assessment System (SQAS), initiated by the European Chemical Industry Council (Cefic), represents best practices for Responsible Care® in the supply chain.
- In 2007, with the rapid development of China's chemical industry, an increasing number of domestic and international chemical companies paid more attention to the safety of chemical transportation in China. However, the market for the transportation of dangerous goods in China still had many safety hazards. To better understand the capabilities of Chinese logistics companies in the transportation of dangerous goods, AICM introduced SQAS to China and started with road transportation safety, establishing the China Road Safety and Quality Assessment System (RSQAS). On one hand, it standardizes transportation companies through the system, and on the other hand, it also provides a reference for chemical production companies to choose suitable logistics suppliers.



Relationship between Responsible Care®, Sustainable Development, and the Circular Economy

Responsible Care®

Responsible Care® is a global voluntary initiative in the chemical industry aimed at continuously improving health, safety, and environmental performance through communication with stakeholders. It focuses on producing safe and affordable products that benefit society.

Sustainable Development

Sustainable Development, on the other hand, is a broader concept that refers to meeting the needs of the present without compromising the ability of future generations to meet their own needs. This is often associated with the United Nations' Sustainable Development Goals (SDGs), which are a universal call to action to promote economic growth, social well-being, and environmental protection through global partnerships.

The relationship between Responsible Care® and Sustainable Development is complementary and mutually reinforcing

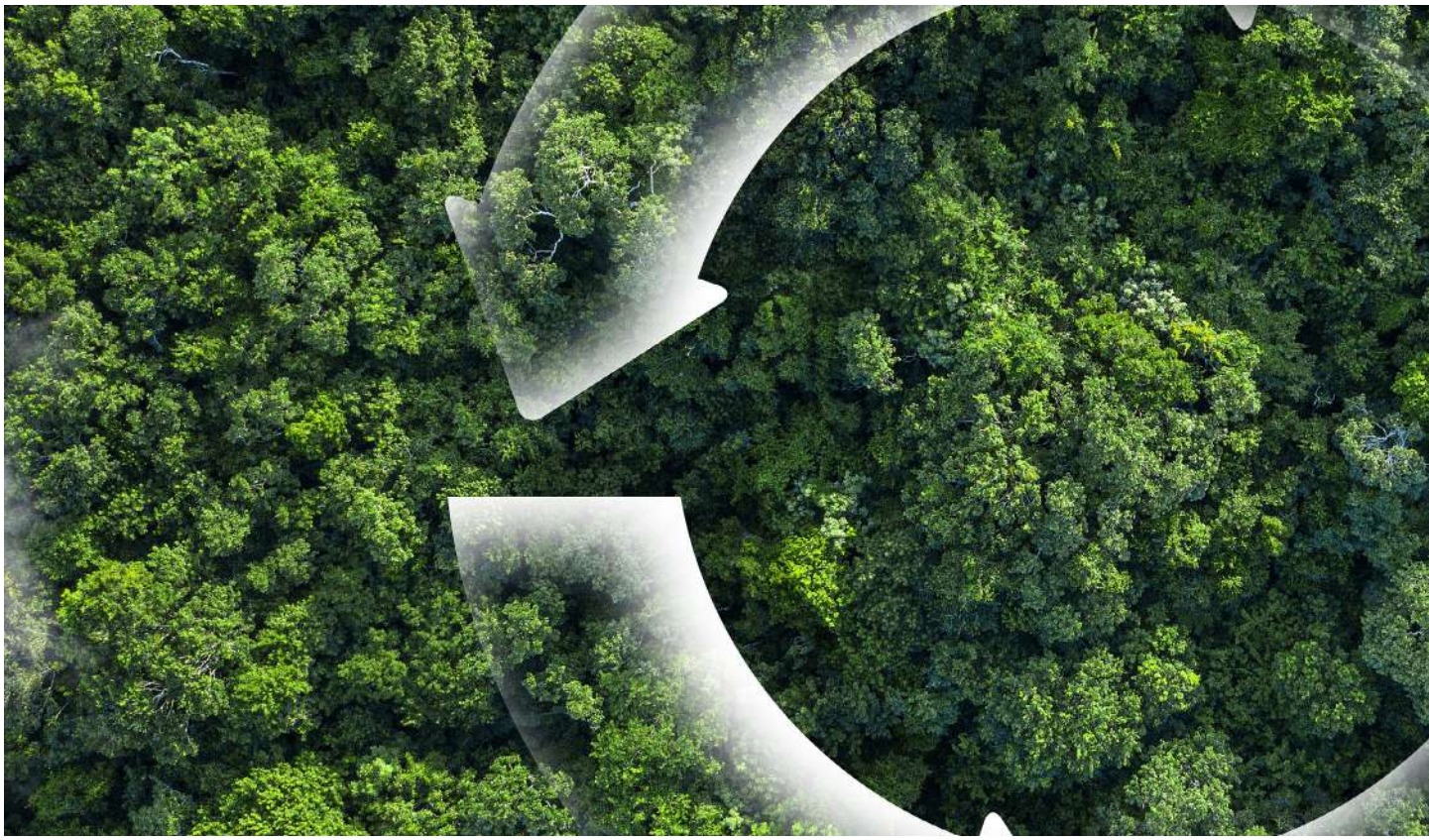
Responsible Care® can be seen as a specific practice that companies adopt within the framework of Sustainable Development

Emphasizing corporate responsibility for the environment, society, and health and safety in their operations. By implementing Responsible Care®, companies can not only enhance their environmental and social responsibility performance but also contribute to the achievement of Sustainable Development goals.

The Sustainable Development Goals (SDGs) provide a macro framework that guides all actors, including businesses, on how to promote the coordinated development of economic, social, and environmental aspects at a global level

Companies support the achievement of SDGs through the practice of Responsible Care®, such as improving process safety, product management, and environmental protection. This directly supports goals like SDG 3 (Good Health and Well-being), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action).

In summary, Responsible Care® is a means for companies to achieve the Sustainable Development Goals, while sustainability provides direction and objectives for a company's Responsible Care® practices. The relationship between the two is interactive, jointly promoting businesses and society towards a more sustainable future.



The Circular Economy

The Circular Economy is a specific economic model for achieving Sustainable Development. It emphasizes the efficient use and recycling of resources, aiming to reduce resource consumption and waste generation, and to achieve a closed-loop flow of materials and energy in economic activities.

The concept of the Circular Economy

Originated in the United States in the 1960s

Began to be introduced to China in the 1990s

01

With the efficient use and recycling of resources at its core

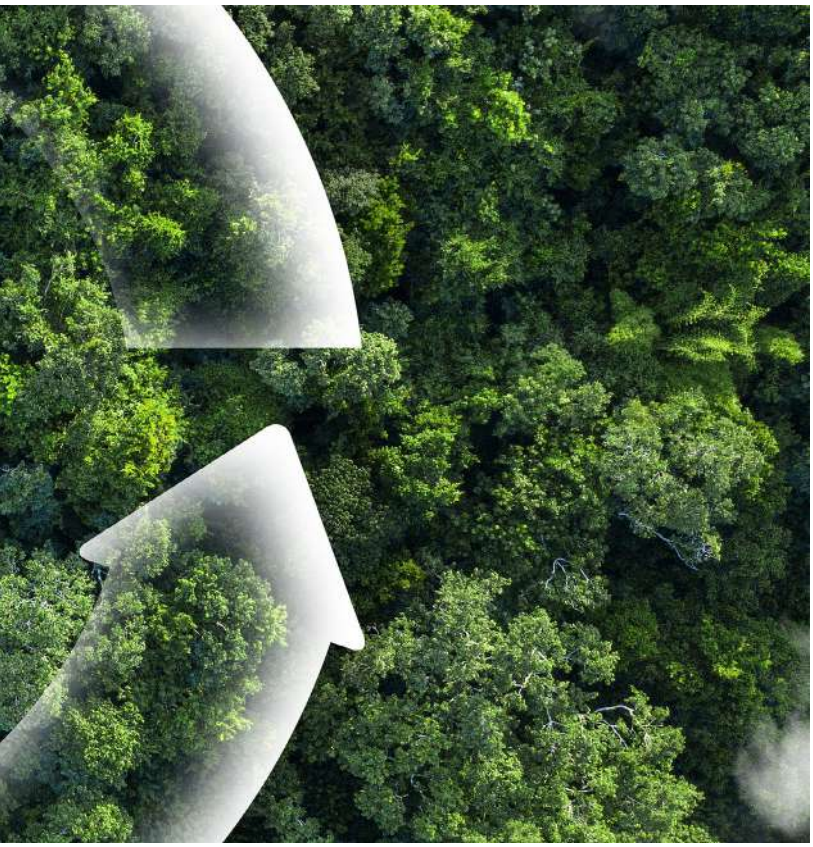
02

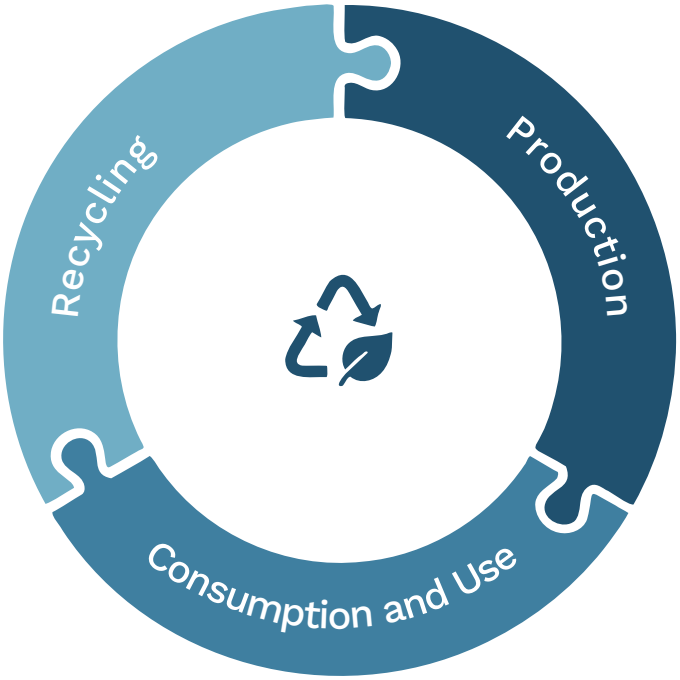
The Circular Economy is based on the principles of reduction, reuse, and recycling

03

It is characterized by low consumption, low emissions, and high efficiency

Representing a growth model that aligns with the Sustainable Development concept and represents a fundamental transformation from the traditional model of mass production, mass consumption, and mass disposal.





Closed-loop model of Circular Economy

The traditional economic model is linear.

We extract resources from nature to manufacture products and ultimately discard them as waste, essentially pursuing quantitative economic growth at the expense of the natural environment, which is contrary to the concept of Sustainable Development.

The Circular Economy replaces the traditional linear production model with a closed-loop production model of "product manufacturing—resource recycling—product regeneration." It takes a comprehensive view of the value chain and establishes a system for resource recovery and value rebirth, aiming to maximize the efficiency of product and asset recycling.

The goal of the Circular Economy is to decouple economic activity from resource consumption, prevent pollution and waste generation from the design phase, and create more socio-economic value while promoting the regeneration of natural resources.

The Circular Economy is a vital pathway to achieving Sustainable Development, as it promotes the coordinated development of the economy, society, and environment by transforming traditional production and consumption patterns. By implementing a Circular Economy, we can significantly reduce resource consumption and environmental pollution, ensuring long-term and stable economic growth while also protecting and improving the ecological environment, thus leaving a more livable planet for future generations.

Overview and Policy Interpretation of Circular Economy in Chemical Industry

Regulatory policy summary and policy trends for the Circular Economy[1]

The world's major economies regard the development of Circular Economy as the basic path to break the constraints of resources and environment, coping with climate change and fostering new points of economic growth, and at present, the European Union, the United States and other developed economies have systematically deployed a new round of action plans for the Circular Economy, accelerating the layout of the development of the Circular Economy in order to cope with the new challenges to the global resources and environment.

EU

- In 2015, the EU released the Circular Economy Action Plan[1], aiming to promote the transformation of the world's largest single market into a Circular Economy.
- In 2022, the European Commission released the New Circular Economy Action Plan[2] on the basis of the first edition, strengthening the coordination of the Circular Economy and emission reduction, systematically changing the way of production, life, and consumption, and promoting the circular change from the front-end of the product design, so as to create business opportunities and economic value.
- In 2023, the EU released the EU Battery and Waste Battery Regulation[3], which put forward a series of requirements such as restrictions on hazardous substances, carbon footprint, CE marking, labelling, due diligence, and so on.

Japan

- Japan has continuously released four versions of the Basic Plan for Promoting the Formation of a Recycling-based Society at five-year intervals from 2013 to 2018, proposing major actions and specific measures for building a recycling-based society.
- In 2020, Japan released the Carbon Neutralization Green Growth Strategy 2050[4], promoting the industrialization of carbon recycling technologies.

1 Circular Economy Promotion Law of the People's Republic of China
China Sets Dual-Carbon Goal
Guidance on the Comprehensive Utilization of Solid Waste during the Fourteenth Five-Year Plan
The 14th Five-Year Plan for Circular Economy Development
Plastic Pollution Control Action during the 14th Five-Year Plan
Notice on Recycling Reform Work in Parks during the 14th Five-Year Plan
The 14th Five-Year Plan for Raw Material Industry Development
Guiding Opinions on Accelerating the Construction of Waste Material Recycling System
Implementing Plan on the Promotion of the Comprehensive Utilization of Industrial Resources
Implementing Opinions on Accelerating the Recycling of Used Textiles
Guiding Opinions on Promoting High-Quality Development of Petrochemical and Chemical Industry during the 14th Five-Year Plan
Measures for the Administration of the Use and Reporting of Single-Use Plastics by Businesses in the Commercial Field

United States

- In 2020, the United States issued the Zero Carbon Emission Action Plan[1], focusing on six major energy production and consumption sectors, namely, power, transport, construction, industry, land and materials, and planning to establish a new national sustainable materials management framework and a Circular Economy system with “ ”reduction, reuse and recycling“ ” as the pillar.

China

- As an active participant and leader in addressing climate change, the Chinese government attaches great importance to the development strategy of the Circular Economy and has formed a Circular Economy theory and policy system with Chinese characteristics during years of exploration and practice. The concept of the Circular Economy contributing to the reduction of greenhouse gas emissions has also been embodied in a number of central policy documents or action programs.

Guiding Opinions on Promoting Green, Innovative and High-Quality Development of the Oil Refining Industry
The Action Plan to Promote the Green Transformation of Packaging for Express Service
Opinions on Comprehensively Promoting the Construction of a Beautiful China
Opinions on Accelerating the Construction of a Waste Recycling System
The Action Plan for Promoting Large-scale Equipment Renewals and Consumer Goods Trade-ins
Opinions on Accelerating the Comprehensive Green Transformation of Economic and Social Development

2 First Circular Economy action plan - European Commission (europa.eu)
3 The New Circular Economy Action Plan (CEAP) (europa.eu)
4 Regulation - 2023/1542 - EN - EUR-Lex (europa.eu)
5 Green Growth Strategy Through Achieving Carbon Neutrality in 2050 / METI Ministry of Economy, Trade and Industry
6 https://www.unsdsn.org/Zero-Carbon-Action-Plan

Timeline of major Circular Economy policies in China in recent years

2008.8 & 2018.10

Circular Economy Promotion Law of the People's Republic of China

Aims to promote the efficient utilization and recycling of resources, reduce pollution and promote Sustainable Development. The law clearly defines the Circular Economy, emphasizes the principles of reduction, reuse and resourcing, and encourages scientific and technological innovation and international cooperation through policy guidance and market mechanisms.

2020.9

China Sets Dual-Carbon Goal

Xi Jinping delivered an important speech at 75th session of the United Nations General Assembly, adopting more vigorous policies and measures, striving to achieve carbon peak by 2030 and carbon neutrality by 2060.

2021.3

Guidance on the Comprehensive Utilization of Solid Waste during the Fourteenth Five-Year Plan

Improve the efficiency of solid waste resource utilization, promote the green and innovative development of the comprehensive utilization of solid waste, and clarify the main targets of solid waste disposal: by 2025, the comprehensive utilization capacity of solid waste will be significantly improved, the scale of utilization will continue to expand, the comprehensive utilization rate of new solid waste will reach 60%, and the stock of solid waste will be reduced in an orderly manner.

2021.7

The 14th Five-Year Plan for Circular Economy Development

The Plan focuses on three major areas, including industry, social life and agriculture, and depicts the roadmap for the development of China's Circular Economy during the 14th Five-Year Plan period. The Plan sets out the main targets: by 2025, circular production methods will have been fully implemented, green design and clean production will have been widely promoted, the capacity for comprehensive utilization of resources will have been significantly enhanced, and a resource-cycling industrial system will have been basically established.

2021.9

Plastic Pollution Control Action during the 14th Five-Year Plan

Strengthen the standardized recycling and clearing of plastic waste, support the construction of plastic waste recycling projects, issue a list of standardized enterprises for the comprehensive utilization of waste plastics, guide the relevant projects to resource recycling bases, industrial resource comprehensive utilization bases and other parks, and promote the development of the plastic waste recycling industry in terms of scale, standardization and cleanliness.

2021.12

Notice on Recycling Reform Work in Parks during the 14th Five-Year Plan

By the end of 2025, all parks above the provincial level will have implemented recycling transformation, significantly enhancing the level of green, low-carbon and recycling development in the parks. Through the recycling transformation, the resource utilization efficiency of the parks in terms of energy, water and land will be significantly improved, and the emissions of carbon dioxide, solid waste, wastewater and major air pollutants will be significantly reduced.

The 14th Five-Year Plan for Raw Material Industry Development

The Plan specifies the development targets by 2025, including upgrading the scale of the new materials industry, reducing energy consumption and carbon emissions, and strengthening intelligent

manufacturing. At the same time, five major projects such as new materials innovation, low-carbon manufacturing and digital empowerment are deployed to ensure that the planning targets are achieved and to promote China's raw materials industry to a higher level.

2022.1

Guiding Opinions on Accelerating the Construction of Waste Material Recycling System

Build a standardized and orderly recycling network system to further improve the level of waste materials recycling; improve the level of technology and equipment in the processing and utilization links to increase the recovery rate of resource materials and reduce carbon emissions more substantially; promote the diversified use of waste materials in conjunction with the actual, orderly promotion of second-hand used goods, remanufacturing industry development, and realize the decarbonization of products.

Implementing Plan on the Promotion of the Comprehensive Utilization of Industrial Resources

Accelerate the promotion of high-value recycling of renewable resources, promote the synergistic use of industrial resources and the standardized use of renewable resources, enhance the value of renewable resources, improve the recycling system of waste power batteries, and deepen the recycling of waste plastics.

2022.3

Implementing Opinions on Accelerating the Recycling of Used Textiles

The Opinions specified nine measures such as textile green design, encourage the use of green fibers, improve the recycling network, etc. from the three aspects of production, recycling, comprehensive utilization.

Guiding Opinions on Promoting High-Quality Development of Petrochemical and Chemical Industry during the 14th Five-Year Plan

The policy clearly encourages the recycling of resources, encourages conditional enterprises to develop in an orderly manner and scientifically promote biodegradable plastics, and promotes the recycling and recycling of waste chemical materials such as waste plastics and waste rubber.

2023.5

Measures for the Administration of the Use and Reporting of Single-Use Plastics by Businesses in the Commercial Field

The policy encourages the reduction of the use of single-use plastic products, scientifically and steadily promote the application of alternative products, and guide the public to actively participate in the control of plastic pollution. Business operators in commodity retail, e-commerce, catering, accommodation, exhibition and other business fields shall abide by the provisions of the State on prohibiting and restricting the use of disposable plastic products such as non-degradable plastic bags.

2023.10

Guiding Opinions on Promoting Green, Innovative and High-Quality Development of the Oil Refining Industry

Enterprises with conditions are encouraged to explore the coupling processing of waste organic substances such as waste plastics, waste lubricating oil, waste grease and waste gas production sludge with crude oil. it encourages the development of low-power pyrolysis and purification pretreatment technologies for waste plastics, develop complete sets of technologies for deep processing of waste plastics with low carbon emissions, and accelerate the pilot demonstration of chemical recycling projects for waste plastics.

2023.11

The Action Plan to Promote the Green Transformation of Packaging for Express Service

Increase efforts to solidly promote the reduction of express packaging, accelerate the cultivation of new models of recyclable express packaging, continue to promote the recycling of used express packaging, enhance the standardization of express packaging, recycling, reduction, harmless level, and promote the high-quality development of e-commerce, express industry.

Opinions on Comprehensively Promoting the Construction of a Beautiful China

Accelerate the construction of a waste recycling system, and promote the recycling of waste wind turbine blades, photovoltaic components, power batteries, express packaging and other waste. Promote the conservation of raw materials and the recycling of resources, and vigorously develop the remanufacturing industry. Comprehensively promote the construction of green mines. By 2035, the utilization efficiency of energy and water resources will reach the international advanced level.

2024.2

Opinions on Accelerating the Construction of a Waste Recycling System

The Opinions further clarify the development direction of the construction of the Circular Economy system, with the goal of improving the efficiency of resource utilization, and achieve win-win economic growth and environmental protection with the goal of improving resource utilization efficiency and the path of fine management, effective recycling and efficient utilization of waste.

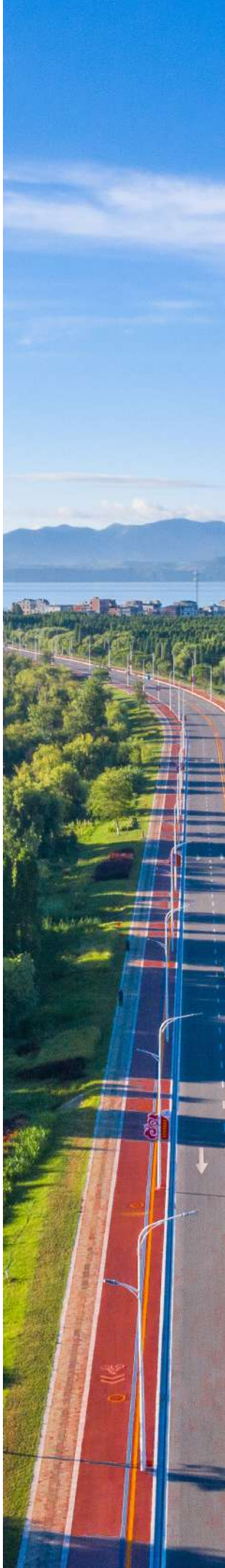
2024.7

The Action Plan for Promoting Large-scale Equipment Renewals and Consumer Goods Trade-ins

The Government takes the lead in arranging about RMB300 billion of ultra-long-term special national bond funds to substantially expand the scope of support and raise the subsidy standard, so as to promote large-scale equipment replacement and consumer goods trade-in.

Opinions on Accelerating the Comprehensive Green Transformation of Economic and Social Development

The Opinions propose to vigorously develop the Circular Economy. Further promote the Circular Economy to help reduce carbon emissions, popularize the resource-cycling production model, vigorously develop the resource recycling industry, promote the high-quality development of the remanufacturing industry, improve the quality of recycled materials and products, and expand the scale of substitution for primary resources. Promote the classification of domestic garbage and enhance the utilization rate of resources. Improve the waste recycling system, strengthen the capacity of waste classification, disposal and recycling, and enhance the scale, standardization and refinement of recycling.



Under the goal of "dual carbon", China attaches great importance to the development of Circular Economy, and takes it as an important way to ensure national resource security, promote the realization of carbon peak and carbon neutrality goals, and promote the construction of ecological civilization. From the 11th Five-Year Plan to the 14th Five-Year Plan, the Chinese government has successively issued a series of policy documents. Especially during the 14th Five-Year Plan period, China has put forward higher requirements for the development of Circular Economy, the policy system of Circular Economy is gradually improving, and the development of Circular Economy in China is gradually entering a new stage.

In order to further enhance the effectiveness of the policy, on the basis of the existing policies, AICM suggests:

On the policy side, it is necessary to further refine the specific implementation plans and incentive policies of the Circular Economy in various industries and fields, such as tax concessions, financial subsidies, green finance, etc., so as to improve the pertinence and operability of the policies.

Establish and improve the regulatory system of the Circular Economy and the industry standards and guide the enterprises to adopt advanced and applicable Circular Economy technologies and equipment by means of the standards; formulate and implement local regulations according to local realities, so as to provide more specific and targeted policy guarantee for the development of local Circular Economy.

Establish a sound regulatory system for the Circular Economy and industrial standards, and guide enterprises through standards to adopt advanced and applicable Circular Economy technologies and equipment. Formulate and implement local laws and regulations according to the local actual situations, so as to provide more specific and targeted policy guarantees for the development of the local Circular Economy.

Core drivers of Circular Economy transformation in the chemical industry

In today's wave of global Sustainable Development, promoting the transformation of the chemical industry[7] into a Circular Economy model has become a widely agreed driving force both inside and outside the industry. This transformation not only stems from the deep concern about energy and resource conservation, but also reflects corporate social responsibility, the result of policy guidance, and the orientation of market demand.

Conservation of energy and resources

During the 14th Five-Year Plan period (2020-2025), China's demand for resources and energy will continue to grow rigidly. Meanwhile, some major resources are highly dependent on foreign countries, and the overall efficiency of resource and energy utilization is still not high, so resource security is under greater pressure. Therefore, the demand of developing Circular Economy, improving the efficiency of resource utilization and the level of renewable resources utilization is very urgent, and the space is huge. Waste itself contains rich resources and energy, and promoting the efficient recycling of renewable resources can alleviate the problem of resource shortage, reduce environmental pressure, and promote Sustainable Development.

During the 14th Five-Year Plan period, China issued the 14th Five-Year Plan for Circular Economy Development, which further clarifies the construction of a resource recycling industrial system and sets development goals for the energy and resource sectors by 2025. On the basis of the achievements in the development of Circular Economy during the 13th Five-Year Plan, it has raised the target requirements for indicators such as the major resources output rates and the output value of resource recycling industry. At the same time, the Plan refined the classification of waste, set more specific targets for the recycling and reutilization of waste, further strengthened the construction of the waste classification system, and improved the efficiency of resource utilization and the level of utilization of recycled resources.

7 The reference to "chemical industry" in the main report mainly focuses on foreign chemical enterprises in China

Figure 1: China's total energy consumption grows year by year[8]

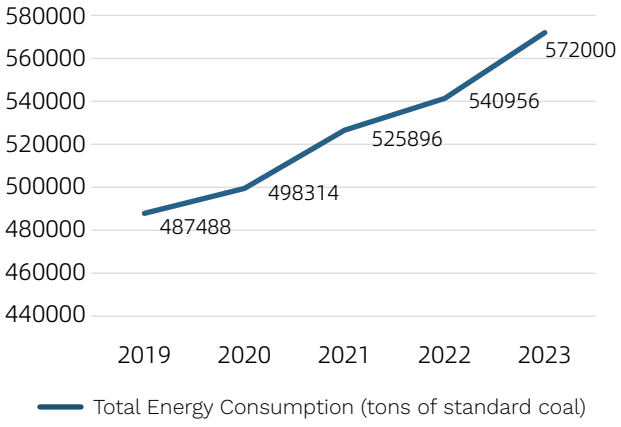


Figure 2: China's total energy consumption of chemical raw materials and chemical products manufacturing industry grows year by year[9]

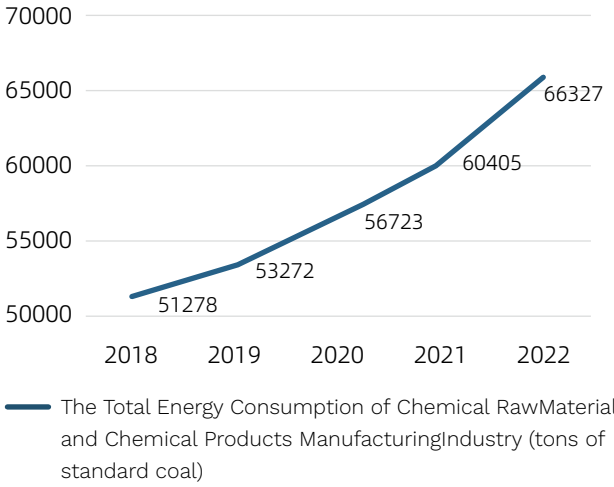


Figure 3: Comparison of Circular Economy development achievements between the 14th Five-Year Plan and the 13th Five-Year Plan[10]

	Circular Economy Achievements in the 13th Five-Year Plan	Circular Economy Achievements in the 14th Five-Year Plan (2025 Targets)
Major resources output rates[11]	Approximately 26% increase from 2015	Approximately 20% increase from 2020
Energy consumption per unit of GDP	Substantial decrease	Approximately 13.5% decrease from 2020
Water consumption per unit of GDP	Cumulative decrease 28%	Approximately 16% decrease from 2020
Solid waste utilization rate	Reach 56%	Reach 60%
Waste paper utilization	Reach 54.9 million tons	Reach 60 million tons
Waste steel utilization	Approximately 260 million tons	Approximately 320 million tons
Recycled non-ferrous metal production	Reach 14.5 million tons	Reach 20 million tons
Output value of resource recycling industry	/	Reach RMB 5 trillion

8 Data from the National Bureau of Statistics: Country data(stats.gov.cn)

9 Data from the National Bureau of Statistics: Country data(stats.gov.cn)

10 Source 14th Five-Year Plan for Circular Economy Development

11 Major resources output rates (yuan/tonne) = GDP (billion yuan, constant prices) ÷ physical consumption of major resources (billion tons)

Major resources include: fossil energy (coal, oil, natural gas), iron and steel resources, non-ferrous metal resources (copper, aluminum, lead, zinc, nickel), non-metallic resources (limestone, phosphorus, sulfur), and biomass resources (wood, grain)

The fulfilment of the dual-carbon target

In 2020, China set the carbon neutrality goal of "achieving carbon peak by 2030 and carbon neutrality by 2060", and subsequently issued the Carbon Peak Action Plan, which specifies the dual-carbon targets for the 14th the 15th Five-Year Plan period, formally incorporating the concept of "carbon neutrality" into the top-level layout. The Plan also specifies the dual-carbon targets for the 14th Five-Year Plan and the 15th Five-Year Plan, formally incorporating the concept of 'carbon neutrality' into the top-level layout.

Dual-carbon goals during 14th Five-Year Plan

- Further improve the policy system favorable to green, low-carbon and recycling development
- The proportion of non-fossil energy consumption reaches about 20%
- Energy consumption per unit of GDP decreases 13.5% from 2020
- Carbon dioxide emissions per unit of GDP decreased 18% from 2020

Dual-carbon goals during 15th Five-Year Plan

- The policy system for green, low-carbon and recycling development is basically sound
- The proportion of non-fossil energy consumption reaches about 25%
- Carbon dioxide emissions per unit of GDP decreased 65% from 2005

In the context of the "dual-carbon" goal, the limitations of the linear economic development model are increasingly apparent, and the development of Circular Economy is of great significance to promote the realization of the "dual-carbon" goal. Circular Economy measures can be applied at all stages of the product life cycle to reduce emissions by changing the way products designed, produced and used. Vigorously developing Circular Economy can effectively reduce the consumption of energy and resources caused by product waste treatment and disposal, thus helping enterprises to achieve the goal of emission reduction.

The development of a Circular Economy has demonstrated a significant supporting role in reducing carbon emissions at both the domestic and international levels. According to preliminary estimates, during the 13th Five-Year Plan period, the comprehensive contribution of the development of Circular Economy to China's carbon emission reduction exceeded 25%; during the 14th Five-Year Plan period, with the in-depth implementation of policies on Circular Economy and the continuous promotion of technological innovations, it is expected that its contribution to carbon emission reduction will be further enhanced, making a greater contribution to the realization of the national carbon neutrality goal and the global climate governance goal.

Meanwhile, in the long run, it is expected that by 2050, the Circular Economy can help reduce carbon dioxide emissions from key industrial sectors such as cement, steel, plastics and aluminum by nearly 40% globally, totaling about 3.7 billion tons, which is of great significance to achieving the carbon neutrality target.

3.7 Billion tons

Policy guidance and support

The government actively releases policy dividends for the development of recycling industry, increases financial and tax support and strengthens policy guarantee. The Announcement on Improving the Value-added Tax Policy on Comprehensive Utilization of Resources[12] and the Catalogue of Enterprise Income Tax Preferences for Comprehensive Utilization of Resources (2021 Edition) [13] were released, which further improved the tax preferential policies on comprehensive utilization of resources and increased the strength of tax preferences.

In 2023, the National Development and Reform Commission and other departments jointly issued the Guiding Opinions on Promoting Green, Innovative and High-Quality Development of the Oil Refining Industry, which aims to promote the green transformation of the upstream petrochemical industry chain.

The policy clearly advocates the principle of resource recycling and encourages qualified enterprises to explore the processing mode of coupling organic materials (including waste plastics, waste lubricating oils, waste oils and greases, and waste biochemical sludge, etc.) with crude oil.

Meanwhile, focusing on waste plastics processing, it encourages the development of low energy consumption pyrolysis and purification pre-treatment technologies for waste plastics, accelerates the citation of complete sets of low-carbon waste plastics oil deep-processing technologies, and promotes the pilot demonstration of chemical recycling engineering for waste plastics.

The 14th Five-Year Plan to Promote Circular Economy proposes to:

Strengthen the legal and policy framework of Circular Economy, including promoting the revision of laws and regulations related to Circular Economy, stimulating the innovation of local legislations, improving the standard system of Circular Economy and deepening the standardization pilot work.

At the same time, the government should optimize the allocation of resources and strengthen the financial support for major projects and capacity building of Circular Economy, and further strengthen the promotion mechanism of the Circular Economy, so as to provide a solid guarantee for the green transformation of the industry.

In this context, key areas of green transformation such as plastic chemical recycling and bio-based chemicals are gradually becoming focus of industry attention.

Market-oriented

With the continuous evolution of consumer preferences and demand in major downstream markets (including public utilities, transportation, textiles and clothing, electronic technology, cleaning products, food and agriculture, cosmetics and beauty and other fields), the business logic of the Circular Economy is becoming more and more apparent in the chemical industry. While pursuing sustainable materials and chemical applications, many chemical companies are also committed to improving product performance and exploring closed-loop recycling mechanisms, with the aim of reducing waste generation and lowering carbon footprint.

Meanwhile, in response to and achieving the United Nations Sustainable Development Goals (SDGs), many chemical companies are actively working with downstream customers, universities and start-ups to jointly develop and implement innovative business models of products and Circular Economy. These collaborations aim to effectively decouple economic growth from resource consumption and environmental pollution through innovative means, optimize the resource utilization efficiency throughout the entire life cycle of products, thereby significantly enhancing the market competitiveness while achieving environmental friendliness.

12 The Announcement on Improving the Value-added Tax Policy on Comprehensive Utilization of Resources

13 The Catalogue of Enterprise Income Tax Preferences for Comprehensive Utilization of Resources (2021 Edition)

The Anatomy of the Main Implementation Paths of Circular Economy

Against the backdrop of global Sustainable Development, Circular Economy has been increasingly emphasized by various industries as an important way to promote green transformation and achieve efficient resource utilization and environmental protection. Research[14] shows that the implementation of Circular Economy has huge potential and could generate $4.5 trillion of additional economic output. The Circular Economy model can help decouple economic growth from natural resource consumption while improving industrial competitiveness.

AICM believes[15] that the effective implementation of Circular Economy by companies is a key path to Sustainable Development in the chemical industry. This chapter aims to introduce the targets, policies, and management frameworks of AICM member companies in the field of Circular Economy, and to discuss the implementation paths and measures taken by the chemical industry to implement Circular Economy, which AICM would like to provide reference and inspiration for the Sustainable Development of the industry.

Current Circular Economy Practices of AICM Member Companies

Through a well-designed questionnaire survey, we have extensively collected information on the Circular Economy practices of AICM member companies in the global and Chinese markets.According to the survey:

96% »

96% of the surveyed member companies have set ESG targets or visions related to the Circular Economy globally, including material innovation, green manufacturing, and recycling and reuse, and are actively exploring resource-saving and environmentally friendly models of Circular Economy development.

93% »

93% of the surveyed member companies have formulated policies to support Circular Economy, set up targets related to resource utilization, waste disposal and discharge, and formed a clear and efficient implementation roadmap.

81% »

81% of the surveyed member companies have set up a Circular Economy management structure[16] to manage matters related to the Circular Economy and corporate sustainability, and to follow up on and evaluate the attainment of the relevant targets.

AICM member companies are committed to promoting the development of the chemical industry towards a greener, more environmentally friendly, and sustainable direction by strengthening systems and management and transforming from a linear economy to a Circular Economy.

Implementation Path and Main Measures of Circular Economy in the Chemical Industry

In the chemical industry, the implementation of Circular Economy is inseparable from the support of process and product innovation. Process and product innovation not only promotes the conservation and efficient utilization of resources, but also promotes the reduction and recycling of waste, reducing the impact of economic activities on natural resources and providing a strong impetus for the development of Circular Economy in the chemical industry. AICM member companies have made significant progress in the following areas:

14 The Circular Economy Could Unlock $4.5 trillion of Economic Growth, Finds New Book by Accenture

15 "AICM believes" and "AICM insight" mentioned in this report represents the position of the Association of International Chemical Manufacturers (AICM) and is based on a comprehensive analysis and judgment of the current chemical industry's (focusing on foreign-funded chemical enterprises) development trend, policy environment, technological progress, and other factors

16 Include equivalent structure and management responsibilities

Material Innovation

The chemical industry permeates a wide range of industries, conducting research and development (R&D), design, production, and manufacturing of materials needed in different fields. While the production and widespread use of materials has greatly facilitated human life, it has also placed a burden on the environment, prompting the industry to explore green alternatives.

The 14th Five-Year Plan for the Development of the Raw Materials Industry[1] emphasizes technological innovation as the first driving force, green safety as the bottom line of development, promotion of raw materials innovation and low-carbon development, and accelerating the green transformation of industrial development. The Circular Economy Promotion Law[1] states that in the process of designing production processes, equipment, products, and packaging materials, the principle of resource conservation and environmental friendliness should be upheld, and materials and design schemes with characteristics of easy recyclability, easy disassembly, easy degradation, non-toxicity, and harmlessness should be preferentially selected, and the compulsory requirements of relevant national standards should be met. Policies and regulations are guiding green and low-carbon innovation in the industry, reducing the consumption of natural resources and long-term environmental pollution resulting from the production, use and end-of-life of materials and products, in order to promote Sustainable Development and Circular Economy.

AICM member companies are actively engaged in innovative practices and are committed to exploring and using renewable, degradable, or recycled materials to gradually reduce the chemical industry's dependence on non-renewable resources. For example, our member companies help downstream companies develop sustainable packaging products that meet market demands and mitigate environmental impacts, reduce ecosystem pollution caused by packaging waste, and promote the green and sustainable transformation of the packaging industry. At the same time, our members also develop environmental sustainability assessment standards and systems for raw materials and products, providing robust support for the application of environmentally friendly materials and green design of products through scientific assessment and standardized approaches, and thereby accelerating the transformation process of sustainable and recyclable models in the industry.

Measures Taken by Surveyed Member Companies in terms of Material Innovation

- **Plastics**
  - -Pre-consumer recycled material[17] solutions
  - -Post-consumer recycled material[18] solutions
  - -PFAS-free solutions
  - -Bio-based and bio-attributed solutions
  - -Bio-degradable solutions
- **Adhesives**
  - -Bio-based and bio-attributed solutions
  - -Low VOC solutions
  - -Compostable solutions
- **Rubber**
  - -Bio-based degradable material solutions
  - -Recyclable material solutions
- **Sustainable Packaging Materials**
  - -Recyclable packaging material solutions
  - -Naturally degradable packaging material solutions
- **Low Carbon Solutions**
  - -Lightweight solutions
  - -Material substitution solutions
  - -Recycled content containing solutions
  - -Co-lamination solutions
  - -Thin-walled solutions
  - -Green building materials solutions

17 Pre-consumer recycled materials are diverted from the waste stream during a manufacturing process and do not reach the end users. They are usually scraps or by-products from production processes

18 Post-consumer recycled materials have been used and discarded by consumers, then collected, cleaned, and processed to be reused in new products. They have completed their life cycle as a consumer item and have been diverted from waste disposal

AICM Insight

In the process of chemical industry's transformation towards a green, low-carbon, and circular industry, AICM deeply recognizes that innovative materials are not only a catalyst for the industry's green transformation, but also a key element in realizing the closed loop of the Circular Economy.

AICM member companies have made great efforts in exploring the R&D of recyclable, bio-degradable, and bio-based materials, and have made innovative products through cutting-edge technologies, which not only provide more environmentally friendly production methods for the chemical industry, but also provide an effective way to solve the environmental burden caused by traditional materials. The active exploration and practices of AICM member companies in this field not only demonstrates the industry's firm commitment to green transformation, but also sets an example for the global chemical industry.

However, as the R&D and application of innovative materials do not happen overnight, it requires the joint efforts of policy guidance, technological innovation, market cultivation, and other aspects.

As an industry association, AICM will continue to play the role of a bridge to facilitate communication and cooperation among the government, enterprises, research institutions and the public to jointly promote the development and application of innovative materials. At the same time, we will also strengthen the guidance and support to member companies, encourage them to increase R&D investment, strengthen technological innovation, and continuously improve the environmental performance and market competitiveness of their products.

Green Manufacturing

Green manufacturing, as a modern manufacturing mode[19] in the context of the new era, not only focuses on optimizing production efficiency, but also incorporates environmental protection and resource efficiency into the important considerations of manufacturing, promoting low-carbon and circular upgrading in aspects such as production processes and techniques, and energy and resource use. Strengthening the innovation and application of cleaner production technologies by enterprises is a crucial link in achieving green manufacturing. Cleaner production technology is conducive to reducing pollutant emissions in the production process, and for example, the introduction of advanced catalytic technology and optimization of reaction conditions can reduce the consumption of catalysts and the generation of waste in the production process, effectively reducing the pressure on the environment.

Production Process

In terms of production processes and techniques, companies deeply analyze the energy consumption and emissions of existing processes, identify key links with high energy consumption and emissions, and introduce low-carbon technologies or improve the design of processes in a targeted manner. For example, by adopting more advanced technology, introducing more efficient equipment, optimizing production parameters, implementing automation and intelligent control, etc., companies can improve the efficiency of resource utilization in the production process, reduce energy and material consumption, optimize production planning and resource allocation, and improve production efficiency and product quality.

Resource Utilization

In terms of resource utilization, companies should establish a resource recycling mode to promote resource conservation and recycling. In the production process, companies carry out energy efficiency improvement projects to improve energy utilization efficiency and reduce energy consumption; also, companies implement measures such as resource reuse and material balance management to ensure efficient utilization of resources and continuous and stable production, thus improving production efficiency while reducing production costs and environmental risks. In addition, our members actively explore and implement strategies to decrease the consumption of packaging materials, reduce unnecessary use of packaging materials through refined design, and adopt novel lightweight and high-strength materials to enhance packaging efficiency and performance, striving to reduce resource consumption and environmental impact at the source.

19 Research on Economics and Management: Current Status and Future Paths of Green Manufacturing and Intelligent Manufacturing Development in China

Measures Taken by Surveyed Member Companies in terms of Green Manufacturing

- **Production Process**
  - Develop process technology for producing propylene oxide (HPPO) from hydrogen peroxide to reduce emissions, energy, co-products, and costs
  - Launch physical[20] recycling compounding line for polycarbonate
  - Renovate production facilities to achieve intelligent and automated production
- **Resource Utilization**
  - Improving industrial water reuse rate, wastewater recycling, indirect cooling water recycling, process water recycling rate, steam condensate utilization rate, etc
  - Renovating facilities, such as upgrading of high-efficiency water pumps and heat pumps, to improve utilization of heat, electricity, water, and other resources
  - Adopting material balance management measures to improve production quality and efficiency
  - Optimizing packaging design to reduce packaging volume and usage while improving transportation efficiency
  - Introducing high-performance materials to achieve consumption reduction through high performance mono-material applications
  - Building a complete supply chain from product design, production to recycling and remanufacturing to ensure the recycling of resources

AICM Insight

From the perspective of AICM, green manufacturing is not only a single pursuit of production efficiency, but also an innovation of manufacturing mode and awareness, which requires enterprises to form a modern manufacturing mode and build a green manufacturing system with comprehensive consideration of environmental impact and resource efficiency.

AICM facilitates the development of highly efficient and circular green manufacturing system of member companies, promotes the innovation and application of process technology, and realizes cleaner production and low-carbon transformation. At the same time, AICM encourages member companies to improve the resource recycling system, reduce resource consumption and waste discharge, and improve resource utilization efficiency, in order to achieve coordinated optimization of economic and social benefits.

20 Physical recycling is the same concept as mechanical recycling that appears later in the report

Recycling and Reuse

In the Circular Economy transformation of chemical industry, material recycling and reuse is an important measure to achieve sustainable utilization of resources and environmental protection. In the chemical industry, proper management and recycling of chemical wastes are of great value for alleviating resource shortage and environmental burden. The wastes that can be recycled and reused cover a wide range of complex material categories, including but not limited to:

- **Chemicals wastes**
  - The recycling and treatment of chemical wastes such as production wastes and waste reactants shall follow strict environmental protection standards and professional technical processes to ensure safe and efficient conversion into reusable resources or harmless treatment, so as to minimize environmental pollution and resource waste.
- **Plastics**
  - Recycling and reuse technologies for plastics are increasingly mature, covering a variety of paths from physical to chemical recovery. This not only promotes the recycling of common plastics such as polyethylene (PE), polypropylene (PP) and polyethylene terephthalate (PET), but also promotes the production and utilization of plastics to a more green and sustainable direction.
- **Metals**
  - Aluminum, copper, nickel, and other metals are recycled through smelting and reprocessing, realizing the transformation from waste to raw materials, promoting the efficient allocation and recycling of resources, and significantly reducing the demand for ore mining and the accompanying environmental damage.
- **Paper and fiber**
  - Recycled paper and fiber can be reprocessed into new paper or textiles through technologies such as pulp recovery and fiber regeneration, effectively reducing dependence on and consumption of virgin wood resources.
- **Rubber**
  - Rubber products such as tires often become one of the main sources of waste at the end of their life cycle. Valuable rubber materials can be acquired through recycling and treatment, so as to achieve recycling of resources, effectively save a large number of natural rubber resources and reduce negative environmental impacts.
- **Batteries**
  - Waste batteries contain heavy metals, electrolytes and other harmful substances, so their safe and environmentally friendly recycling treatment is particularly important for the ecological environment and human health. With the continuous expansion of the new energy vehicle market and the continuous progress of technology, the recycling of power batteries has also entered a period of rapid growth.

Under the background of the current trend of Circular Economy and the development of recycling technology in the industry, our member companies have gradually built robust waste recycling systems, which carry out fine classification, professional treatment, reprocessing and recycling of recycled waste, to transform it into valuable resources or recycled products, so as to truly achieve circular utilization. In this process, companies actively seek to establish cooperative relations with waste disposal enterprises, raw material suppliers and packaging material recycling enterprises, to collaboratively improve the disposal efficiency and recycling of waste, forming a virtuous circle and win-win pattern of resource utilization, which also brings dual improvements in economic efficiency and social responsibility for the companies.

Measures Taken by Surveyed Member Companies in terms of Recycling and Reuse

- **Optimizing Waste Management**
  - -Establishing a sound waste classification and recycling system to improve waste recycling rate
  - -Optimizing waste disposal methods and promote waste recycling and reuse to achieve zero landfill of waste
- **Building a Closed-loop Supply Chain**
  - -Collaborate with supply chain partners to implement waste recycling and reuse programs
- **Diversified Advanced Recycling Technologies**
  - -Physical recycling
    - ▷ Such as dissolution technology, which uses a solvent to extract polymers to create a high-quality recycled polymer
  - -Chemical recycling
    - ▷ Such as depolymerization technology, which returns polymers to their constituent monomers to produce high-purity feedstocks
    - ▷ Such as electrochemical recovery processes that efficiently recover metal ions for use in the manufacture of new batteries
    - ▷ Such as an efficient impurity removal technology, in which new catalysts and adsorbents are designed for the purification of pyrolysis oil made from mixed plastic waste that is difficult to recycle
    - ▷ Such as methanol alcoholysis process that promotes the recycling of high-polluting PET waste

AICM Insight

The chemical industry is a resource-intensive industry, and its waste disposal and recycling are directly related to the improvement of global resource security and environmental quality.

AICM believes that waste is a “secondary resource” with great potential. AICM and member companies actively respond to the strategic guidance of accelerating the construction of a waste recycling system in the Opinions on Comprehensively Promoting the Construction of a Beautiful China1 issued by the Central Committee of the Communist Party of China and the State Council. Through advanced recycling technologies and scientific management models, waste can be transformed into valuable raw materials and re-entered into the production chain, so as to maximize the utilization of resources and minimize the impact on the environment.

At the same time, AICM also realizes that the successful implementation of Circular Economy is inseparable from the close cooperation and collaborative innovation of upstream and downstream of the industrial chain.

Therefore, we encourage and promote member companies to establish long-term and stable cooperative relations with waste disposal enterprises and raw material suppliers, and jointly build a closed-loop supply chain system. Through the sharing of information, resources, and benefits, we can realize the effective recycling and reuse of waste and promote the efficient circulation and optimal allocation of resources in the industrial chain.

To sum up, AICM member companies have gradually transformed towards Circular Economy, continuously exploring Circular Economy practices such as the research and development of innovative materials, the continuous breakthrough of green manufacturing technology, and the increasingly improvement of recycling and reuse system, and practicing the concept of Circular Economy with practical actions to drive the green transformation and sustainability of the chemical industry. In the future, with the emergence of more innovative achievements, the accumulation of practical experience, and the strengthening of industrial cooperation, our member companies will continue to promote the development of a more sustainable Circular Economy development model.

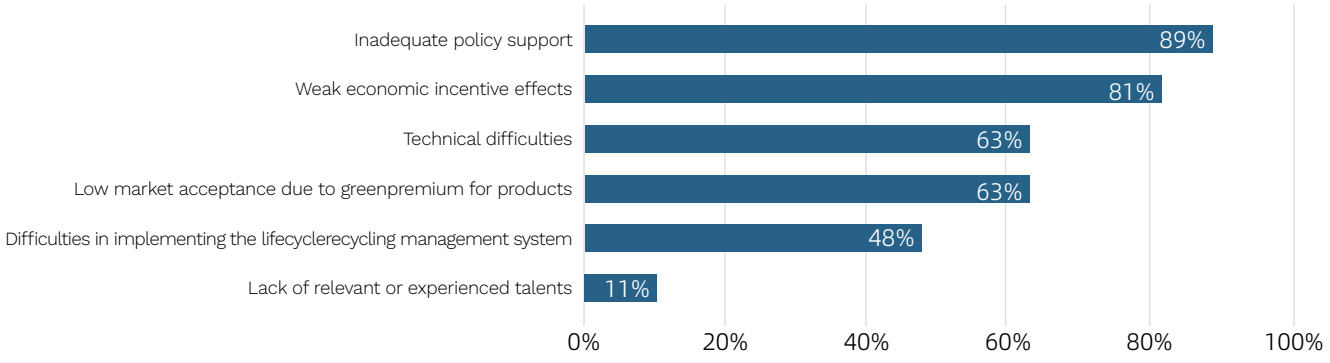
Challenges and Opportunities

In today's wave of global Sustainable Development, Circular Economy, with its unique green, low-carbon and high-efficiency development model, is gradually becoming an important engine to promote green transformation and achieve Sustainable Development in the chemical industry. The concept and practice of Circular Economy has brought unprecedented opportunities for the development of the industry, accompanied by a series of challenges that need to be overcome. Therefore, grasping the pace of the development of Circular Economy, actively responding to the challenges and transforming the crisis into opportunities are important topics for the current and future development of the chemical industry.

Challenges

In the context of dual-carbon goals, the Circular Economy, as a model of economic growth centered on the efficient utilization and recycling of resources, provides a path for improving the resilience of the chemical industry. However, the chemical industry is still facing many bottlenecks and challenges in the development process of Circular Economy. According to the results of our survey, the main difficulties faced by the surveyed member companies in the development of Circular Economy include the urgent need to improve the system of laws, regulations, policies, and standards related to the Circular Economy, the lack of economic benefits of recycled products, the technical difficulties of recycled products, and the low market acceptance of recycled product premiums.

Challenges during the Transformation of the Chemical Industry into a Circular Economy



Inadequate policy support

Effective policies are the important driving force and necessary guarantee for the development of the Circular Economy. At present, the development of Circular Economy in China mainly adopts a top-down approach by formulating special plans for Circular Economy, carrying out various demonstration and pilot projects, and issuing various documents to clarify the development priorities and tasks in different time periods. According to the survey, 89% of the surveyed member companies believe that the development of Circular Economy is currently facing the challenge of inadequate policies and regulations. AICM has summarized the issues and examples shared by member companies that are of high concern:

The existing Circular Economy policy system is still not sound enough, and the marketization efforts and environmental friendliness are insufficient, which is especially obvious in the promotion and application of environmentally friendly materials, for example:

- Food-accessible recycled plastics have been legally recognized by in the US, Japan, the EU and other countries and regions, and industry guidelines have also been established in some of these countries. However, China has not yet to establish laws, regulations and industry standards for the application of recycled plastics in food contact materials, which hinders they're its widespread application and development as an environmentally friendly material;
- The environmental impact assessment requirements for waste plastics recycling enterprises in the 2021 edition of the Environmental Impact Assessment Catalogue are simplified from "environmental protection report" to "environmental impact assessment report form", while the plastic manufacturing industry using recycled plastics as raw materials still requires "environmental protection report", which may ignore the higher environmental risks of waste plastics recycling enterprises and may hinder the promotion and sustainability of recycled plastics.

Policies and regulations are biased towards the macro level, lacking systematic and more industry-specific supporting policies and standard systems. It is difficult to form a real industry guidance role, such as:

- Cracked oil, as a key intermediate product in the chemical recycling process, lacks a unified transport standard and product standard dedicated for such special products, its industry ownership is vague and the approval process is complex, which hinders the application process of products and makes it difficult for specific projects to implement;
- The supporting policies in the relevant green development plans lack details, such as the lack of detailed laws and regulations on chemical recycling, difficulties in project creation and environmental impact assessment, and various types of standards are still in the process of exploration.

With the continuous updating and iteration of recycling technologies, the existing laws and regulations are not updated in a timely manner, and the speed of the policy framework cannot keep up with the pace of the industry, resulting in insufficient policy incentives and guidance to meet the needs of the industry's development.

Weak economic incentive effects

At present, China's promotion of the Circular Economy is dominated by short-term incentives such as pilot demonstrations, investment subsidies and tax incentives. Due to the lack of long-term and stable incentives and the insufficient support and coverage of these incentives, the motivation of companies to participate in the transformation have been significantly affected, thus restricting the in-depth development and wide application of the Circular Economy. The survey shows that 81% of the surveyed member companies believe that the weak economic incentives restrict their development of the Circular Economy, which is mainly reflected in the following aspects:

- When introducing advanced recycling technologies and equipment, enterprises need to bear high initial investments, which often take a long time to be recovered through economic benefits, and this contradiction between long-term investment and short-term return has become one of the obstacles to the large-scale practice of recycling economy.
- Compared with the traditional production mode, the maturity of Circular Economy at the technical and market levels is still at a low level. The process of developing and applying new technologies is fraught with uncertainty, which may lead to investment failures or actual benefits that are much lower than expected, further increasing the risks and concerns of enterprises in the transition.
- The lack of industry-specific financial support and tax incentives makes it difficult for enterprises to receive adequate and sustained policy support and incentives in the transformation process.

Technical difficulties, such as resource circulation limitations

Technology innovation is the core driving force for promoting resource recycling, and advanced and applicable resource recycling technologies and equipment are the basic conditions for the development of Circular Economy. The survey shows that 63% of the surveyed member companies believe that the development of Circular Economy is challenged by technical difficulties. Inadequate innovation in key recycling technologies, processes and equipment restricts the promotion of recycling-based production, large-scale development, and the cost effective of recycled products in the chemical industry.

Take plastic recycling as an example:

- Currently, plastic recycling methods are mainly based on physical decomposition and chemical decomposition, due to the related technology research and development has just begun, the current mature process technology of the emerging biotechnology is relatively small.
- The physical decomposition has low economic efficiency, most of which are degraded and recycled, and the generated wastewater and exhaust gas have great damage to the environment. And the top brand companies have very high-quality requirements for packaging materials, most of the post-consumer recycled plastics produced after physical recycling are difficult to meet the requirements of food and pharmaceutical grade quality.
- Chemical decomposition is a globally recognized low carbon and clean recycling method that can achieve homogeneous recycling, but the high price of solvents and catalytic agents, and the complexity of equipment and processes, have not yet enabled large-scale industrialization.

Low market acceptance due to green premium for products

Circular Economy products often have high production costs due to technology costs, recycling costs and other factors. In the fierce competition environment of China's chemical industry, there are still a large number of low-cost traditional products in the market. The current mainstream consumer group still belongs to price-sensitive consumers, with limited actual purchasing power for green and recycled products where a certain premium exists. According to the survey, 63% of the surveyed member companies believe that the following factors lead to low market acceptance of recycled products and restrict the development of the recycling economy.

- Recycled products often face the pressure of price competition. How to ensure product quality and environmental performance while reducing production costs and improving market competitiveness is one of the key challenges facing chemical companies.
- Consumer's awareness of green consumption has increased, but the actual consumption behavior is still lagging behind, and green consumption incentives and constraints still need to be improved.
- The remaining problems in the recycled product market, such as inadequate certification systems, poor information communication and the lack of a traceability mechanism, further hinder consumers' purchasing decisions and restrict the expansion of the market.

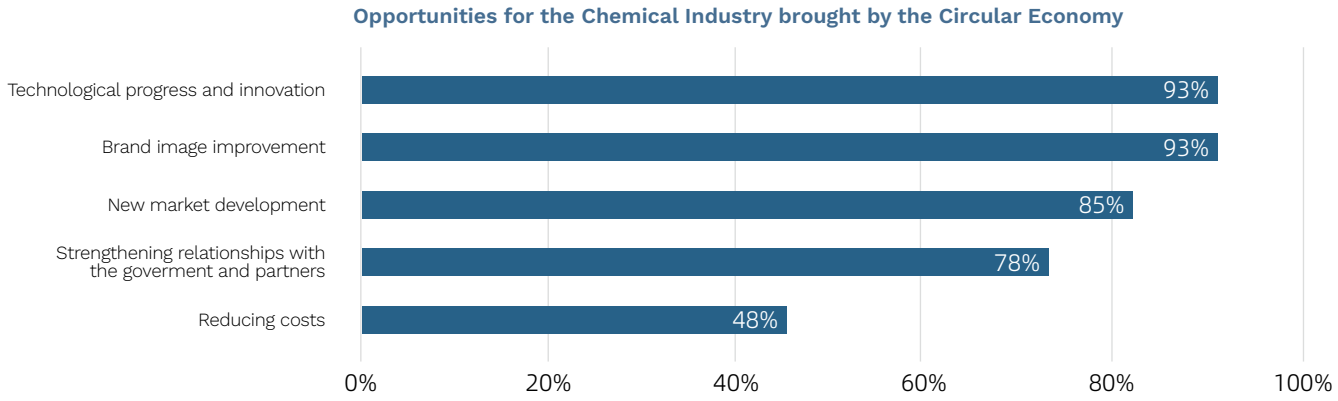
Difficulties in implementing the lifecycle recycling management system

Establishing an effective collection and sorting system for recyclable materials is a major challenge for the chemical industry to implement Circular Economy principles. According to the survey, 48% of the surveyed member companies believe that the development of Circular Economy is challenged by difficulties in supply chain management, mainly in the following areas.

- China's waste materials recycling industry still faces issues such as low levels of refined sorting and irregular recycling practices recycling in some small factories, leading to environmental pollution, low overall recycling rates, and limited high-value recycled applications.
- There is still a lack of standard recycling and reuse standards in terms of policy, leading to inconsistent application of recycling technologies, which not only affects the efficiency of material recycling, leads to the inability to guarantee the quality of waste recycling, but also limits the market acceptance of recycled products.
- The extended producer responsibility system is piloted in a few industries, and has not yet fully covered products in the chemical industry, resulting in problems such as unclear responsibility for the main body of recycling and inadequate responsibility mechanisms, and incomplete reflection of the responsibilities of producers and consumers.
- Although waste classification has been promoted nationwide, a sound classification system has not yet been formed, and problems such as unreasonable layout of recycling network and low coverage of recycling sites still exist, especially for low-value-added wastes, which are often not effectively recycled and treated.
- The cost of green logistics remains high, and green transportation (such as electric or hydrogen energy) infrastructure remains to be improved.

Opportunities

While the pattern of the chemical industry continues to evolve, new business models are gradually emerging. For AICM, the trend of Circular Economy transformation is not only a challenge, but also an unprecedented development opportunity. AICM member companies can give full play to their leading role in the international chemical industry, transforming their advanced technology, rich management experience and strong innovation capacity into practical impetus for promoting the green transformation of the chemical industry in China and the world.



Technological progress and innovation

At a time when the chemical industry is facing the pressure of resources and environment and seeking the path of sustainability, technological innovation has become the core driving force to promote the transformation of Circular Economy in the industry. With the continuous progress of science and technology and a high degree of global consensus on the goal of Sustainable Development, the chemical industry is ushering in technological innovation opportunities.

According to the survey, 93% of the surveyed member companies believe that this transformation will give rise to opportunities for technological progress and innovation. Behind this belief are the possibilities brought about by the continuous breakthroughs in science and technology, as well as the wide application of new technologies and processes in chemical waste treatment, resource utilization and product innovation.

As the core engine of this transformation, technological innovation is leading the chemical industry towards a more efficient and environmentally friendly direction. From green design and material innovation for new products to resource utilization of waste, each technological breakthrough brings new development possibilities for companies. AICM has summarized the following technological and material innovation opportunities that are of great interest to member companies:

Production side

- Chemical recycling technologies: Chemical recycling encompasses a range of technologies that can help unlock the value of used plastics. Globally, only a small percentage of plastic waste is currently collected, and an even lower percentage is recycled, mainly through physical recycling. Chemical recycling, however, presents an opportunity to help unlock the intrinsic value of used plastics, diverting them from landfills or incineration. As chemical recycling complements physical recycling, it can help to expand the range of plastics that can be recycled;
- Energy supply: use green power and alternative raw materials to reduce dependence on fossil resources and build a more resilient supply chain.

Product side

- Bio-based recycling materials applications: Bio-based recycling materials from natural resources are used to develop products such as adhesives and coating formulations to reduce carbon emissions.

Brand Image Improvement

The chemical industry is often considered as an industry with high pollution and high emissions, and the transformation through the Circular Economy helps the chemical industry establish a new image of green development.

According to the survey, 93% of the surveyed member companies believe that the transition to Circular Economy is conducive to enhancing the company's brand image. As society's concern for environmental protection and Sustainable Development continues to grow, so does consumers' awareness of environmental protection, and they are more inclined to choose products from companies that focus on environmental protection and have a sense of social responsibility.

- Adoption of advanced clean production technologies to reduce the emission of hazardous substances and enhance the recycling rate of resources. These practical actions directly reduce a company's environmental footprint and can send a strong signal to the market that the company is committed to green production.
- Promotion of the use of biodegradable and recyclable packaging materials to reduce plastic pollution, enhancing consumers' trust and goodwill towards corporate brands.
- Member companies can regularly publish corporate environmental performance reports, including energy saving and emission reduction achievements, environmental protection investments and technological innovations to show the efforts and effectiveness of the companies in the transformation of the Circular Economy.

New market development

The transformation of the chemical industry into a Circular Economy is giving rise to new market opportunities. This transformation not only responds to the urgent global demand for Sustainable Development, but also opens up a broad development space for the chemical industry.

According to the survey, 85% of the surveyed member companies believe that the transition to a Circular Economy is conducive to expanding into new markets. AICM has summarized the key areas of focus for member companies in their efforts to develop new markets, as customers' growing environmental needs and Sustainable Development requirements are driving them to move towards a new model of Circular Economy development to provide high-performance and environmentally friendly chemical products to the market:

- Additive manufacturing: In the field of additive manufacturing, chemical companies can focus on developing green and efficient additive products to meet market demand for both environmental protection and performance.
- Water treatment: in the field of water treatment, chemical companies can utilize their advantages in chemicals and technology to develop more efficient and environmentally friendly water treatment solutions. Targeting industrial users such as petrochemical companies, they provide technologies and products for circulating water treatment and wastewater treatment to help companies realize the goal of water conservation and emission reduction. For example, through the research and development of new flocculants, scale inhibitors and other water treatment chemicals, companies can improve the efficiency and stability of the circulating water system, and reduce the waste of water resources and environmental pollution.
- Glass manufacturing: In the field of glass manufacturing, chemical companies can focus on the production technology and market demand for high-end products such as float glass. By optimizing raw material formulations and improving production processes, they can improve the quality and performance of glass products and meet the demand for high-performance glass in construction, automotive, photovoltaic, and other industries. At the same time, with the promotion of Circular Economy, chemical companies can also participate in the recycling of waste glass recycling projects, the development of recycled glass production technology, reduce production costs and improve resource utilization.
- Biogas market: In the biogas market, chemical companies can utilize their advantages in chemical engineering and biotechnology to develop biogas purification technology. With the continuous increase of agricultural waste, urban waste and other organic waste, biogas as a renewable energy has a broad development prospect.

Strengthening relationships with the government and partners

As a policy guide and resource allocator, the government's support plays an important role in the transformation of the industry. By actively communicating and cooperating with the government, chemical companies can gain timely insight into policy guidance, participate in policy discussions at the right time, and strive for policy support more efficiently to provide a strong guarantee for transformation.

According to the survey, 78% of the surveyed member companies recognize the importance of Circular Economy transformation for strengthening the relationship with the government and partners.

- Member companies indicated that more and more governments are supporting the development of Circular Economy by formulating relevant policies and regulations to encourage or require companies to adopt greener and lower carbon technologies and practices. With policy support, companies can capitalize on the opportunity to accelerate the implementation of the Circular Economy model.
- Establishing partnerships with upstream and downstream companies, scientific research institutions and environmental protection organizations in the industrial chain is also an important way to promote the Circular Economy transformation of chemical enterprises. Through resource sharing, complementary advantages and collaborative innovation, partners can jointly meet the challenges of transformation and jointly explore new opportunities and new paths for Circular Economy development.

After discussing many challenges and opportunities faced by AICM member companies in Circular Economy transformation, we can clearly see that this transformation is not only an inevitable trend of industry development, but also an important way to achieve sustainability. Faced with challenges such as technological bottlenecks, cost pressures and uncertainties in the policy environment, we can also seize the opportunities of transformation and constantly break through bottlenecks, laying a solid cornerstone for the transition.

In response to these challenges and opportunities, AICM proposes the following suggestions to help member companies move forward steadily on the road of Circular Economy transformation:

Promoting Circular Economy through policy guidance and enterprise response

In the process of promoting the transformation of Circular Economy, the synergy between policy guidance and positive response of enterprises is crucial. AICM is deeply aware of this and puts forward the following key suggestions, aiming at ensuring the smooth progress and in-depth development of Circular Economy transformation through strengthening policy guidance, technical support, government-enterprise communication, and company compliance management.

- It is suggested that the government could accelerate the construction of a comprehensive and systematic legal and regulatory framework for Circular Economy, and clarify the definition, objectives, principles and implementation path of Circular Economy. This includes the formulation of incentive measures such as tax incentives, subsidies and incentives, and the clarification of the management structure of the Circular Economy, applicable laws and regulations, rules and approval guidelines for project approval and environmental impact assessment;
- It is suggested that the government clarify the industry classification of issues related to recycling of plastics and other wastes and accelerate the development of exclusive product standards in order to reduce resistance to project implementation, enhance technological economics and achieve carbon reduction;
- Advocate associations and companies to use their professional knowledge to provide technical support to the government, assist in the establishment of a fair and reasonable reward and punishment system, and promote the effective implementation of policies;

- It is suggested that the government could strengthen communication with companies and absorb opinions from various parties to ensure that policy formulation is more targeted and applicable; At the same time, after the introduction of the policy, it should be interpreted and guided to help companies implement it smoothly;
- The company should invest more resources to communicate with the Chinese government and local communities to ensure consistency in policy interpretation;
- The company should have a system in place to monitor regulatory updates and assess the impact on the business; and establish a regular audit program to ensure that all operations are in compliance with all up-to-date regulatory requirements.

Innovative business models

By optimizing internal operations, responding to the needs of the downstream industry, and at the same time making use of new technologies, chemical companies are transforming change into their own advantages. Surveyed member companies indicate that the development of Circular Economy can help the industry actively build a closed-loop innovation business model for materials, promote recycling and efficient reuse of materials by deepening resource sharing and technology exchange with partners, and use this as a basis to continuously explore the potential for product innovation.

- Building a circular supply chain: Companies need to re-examine and optimize their supply chain layout, shift their internal processes to the mode of using renewable energy, and actively introduce sustainable materials or fully recyclable materials in the production process to replace traditional disposable resources;
- Enhanced recycling and reuse mechanisms: Companies can delve deeper into the potential for recovering valuable resources or energy from products and their by-products, especially in the recycling and reuse of key materials such as plastics;
- Extending product life cycles: Chemical companies can focus on developing products with greater durability, aiming to minimize the waste of resources due to rapid product obsolescence. These design strategies can effectively extend the useful life of their downstream applications without changing the basic molecular structure of the product;
- Establishment of mechanisms for cross-sectoral cooperation: manufacturers, suppliers, customers and waste management entities work together to achieve closed-loop, resource-sharing systems and to ensure effective recycling and recovery processes that increase resource efficiency throughout the ecosystem.

Initiative and innovation— Member Practices Sharing

All member companies of AICM, leveraging their extensive global experience in Sustainable Development, are bringing these valuable practices to the Chinese market. We are committed to ensuring safe operations in accordance with the principles of Responsible Care® and have taken even more proactive measures in reducing carbon emissions. Many member companies have set clear quantitative targets and timetables, demonstrating our firm commitment to environmental protection.

AICM firmly believes that by leveraging our global perspective, promoting best practices, and developing cutting-edge products, the low-carbon transition of international chemical companies can not only promote their own Sustainable Development but also drive the entire industrial value chain to transform in a more environmentally friendly and efficient direction. We hope that through the following practical examples, the public can gain a deeper understanding of how the chemical industry, as a provider of solutions for a green society, is continuously striving and contributing. At the same time, we also hope that these sharing can inspire in-depth exchanges within the industry on sustainable practices, jointly grasp the latest industry trends, and promote the transformation of the entire society towards a Circular Economy.

Air Liquide

Air Liquide

Air Liquide today operates more than 120 plants in over 40 cities and employs over 5,600 people nationwide. Main businesses include industrial and medical gas operations, home health service, Engineering & Construction, as well as innovation activities by Global Markets & Technologies and Innovation Campus Shanghai. With a strong presence in China's key coastal industrial areas, Air Liquide is now further expanding into the nation's central, southern and western regions.

Air Liquide pursues profitable and sustainable growth over the long term through delivering excellent performance and acting responsibly, while maintaining a leading position in China. Relying on the Group's long-term strategy and resources worldwide, we strive to create new markets and new business opportunities with a focus on the energy, environment, high technology, and healthcare sectors. With dedicated support from our professional teams, Air Liquide China provides reliable services and value-added solutions to our customers while fulfilling our role as a responsible corporate citizen.

120
Plants

40
Cities

5,600
People

Bullet Point: Green Manufacturing

Region: Tianjin China

Air Liquide Yongli (Tianjin) Co., Ltd. (ALYL) is a joint venture of Air Liquide (China) Holding Co., Ltd. (ALCH) and Tianjin Bohua Yongli Chemical Industry Co., Ltd (YLC).

ALYL operates two Air Separation Units (ASUs), each has an oxygen capacity of 2,000 ton per day. The main energy-consuming equipment is compressor unit (air compressor and booster air compressor) which used to be steam driven. The steam needed used to be supplied by the coal-fired boilers in Bohua Yongli thermal power plant.

In response to China and Tianjin's energy consumption "Dual Control" targets, YLC transformed its coal-fired boilers into natural gas boilers to reduce CO_2 and pollution emissions, aiming to meet the requirement of coal quota management.

Solution

To support the "coal-to-natural gas" project of Bohua Yongli Thermal Power Plant, ALCH invested RMB 460 million for upgrading and renovating ALYL's two ASUs, turning the steam-driven compressors into high-efficiency electric motor-driven compressors (electrification project).

Thus, ALYL's steam consumption (supplied by YLC Thermal Power Plant) will be greatly decreased while saving a large amount of circulating cooling water for the steam. As a result, YLC's fossil fuel consumption such as natural gas will be reduced eventually. Moreover, electric motor-driven compressors can save much time during start-up & shut-down, contributing to stable operations and product supply to the customers.

Meanwhile, to match the deployment of the electrification project, ALYL will upgrade its existing ASUs to improve energy efficiency and the level of smart production of the plant, aiming to provide YLC with safer and more stable gas products with lower carbon footprints.

ALCH invested RMB 460 million for upgrading and renovating ALYL's two ASUs

460

After being put into production, 370,000 tons of CO_2 per year will be avoided

370,000

Benefit

With the deployment of the electrification project, ALYL is expected to help its customer YLC save around RMB 100 million CNY of gas cost per year. After being put into production, 370,000 tons of CO_2 per year will be avoided, which is equivalent to electricity-related emissions of 1 million Chinese households. Moreover, ALCH is actively seeking power purchasing agreement opportunities with power generation companies, aiming at reaching 100% Renewable power supply for this project. Via 100% Renewable power supply, the project is expected to further reduce 460,000 ton of CO_2 per year.

ARKEMA

Arkema

Arkema is a major player in Specialty Materials whose business is focused around three coherent and complementary segments, Adhesive Solutions, Advanced Materials and Coating Solutions. The Group has a leading industrial and commercial presence, and benefits from a balanced geographical sales split between Europe, North America and Asia.

Adhesive Solutions + Advanced Materials + Coating Solutions

Bullet Point: Recycling and Reuse

Region: China

The annual production of calcium chloride and calcium fluoride filter cake is relatively large, about 1,000 tons every year. As it is an inorganic sludge with no calorific value, the original disposal method is all landfill which is not environment friendly and sustainable disposal method.

Solution

The calcium fluoride and calcium chloride sludge collected from Arkema mixed with other general waste are dried then sent to incinerator, and the tail gas is treated with deacidification and dust removal to meet the emission standards. The slag is used as a raw material for brick making.

Benefit

In 2023, 868 tons of sludge have been disposed of through resource utilization, saving approximately 22k€ in disposal costs.

Before

After

Bullet Point: Recycling and Reuse

Region: Global

Bags, pouches, and films are often multilayered/multi-material laminated by adhesive and can't be separated for mechanical recycling. Plastic materials are usually difficult to degrade naturally, and unrecycled plastics can cause serious environmental pollution, including pollution of oceans, soil and water sources.

Solution

Bostik Herberts SF10M A+B is a 2 components PU laminating adhesive designed for recyclability and approved by Recyclass to be "fully compatible with PE or PP flexible recycling stream."

Benefit

Recyclass approved, promoting the recycling of packaging materials, providing sustainable solutions.

Suitable for laminates consisting of unprinted/printed plastic films, such as BOPE, MDOPE, PE, BOPP and CPP. Achieve high bonding performance and material recycling.

Solvent-free adhesive: Heighten end-user safety, material recycling.

ARLANXEO
Performance Elastomers

ARLANXEO

ARLANXEO is a wholly owned subsidiary of global energy and chemicals giant Saudi Aramco. As the world's leading supplier of synthetic rubber, ARLANXEO's core business is the development, manufacturing and sale of high performance rubber products for a wide range of applications in the automotive, tire, construction and oil & gas industries.

Bullet Point: Sustainable Packaging

Region: Changzhou China

Wood fiber is the main raw material of carton package, its production process notonly consume large amounts of trees resources, but also produces large quantities of wastewater and waste gas, serious impact on the environment. In addition, the service life of the cartons short, tend to be discarded after single use, increased pressure on waste disposal.

Solution

The use of recyclable MB5 iron box instead of carton packaging, iron box can not only meet the functional needs of packaging, but also establish a good environmental image for the enterprise, enhance the brand value.

Benefit

MB5 iron box can be recycled, its service life is long, can be reused, reduce the consumption of a lot of tree resources and the big quantities of wastewater and waste gas, decrease the impact on the environment.

MB5 iron box has higher strength and durability. Compared with cardboard boxes, iron boxes can better protect the contents of the package and reduce damage and loss during transportation. This not only helps to reduce the cost of the business, but also reduces the waste generated due to product damage.

Iron box packaging is a win-win choice with economic and environmental benefits.

Carton packaging before

MB5 iron box after

BYK

150 years ago, BYK was founded in Berlin, Germany in 1873 and has become one of the leading global suppliers of specialty chemicals. BYK creates value for customers by developing, manufacturing, selling, delivering and supporting innovative differentiated solutions in Additives and Instruments based on technology and application expertise in selected industries, globally.

Bullet Point: Material Innovation

Region: China

Perfluoro and polyfluoroalkyl substances (PFAS) have become a focal point of discussion due to their ultra-stable group of chemical compounds. Known for their unique physical and chemical properties, such as oil and water resistance, high-temperature tolerance, and chemical resistance, they are widely used in various consumer products and industrial applications. However, the stability of PFAS also means that they are not easily degradable in the environment, earning them the moniker “forever chemicals.” PFAS are virtually non-degradable and can accumulate in the environment, as well as in human and animal bodies. The known hazards of PFAS currently include increased risk of cancer, increased three high risk, impaired fertility, interference with hormone levels, inhibition of growth and development, and impact on immunity.

Solution

BYK has spent years actively directing significant research efforts, investments, and human resources towards replacing PFAS materials. BYK has now reached a point that allows us to offer you sustainable PFAS-free solutions for almost of products. BYK announced to end production of additives containing PFAS by end of 2025. Apart from terminating its shipments of additives with PFAS content by the end of 2025, BYK will by then also have converted all its production facilities worldwide to PFAS-free firefighting foam.

Please follow the webpage for more information on PFAS solutions.
https://www.byk.com/zh/product/highlights/pfas-free-additive-solutions?utm_campaign=pfas-free&utm_medium=display&utm_source=shortcut

CABOT

Cabot

Founded in 1882, Cabot Corporation is a leading global specialty chemicals and performance materials company headquartered in Boston, USA, with 35 manufacturing facilities and approximately 4,100 employees in 21 countries. In recent years, we have accelerated our pace of innovation and are committed to empowering and supporting our customers' product innovation through new materials systemic solutions. Cabot's advanced materials including conductive carbons, specialty carbons, carbon nanotubes, fumed metal oxides, aerogels, specialty compounds etc., are widely adopted in many critical components in applications such as vehicles, Lithium-ion batteries, aviation, high-speed trains, ships, solar energy, wind turbines, etc., enabling the final products better performance and safer.

Bullet Point: Green Manufacturing

Region: Shanghai China

21
Countries

35
Manufacturing facilities

4,100
Employees

Figure 1 Heat and Water recycle from SCR De-NOx facility downstream

Cabot's purpose is "Creating materials that improve daily life and enable a more sustainable future." Our vision of sustainability is that through our commitment to responsible operations, resource conservation, and the development of innovative, high-performance materials, we will relentlessly address the challenges of sustainability and achieve net-zero emissions.

Cabot's Global Sustainability Goal 2025 also includes a water sustainability goal to reduce water intensity per unit of product by adopting green manufacturing processes, improving recycling efficiency and other means.

We continue to put it into practice. In Cabot's Shanghai plant, which has a history of more than 30 years, and which is ever new and tireless, technological innovation continues to fuel Sustainable Development. We invested 12 million RMB in 2015 in the SCR catalytic reaction De-NOx unit, which effectively reduces NOx emissions by 90%, meanwhile the flue gas for the effective operation of the SCR unit and downstream De-SO2 needs to appropriate temperature in process. The operation to achieve this process depends on 3.5t/h direct cooling water, this pollution abatement results the loss of water and energy.

Figure 2 Heat and Water recycle from SCR De-NOx facility downstream

Cabot Shanghai Plant Heat and Water recycle from SCR De-NOx facility downstream

Solution

1) The team is highly aware of the significance of the company's Sustainable Development goals, materiality assessment and development of Sustainable Development, and the positive identification of impactful operational practices.

2) The Shanghai plant's annual targets are proactively aligned with the sustainability goals, and the whole lift cycle adopts site 'Innovation' platform that truly motivates innovation culture, resulting in a number of good practices, such as the new heat exchange for energy recycle, shared recyclable plastic pallets significantly reducing resource and waste, and the use of VFD control for high-power motors effectively improving energy efficiency.

3) In this sustainable project, with proper technical assessment and investment of 3 million RMB, a flue gas heat exchange is installed after SCR unit to recycle heat and the cooling water condensate. The recycled heat is used in heating the boiler DI feed water.

4) The Shanghai plant also proactively integrates with and gives back to the community. Every year, through Open-to-public Days and Sustainability Day activities, the plant shares with the community its achievements in sustainability and listens to the community's suggestions, and the plant puts them into practical action, such as SCR heat utilization projects, so that the plant can export more of its production-converted energy to the community, and become an excellent practice of energy saving and carbon reduction.

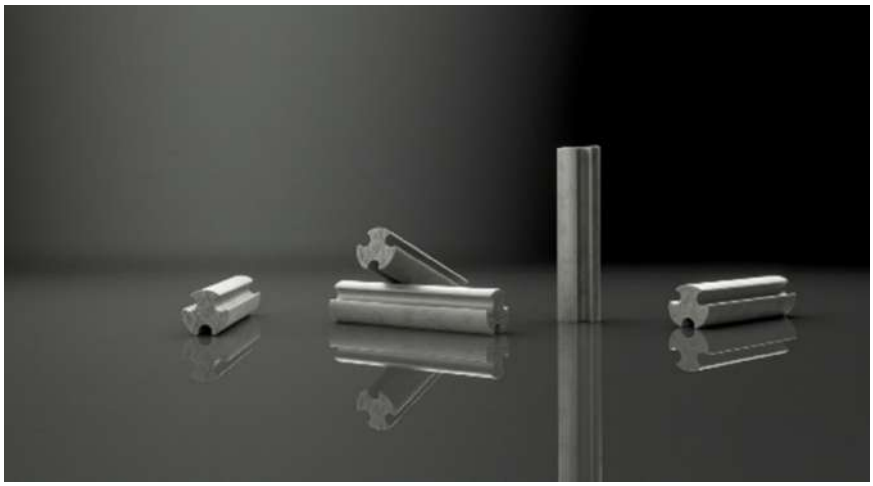
Benefit

1) Indirect cooling water savings of 35,000 t/y from the SCR heat utilization project and others water saving initiatives contribute the water intensity reduced by 12%.

2) Recycle the energy from SCR downstream heat exchange device generates 47,000t/a steam that contributes more energy export ratio, and reduction of 4,700 tce/a, i.e., 12,200t/a CO_2e emission.

CLARIANT

Clariant Chemicals



As one of the world's leading specialty chemical companies, Clariant contributes to value creation with innovative and sustainable solutions for customers from many industries.

Bullet Point: Recycling and Reuse

Region: Global

Pyrolysis oils are made from a chemical recycling process that breaks polymers down into basic building blocks to be used for new feedstock streams. Since the process helps to reduce the environmental burden created by plastic waste that would otherwise be incinerated or landfilled, it enables a circular value chain to produce base chemicals.

Solution

The new catalysts and adsorbents are designed for the purification of pyrolysis oil made from hard-to-recycle mixed plastic waste. Tailored to remove a wide range of contaminants that are continuously changing in the feed, the new products provide the flexibility producers need, regardless of process configuration. Clariant's solution also includes operational assistance from startup to process optimization, which continues throughout the lifetime of the product. As a result, producers benefit from highly efficient impurity removal to achieve pyrolysis oil that is compatible with ethylene plants.

Covestro

Covestro is one of the world's leading manufacturers of high-quality plastics and their components. With its innovative products, processes and methods, the company helps enhance sustainability and the quality of life in many areas. Covestro supplies customers around the world in key industries such as mobility, building and living, as well as the electrical, electronics and telecommunications sector. In addition, polymers from Covestro are used in areas such as health, sports and leisure and the chemical industry itself.

The company, based in Leverkusen, Germany, is committed to becoming fully circular and helping to make the Circular Economy a global guiding principle. In addition, Covestro aims to achieve climate neutrality at operational level by 2035, while the whole group is set to be climate neutral by 2050. Covestro generated sales of EUR 14.4 billion in fiscal 2023. At the end of 2023, the company had 48 production sites worldwide and employed approximately 17,500 people (calculated as full-time equivalents).

China is among the company's largest markets, and it has been present there for decades. In 2023, turnover in China totaled EUR 3.1 billion, while the cumulative investment exceeded EUR 4 billion. In Greater China, Covestro operates 10 production sites, hosts an Asia Pacific innovation hub, and employs around 3,300 people. The company has been awarded Top Employer China for six consecutive years by the Top Employers Institute for its exceptional employee offerings in the country.

Covestro has demonstrated excellence in multiple international sustainability ratings, with the latest results including an "A-" level from CDP (Environmental Leadership) and a Gold Status from EcoVadis.

Bullet Point: Green Manufacturing

Region: Shanghai China

As the issue of global climate change becomes increasingly severe, the environmental impact of industrial production has come under intense scrutiny. The chemical industry, known for its high energy consumption and high emissions, faces the key challenge of achieving green production and climate neutrality.

In March 2022, Covestro published ambitious targets for scope 1 and scope 2 emissions in 2022, which included achieving operational climate neutrality by 2035. At the beginning of 2024, Covestro announced its climate neutrality targets for scope 3 emissions. As a short-term goal, the company plans to reduce greenhouse gases by 10 million metric tons by 2035. In the long-term, Covestro plans to be climate-neutral in terms of scope 3 emissions by 2050.

Covestro Integrated Site Shanghai is Covestro's largest production site globally, accounting for about a quarter of the company's global output, thus playing a significant role in the company's climate target process. Covestro's Shanghai site is promoting the achievement of more sustainable manufacturing, the application of green energy, and the use of alternative raw materials through a series of innovative measures.

More Sustainable Production and Manufacturing

Solution

To reduce energy consumption, effectively control, and minimize carbon dioxide emissions, Covestro is actively exploring research and development as well as innovation in clean production, energy-saving upgrades, and safety and environmental protection. It has carried out effective technical practices at its Shanghai site:

- In 2022, a new environmental protection facility, the vacuum drying system, was used to recover toluene diisocyanate (TDI) from residues, increasing TDI production capacity by 10,000 tons/year while reducing carbon dioxide emissions by 18,000 tons of CO_2 equivalents/year.
- In 2022, the resource utilization of HDI residues was achieved, reducing emissions by about 8,000 tons of CO_2 equivalents/year.
- The TDI waste heat utilization project, which will be launched in 2024, will reduce emissions by 30,000 tons of CO_2 equivalents/year.
- Oxides of nitrogen have already been reduced by 1 million tons of CO_2 equivalents/year. By 2025, it is expected to reduce emissions by an additional 200,000 tons of CO_2 equivalents, achieving nearly zero emissions.

Benefit

The carbon emissions per unit product at Covestro Integrated Site Shanghai in 2023 have decreased by 74% compared to 2009. A 25% reduction in energy intensity was achieved between 2016 and 2020. The site contributes 16% to the total industrial output value of the Shanghai Chemical Industry Park, while its total energy consumption accounts for only 4%. Notably, the specific consumption of diphenylmethane diisocyanate (MDI) and toluene diisocyanate (TDI) products is better than the advanced value of the energy consumption quota standard. Covestro's Shanghai site has carried out two major energy efficiency inspections in 2016 and 2020, respectively, and implemented energy-saving projects according to the project implementation plan, achieving the expected energy savings.

Covestro's Shanghai integrated site's large-scale distributed photovoltaic power facility has been recently commissioned, with an expected annual power generation of 6 million kilowatt-hours.

Covestro has announced that its first global production line dedicated to Mechanical Circulation Recycling (MCR) of polycarbonate has officially started operation at its Shanghai integrated site.

Active Use of More Renewable Electricity

Solution

Covestro is firmly advancing the use of renewable energy because it is an important path to achieving our Circular Economy vision. At Covestro Integrated Site Shanghai, the consumption of green electricity exceeded 40% in 2023. This is mainly based on multi-year power purchase agreements signed with suppliers such as CGN New Energy.

Covestro has successfully implemented a pioneering distributed photovoltaic (PV) power generation facility at its Shanghai site. The project officially started operation at the end of January 2024 and can generate 6 million kWh of electricity per year for the site's daily operations. With the existing photovoltaic facilities, the site's total annual solar power generation will rise to 6.5 million kWh, reducing carbon emissions by about 5,000 tons per year, equivalent to saving about 2,000 tons of standard coal. Covestro integrated PV modules with frames partially made of its polyurethane (PU) composites into this project. As non-metallic insulating materials, PU composite frames mitigate Potential-Induced Degradation (PID), thereby enhancing the power generation efficiency of solar panels. This material has been certified by TÜV Rheinland and TÜV SÜD as suitable materials for solar panels. The "cradle-to-gate" carbon footprint of this PU composite is 85% lower than that of traditional aluminum profiles.

Benefit

In 2023, the utilization rate of green electricity at Covestro Integrated Site Shanghai has exceeded 40%. It ranked 30th in the "2023 China Green Electricity (Green Certificate) Consumption TOP100 Enterprises" jointly released by the China Electricity Council, Beijing Electric Power Exchange Center, Guangzhou Electric Power Exchange Center, and the National Renewable Energy Information Management Center.

Promoting Circular Design with Alternative Raw Materials

Solution

In terms of alternative raw materials, Covestro is actively developing green materials, including mass balance solutions. More and more of Covestro's production sites around the world have obtained the internationally recognized ISCC PLUS sustainable standard certification. By the end of 2023, a total of 16 of the company's production sites worldwide had obtained this certification. Covestro Integrated Site Shanghai had already obtained this certification in 2021 and has the capability to supply raw materials containing a significant share of biomass raw materials in large quantities.

Based on the mass balance approach, Covestro has developed low-carbon-footprint TDI, MDI, TPU, and other products utilizing bio-circular materials such as waste oil and plant residues, as well as polycarbonates containing a share of post-consumer chemically recycled materials. The company also offers a variety of green products, including polycarbonate with up to 90% post-consumer recycled content, post-consumer recycled TPU, and water-based bio-based polyurethane coating raw materials. Presently, Covestro's product portfolio introduces the Circular Intelligence (CQ) label for circular solutions, with CQ products containing at least 25% alternative or recycled raw materials.

In October 2023, Covestro's first dedicated mechanical recycling (MCR) compounding line for polycarbonates was put into operation at its Shanghai site, with an annual capacity of 25,000 tons. Covestro is committed to supplying over 60,000 tons of recycled-content polycarbonates annually in the Asia Pacific region by 2026, in response to robust market demand.

Benefit

In addition to actively promoting circular design at the product end, Covestro is taking a variety of measures to enhance transparency in the Circular Economy value chain. For instance, the life cycle calculation method used by Covestro's new generation of product environmental footprint cloud management system was certified by TÜV Rheinland in June 2023. Its "Cloud-based Environmental Footprint Management Platform for Chemical Product Life Cycle" calculates the environmental footprint of products through cloud-native solutions, achieving cloud-based and automated life cycle assessment. This project was selected in the "Shanghai 2023 First Batch of Industrial and Communication Industry Carbon Management Pilot List" in August 2023.

Dow Company

Dow (NYSE: DOW) is one of the world's leading materials science companies, serving customers in high-growth markets such as packaging, infrastructure, mobility and consumer applications. Our global breadth, asset integration and scale, focused innovation, leading business positions and commitment to sustainability enable us to achieve profitable growth and help deliver a sustainable future. We operate manufacturing sites in 31 countries and employ approximately 35,900 people. Dow delivered sales of approximately $45 billion in 2023. References to Dow or the Company mean Dow Inc. and its subsidiaries. Learn more about us and our ambition to be the most innovative, customer-centric, inclusive and sustainable materials science company in the world by visiting www.dow.com.

Bullet Point: Sustainable Packaging

Region: China

For the dairy industry, traditional package is multiple material laminated structure, a hard-to-recycle packaging. This case is to transform this package into easy-to-recycle structure and integrate it into closed-loop recycling streams through responsible collection and mechanical recycling technology, providing consumers with more choices of sustainable packaging.

Solution

Dow has partnered with Mengniu, a leading dairy company in China, to launch an all-polyethylene (PE) yogurt pouch designed for recyclability. This innovation strengthens both companies' commitment to achieving a Circular Economy in China. Leveraging the materials science expertise of Dow and the collaboration across the value chain, Mengniu developed its first all-PE yogurt pouch designed for recyclability. Dow's INNATE™ TF-BOPE resins help ensure that packaging maintains its superior appearance and productiveness. The newly developed all-PE packaging enabled by INNATE™ TF-BOPE resins is a breakthrough for the dairy industry, as it enables traditional hard-to-recycle packaging to be integrated into closed-loop recycling streams through responsible collection and mechanical recycling technology, providing consumers with more choices of sustainable packaging.

Benefit

An all-polyethylene (PE) yogurt pouch designed for recyclability.

Bullet Point: Material Innovation

Region: China

With the rapid development of economy and society in China, in parallel with economic benefit increase, the problems around energy crisis and environment polution are rising and getting worse. Sustainability is getting more and more tractions from government and industry. The contribution from biobased industry can hardly be neglected. It can help to reduce the dependence on fossil fuels, achieve low carbon emission and reduce greenhouse effect.In recent years, there has been increasing demand from end consumers for more environmental friendly emulsion (like allergy-friendly paint) and high performance emulsion. Solvent free paints have gained high appealingness due to its superior properties in environmental friendly. Traditional biobased binders can hardly achieve the balance between low temperature film forming and high performance. In order to address to this pain point, Dow developed new generation biobased acrylic binder which can achieve ≥50% biobased carbon content. Meanwhile, it can also solve the issues, such as low temperature cracking in solvent free formulations, free thaw stability, brush clogging, washability, stain removal, etc. In this way it can make paints greener and more durable, largely extending biobased products to more applications. Dow is the leading player in biobased technology in this industry.

Solution

Dow bio-based acrylic emulsion provides the architectural coatings market with a premium interior binder that is more sustainable and potentially healthier than incumbent petroleum-based products. Dow bio-based acrylic emulsion is ultra-low odor, low-VOC, solvent-free and provides the added benefits of formaldehyde abatement technology and Asthma & Allergy Friendly® certification, as well as excellent performance meeting the criteria for a premium coating.

Benefit

The key properties of Dow bio-based acrylic emulsion are hallmarks of three pillars we strive for when developing best-in-class innovation: protecting the climate, creating safer materials, and increasing sustainability. Dow bio-based acrylic emulsion is the first biobased polymer on the market that combines sustainability, potential health and performance benefits in one product for the premium interior architectural coatings market. Dow bio-based acrylic emulsion achieves a biocarbon content of ≥50% according to ASTM D6866, well above the threshold for USDA biobased certification, and a 46% carbon footprint reduction compared to an equivalent all-acrylic petroleum-based emulsion according to Life Cycle Analysis calculations. Dow bio-based acrylic emulsion is compatible in a broad-spectrum of formulations, including “solvent-free” systems, allowing for the realization of ultra-low odor, ultra-low VOC and ultra-low emissions paint. Given this latitude and keen awareness for using non-allergenic raw materials, Dow bio-based acrylic emulsion is certified as Asthma & Allergy friendly as it meets or exceeds all stringent performance standards for Indoor Air Quality Certification in the US, China and Europe. Dow bio-based acrylic emulsion enables paints with high scrubbing resistance and stain resistance, good low temperature film formation, and excellent freeze-thaw stability even when formulated with zero coalescent added formulations, meeting the criteria for a premium coating. This directed design yields a material which is extremely stable before application and then create a damage resistant durable very long-lasting paint reducing the need to repaint.

EASTMAN

Eastman

Founded in 1920, Eastman is a global specialty materials company that produces a broad range of products found in items people use every day. With the purpose of enhancing the quality of life in a material way, Eastman works with customers to deliver innovative products and solutions while maintaining a commitment to safety and sustainability. The company's innovation-driven growth model takes advantage of world-class technology platforms, deep customer engagement, and differentiated application development to grow its leading positions in attractive end markets such as transportation, building and construction, and consumables. As a globally inclusive and diverse company, Eastman employs approximately 14,000 people around the world and serves customers in more than 100 countries. The company had 2023 revenue of approximately $9.2 billion and is headquartered in Kingsport, Tennessee, USA. For more information, visit www.eastman.com.

Bullet Point: Social Responsibility

Region: Beijing China

The problem addressed is the need for sustainable practices and innovation in the fashion industry. This involves educating future designers on eco-friendly materials, promoting sustainable textile solutions, and reducing the environmental impact of garment production.

Solution

To inspire the next generation of sustainably minded fashion designers, Eastman collaborated with the Beijing Institute of Fashion Technology (BIFT) by working with three exceptional students complete their theses by researching the properties of fabrics made with Eastman Naia™ cellulosic fibers and incorporating them into garment design.

Around the world and serves customers in more than 100 countries

100

Eastman employs approximately 14,000 people

14,000

Benefit

Enhanced students' understanding of sustainable fashion and innovative sustainable materials. Provided a platform for students to showcase their creative sustainable designs, which gained attention at major exhibition, highlighting sustainable fashion.

Bullet Point: Recycling and Reuse

Region: KINGSPORT Tennessee United States

Eastman and Patagonia join forces to tackle global textile waste crisis.

Solution

Eastman teamed up with Patagonia to recycle 8,000 pounds of pre- and post-consumer clothing waste, which Eastman processed through its molecular recycling technology. The process involves breaking down Patagonia's unusable apparel into molecular building blocks that Eastman can use to make new fibers.

Benefit

Eastman and Patagonia collaborate to tackle textile waste, advancing circular fashion with sustainable textile solutions through advanced technology.

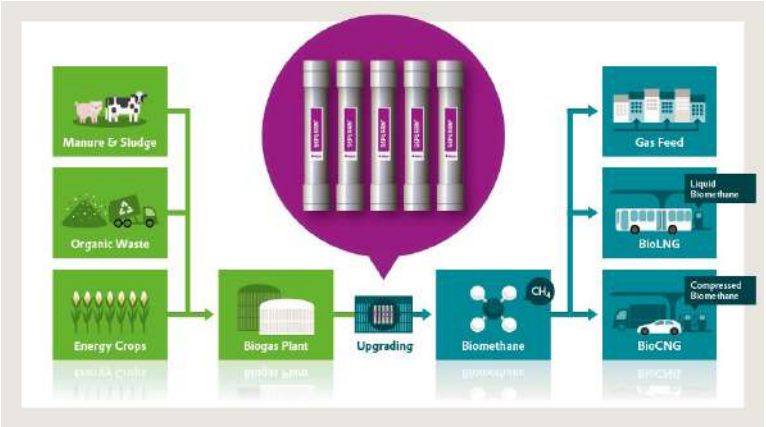
Evonik

Evonik is one of the world leaders in specialty chemicals. Active in more than 100 countries around the world, Evonik goes far beyond chemistry to create innovative, profitable and sustainable solutions for customers. More than 33,000 employees work together for a common purpose: We want to improve life today and tomorrow.

Focusing on the social and economic megatrends, we work together with customers and partners to deliver high quality solutions in booming industries such as e-mobility, renewable energy, green manufacturing, new infrastructure, sustainable food production and healthcare.

Bullet Point: Green Manufacturing

Region: Germany



Biomethane is an important building block in the renewable energy mix, alongside solar and wind technology. For years, Europe, with France as the pioneer, has played a leading role in biogas production on an international scale. In the meantime, many other European countries such as Italy, Belgium and the Netherlands, but also the large economies of the USA and China, are relying on this climate-friendly energy source. Biogas is produced by the fermentation of biomass - an organic substance, for example, from waste such as liquid manure and sewage sludge or from renewable raw materials. How to get high purity biomethane from biogas cleanly and efficiently?

Solution

Biogas is produced by the fermentation of biomass - an organic substance, for example, from waste such as liquid manure and sewage sludge or from renewable raw materials. The particularly selective hollow-fiber membranes from Evonik easily and efficiently separate raw biogas, which consists of the energy carrier biomethane and renewable carbon dioxide, into high-purity biomethane and Bio-CO_2. The climate-friendly energy source can consequently be used to generate electricity and heat or used as a fuel. Bio-CO_2, on the other hand, can be liquified onsite and used as renewable raw material for various applications. The membranes are made of a high-performance polymer specially developed by Evonik that is highly resistant to pressure and temperature.

Benefit

Advantages of biogas upgrading with membranes.

Compared with other biogas upgrading processes such as pressurized water scrubbing, pressure swing adsorption, or amine scrubbing, Evonik's membrane technology has significant advantages: It requires comparatively little energy and does not need any auxiliary materials or chemicals. No waste or wastewater is produced that would otherwise have to be treated and require disposal.

In North Rhine-Westphalia, Germany, the 1,000th biogas extraction unit with Evonik membranes is under construction, marking a milestone achievement for Evonik gas membranes in biogas purification applications.

Since the product launch in 2011, Evonik has worked with selected partners to develop its membrane technology into a new quality standard in biogas upgrading. The group is driving forward the green transformation toward a sustainable gas economy.

ExxonMobil

ExxonMobil

ExxonMobil is one of the largest publicly traded international energy and petrochemical companies, creates solutions that improve quality of life and meet society's evolving needs.

ExxonMobil has a long history in China dating back to 1892. Today, our business portfolio here spans the full spectrum of the industry, from upstream (LNG) to downstream, chemicals, technology center and low carbon solutions.

Bullet Point: Material Innovation

Region: Baytown Texas United States

The challenge society faces is maintaining the benefits of plastics while addressing the issue of waste. Plastic recycling rates remain low. According to a 2022 report by the Organization for Economic Cooperation and Development (OECD), globally, the bulk of plastic waste ends up "in landfill, incinerated or leaking into the environment, and only 9 percent successfully recycled."[1]

Advanced recycling complements mechanical recycling and supports a more circular plastic economy by driving demand for plastic waste as a valuable feedstock.

Solution

ExxonMobil's technology for advanced recycling helps address a broader range of plastic waste.

Instead of Mechanical recycling, ExxonMobil's advanced recycling uses heat to transform plastic waste at a molecular level into raw materials for use in manufacturing a wide array of new products. This process takes place in a unit in our integrated facility and is often referred to as pyrolysis. Our advanced recycling technology converts plastic waste at a molecular level to produce virgin-quality raw materials.

Many of these raw materials are the same as the raw materials produced during the processing of fossil-based crudes and are used to produce a wide range of valuable new products from fuels to lubricants to high performance chemicals and plastics.

Benefit

Our advanced recycling facility in Baytown, Texas, has been operating since December 2022, with the capacity to process 80 million pounds of plastic waste per year (equals to 36,000 tons).

This facility is already helping to support a more Circular Economy for plastics.

We plan to increase our global advanced recycling capacity to more than 1 billion pounds per year by 2027 (equals to 500,000 tons), with facilities in discussion around the world.

Bullet Point: Material Innovation

Region: China

POF is a kind of widely used shrink film for applications such as consumer electronic devices, home appliances, and food & beverage. Both traditional shrink film with PP/PE/PP structure and cross linked POF can be difficult to mechanically recycle. Snug fit shrinkage and great optical are important to help increase finish goods shelf appeal. Chinese local Shantou Mingca Packaging Co Ltd. (a leading shrink film manufacturer), wanted to improve the recyclability* of POF while maintaining shrink performance, softness and optics, to help address their customers' needs.

Solution

Ultra-low density performance polyethylene can be used to create PE-based shrink film

After four years of collaboration, Mingca and ExxonMobil Asia Pacific Research & Development Co., Ltd (ExxonMobil), developed an innovative double bubble polyethylene-based shrink film (PEF) solution that incorporates ultra-low density performance polyethylene.

Starting from this formulation, Mingca made custom modifications to its lines to arrive at a polyethylene-based solution.

Benefit

The solution's polyethylene-based structure helped create packaging that can be more easily mechanically

recycled than conventional multi-material POF solutions. The recyclability* of the film structure has been third party validated and certified by TÜV Rheinland[2].

PEF shrink film can also help enable exceptional "shelf appeal" for products (enabling the items contained inside the film to look attractive to consumers). In addition, the PEF solution can provide a snug fit with small and soft corners, further increasing appearance aesthetics.

PEF can enable excellent shrink performance at lower temperatures. Thanks to its low-temperature shrinkage capability, the new solution can offer potential cost savings due to the shrink tunnel consuming less energy than what is typically needed with conventional POF solutions[3].

1 OECD, Plastic pollution is growing relentlessly as waste management and recycling fall short, says OECD (Feb. 22, 2022), https://www.oecd.org/environment/plastic-pollution-is-growing-relentlessly-as-waste-management-and-recycling-fall-short.htm https://www.oecd.org/environment/plastic-pollution-is-growing-relentlessly-as-waste-management-and-recycling-fall-short.htm.

*Recyclable in communities with programs and facilities in place that collect and recycle plastic films.

*The terms"recyclable" and "recyclability" are intended to refer to the potential for recyclability of packaging solutions designed and manufactured in accordance with recycling guidelines such as PRE RecyClass. Ultimate recyclability of packaging incorporating ExxonMobil's performance PE resins will depend on a number of factors outside of ExxonMobil's control including, but not limited to, availability of programs and facilities that collect and recycle plastic packaging within a given community. Any and all claims about the recyclability of packaging are the sole responsibility of the packaging manufacturer.

2 Per DIN EN ISO 14021:2021-10.

3 Based on calculation of Mingca Packaging.

HUNTSMAN
Enriching lives through innovation

Huntsman

Manufacture polyurethanes and provide MDI-based polyurethane solutions.

Bullet Point: Green Manufacturing

Region: China

Methylene diphenyl diisocyanate (MDI) is one of the most important raw materials for polyurethane industry. Currently, the liquid-phase phosgene method is used by major MDI manufacturers to produce MDI, which uses chlorine gas as raw material and generates large amounts of hydrogen chloride as by-products.

Chlorine is normally produced by NaCl electrolysis, which consumes large amount of energy. Hydrogen chloride by-product can be used to produce hydrochloric acid or polyvinyl chloride resins. However, it is a great challenge and concern for the isocyanate industry to deal with hydrogen chloride by-product due to the serious overcapacity of polyvinyl chloride resin and low value of hydrochloric acid.

Solution

Shanghai Huntsman Polyurethane Co., Ltd. adopted a cutting-edge hydrogen chloride oxidation technology to convert hydrogen chloride by-product into high quality chlorine, with an oxidation efficiency of higher than 90%.

Benefit

This technology significantly reduced energy consumption of chlorine compared to traditional electrolysis method and achieved circular recycling of chlorine element, which meets the requirements of clean production and Circular Economy and is of great significance to the Sustainable Development of MDI and polyurethane industry.

Oxidation efficiency of higher than

90%

Bullet Point: Material Innovation

Region: Houston United States, Taiwan China

Explore and use recyclable materials to reduce reliance on non-renewable resources is one of ways to implement Circular Economy. Huntsman utilize chemical recycling process to turn wasted PET into polyester polyols is of great significance to promote Circular Economy development.

Solution

Huntsman utilizes both pre-consumer and post-consumer sources of recycled PET in their processes for producing the aromatic polyester polyols product line. In both cases, the PET is collected, sorted, washed and size reduced for digestion in reactors using mixtures of glycols. PET from postconsumer sources is collected from curbside and municipal programs. These polyester polyols have been certified by Recycled Claim Standard (RCS) and UL 2809 standards. Both standards are voluntary and helpful in demonstrating eco credentials to customers in target markets – who can find it hard to differentiate between products that are genuinely environmentally preferable, and those that are not.

Benefit

Huntsman has built two chemical recycling wasted PET plants. The Houston plant located in United States recycles more than 30,000 tons of wasted PET per year. Huntsman opened a similar plant in Taiwan in 2020, recycling more than 10,000 tons of wasted PET per year. The two plants reduce 100,000 tones CO_2 equivalent emissions per year by chemical recycling wasted PET.

kemira

Kemira

The areas of expertise of Kemira Group are pulp & paper, water intensive industries & municipal water treatment, and oil & gas, which business is organized into two customer-based segments: Pulp & Paper represents some 60% of our group revenues, and Industry & Water 40%.

Spread across three regions: Americas, Asia Pacific (APAC) and Europe, Middle East & Africa (EMEA), Kemira Group has 62 manufacturing sites globally. Kemira serves customers around the world and improve their product quality, resource efficiency and sustainability.

Bullet Point: Recycling and Reuse

Region: Nanjing China

One production line of the site produced residual water which mainly contained a specific organic acid and handled as Hazardous waste with high cost; meanwhile another production line produced intermediate by purchasing this specific organic acid anhydride. By pre-treating the residual water and reusing in the intermediate process, the cost, waste and the storage input can be reduced for both lines.

Solution

Improve the pre-treatment of the residual water; Study the appropriate replacement ratio and process; Get legal approval from authority; Recycle in the real production.

Benefit

Save the cost of Hazardous Waste treatment & the raw material above 300,000 RMB/a; Decrease the total waste and logistics storage input of Nanjing site also.

Manufacturing sites globally

62

Bullet Point:
Material Innovation

Region:
APAC

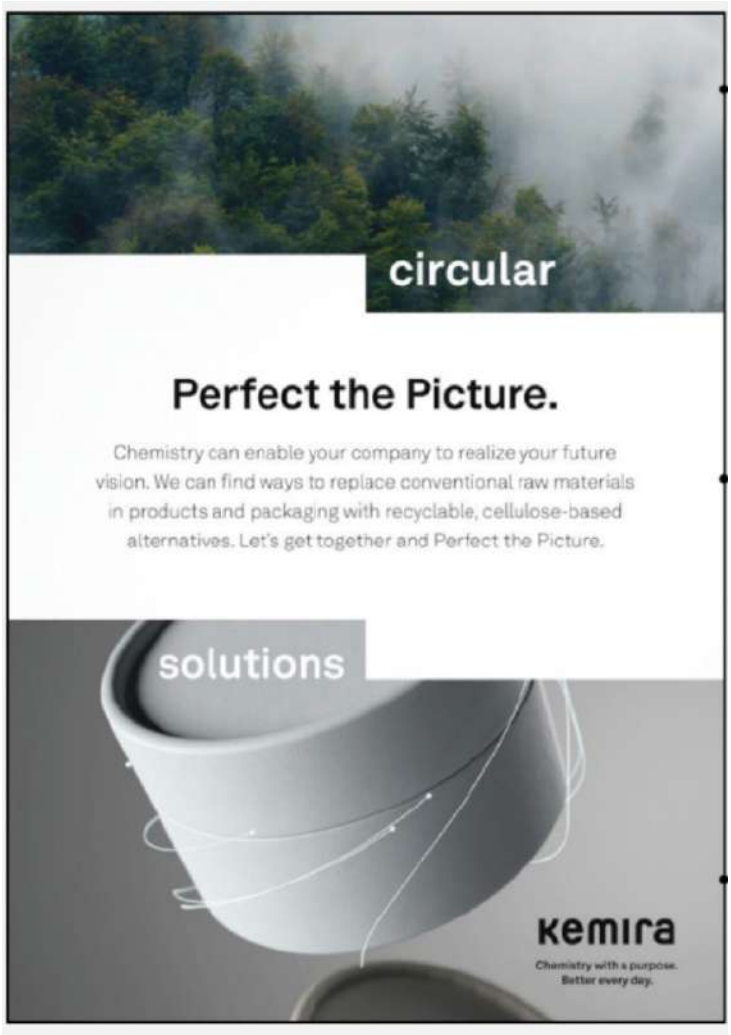
More molded fiber applied as plastic replacement in daily life. Some advanced application of Molded fiber is for food packaging, PFAS based chemistry normally added for oil resistance. However, this chemistry is potential to cause cancer, which requested to ban in more and more Countries.

Solution

Kemira developed the PFAS free chemistry as more sustainable product for molded fiber industry, FennoGuard MLD series, 2 years R&D support and close to launch in APAC region.

Benefit

It is PFAS free, FDA and GB approved, equal performance to replace existing PFAS chemistry, environmental and health friendly.



Making our world more productive

Linde

Linde is a leading global industrial gases and engineering company with 2023 sales of $33 billion. We live our mission of making our world more productive every day by providing high-quality solutions, technologies and services which are making our customers more successful and helping to sustain, decarbonize and protect our planet.

The company serves a variety of end markets such as chemicals & energy, food & beverage, electronics, healthcare, manufacturing, metals and mining.

Linde's industrial gases and technologies are used in countless applications including production of clean hydrogen and carbon capture systems critical to the energy transition, life-saving medical oxygen and high-purity & specialty gases for electronics. Linde also delivers state-of-the-art gas processing solutions to support customer expansion, efficiency improvements and emissions reductions.

Bullet Point: Green Manufacturing

Region: Changzhou China

Providing green and low-carbon industrial gas supply for the Changzhou Park.

Solution

Linde's Changzhou site, awarded "Green Factory" in 2023, is advancing efficiency and collaborating with energy partners to pioneer green, low-carbon energy, establishing a foundation for building a net-zero carbon facility.

1.Fully covered photovoltaic panels on office and distribution house roofs, meeting on-site office electricity needs.

2.Collaborating with energy groups to use surplus compressed air for on-site equipment production, enhancing energy cascade utilization and improving equipment efficiency to reduce energy consumption, achieving a win-win in business.

3.Cooperating with energy groups to achieve 100% usage of green and low-carbon energy in the factory.

4.Optimizing water sources in the factory through technological transformations to reduce tap water replenishment and optimize costs.

Benefit

Full coverage of green and low-carbon energy further accelerates the development of Linde's green gas port in Changzhou's industrial park.

Lubrizol

Lubrizol

The Lubrizol Corporation, a Berkshire Hathaway company, leverages unmatched chemistry to unlock immense possibilities at the molecular level. Our solutions are found in products used by people every day, driving sustainable and measurable results to help the world move cleaner, create smarter and live better. Lubrizol enhances every facet of our lives from the way we move, to how we take care of ourselves and our families, and how we work and play. Our technologies and market expertise help our customers and consumers overcome everyday challenges and improve product performance.

Bullet Point: Recycling and Reuse

Region: Zhuhai China

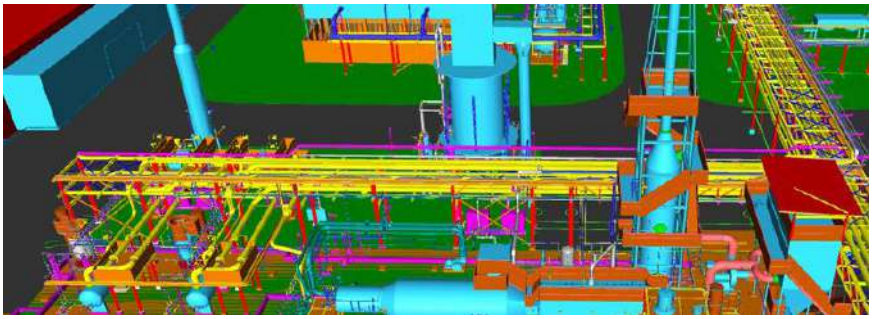
The Zhuhai site currently has a set of thermal oxidizers used to treat the process waste gas from the upstream units. Due to the intermittent production of the upstream unit, the flow rate and heating value of the process vent gases are highly unstable. It requires 60 to 90 Nm3/hr of natural gas consumption to maintain the furnace temperature at around 800℃ . Additionally, the direct emission of high-temperature flue gas into the atmosphere after combustion causes heat loss.

Solution

In year 2024, the Zhuhai site is building a new incinerator with heat recovery, primarily using the high calorific/heating value waste liquid from the Phenate Unit as the main fuel, with natural gas as auxiliary fuel. It will destroy the process vent gas and also treat the high-COD wastewater from Phenate Unit. Furthermore, the downstream waste heat boiler can recover 70% of the heat to produce steam for internal use in the factory.

Benefit

Zhuhai New Incinerator:
1.It is safer, more reliable, and environmentally friendly.
2.It will reduce about 30% of the site CO_2 footprint.
3.It will reduce about 20% of the site hazardous waste generation.
4.It saves approximately 8 million RMB operating costs per year.



Bullet Point:
Green Manufacturing

Region:
Shanghai China

The Songjiang site fluidized bed air flowrate setting does not differentiate between products. Under the same air flowrate conditions, some products boil high and some boil low, and the final aging effect is the same under the same time. Therefore, those products with high boiling waste the electricity.

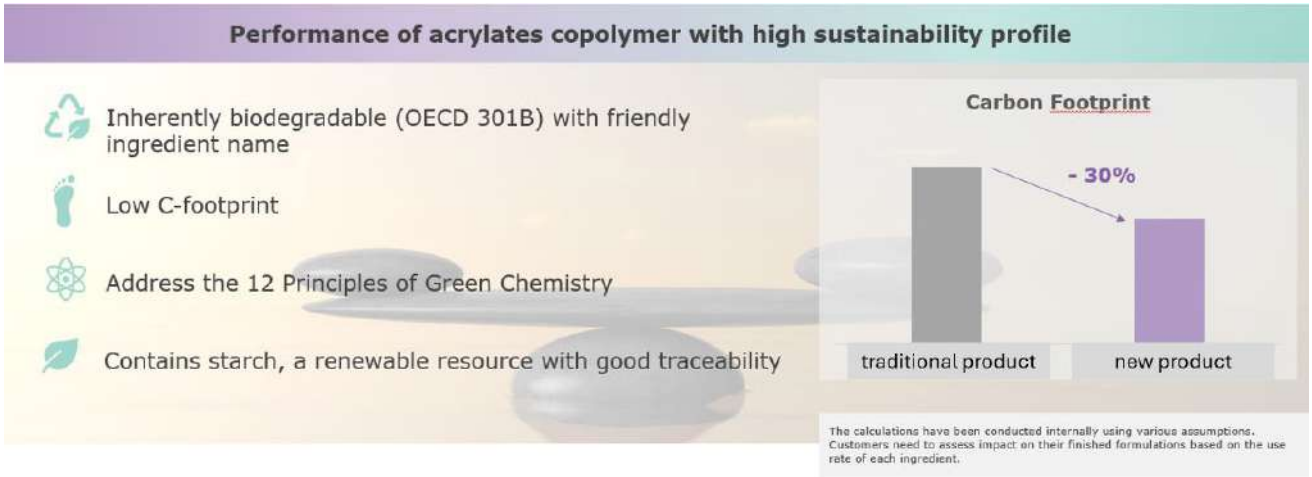
Solution

In 2024, the Songjiang site achieved the goal of reducing fluidized bed power consumption per unit product(kwh/T) by 5% compared to 2023 through optimizing the set value of fluidized bed aging air flowrate. Based on the production plan, 9 products that are frequently produced (accounting for 88.3% of the total product) were identified and the fluidized bed air flowrate data was collected and statistically analyzed. Then, the aging air flowrate of these 9 products was adjusted and tested to determine the optimal air flowrate by production team together with process engineers, which can not only ensure the boiling effect but also prevent dead fluidized bed.

Benefit

Songjiang Fluidized Bed Air Flowrate Optimization:

By end of July 2024, the average electricity consumption per unit product(kwh/T) has been reduced by 11.3% compared to 2023.



Bullet Point: Material Innovation

Region: Global except China

Market needs for a rheology modifier with same performance as Acrylates copolymer (suspension, stabilization, sensory, viscosity... in surfactant systems) but with improved sustainability profile. Current benchmark fully synthetic, non-biodegradable and address 10 principles of green chemistry.

Solution

The new product displays the same level of performance at Acrylates copolymer and is a hybrid polymer containing starch (sustainably sourced).

It is inherently biodegradable and address 12 principles of green chemistry.

It also displays lower carbon footprint vs Acrylates copolymer.

Benefit

It is inherently biodegradable and address 12 principles of green chemistry, with the following Sustainable Benefits:

- NOC with water: 85% (according to ISO 16128)
- RCI: 0.26
- Inherently biodegradable (OECD 301B)
- Consumer friendly ingredient name
- Contains starch, a traceable renewable resource grown sustainably and not competing with food
- Process addresses all 12 Principles of Green Chemistry
- Free from: GMO/EO/PEGs

LyondellBasell

LyondellBasell

We are LyondellBasell (NYSE: LYB) – a leader in the global chemical industry creating solutions for everyday sustainable living. Through advanced technology and focused investments, we are enabling a circular and low carbon economy. Across all we do, we aim to unlock value for our customers, investors and society. As one of the world's largest producers of polymers and a leader in polyolefin technologies, we develop, manufacture and market high-quality and innovative products for applications ranging from sustainable transportation and food safety to clean water and quality healthcare.

Bullet Point: Recycling and Reuse

Region: Guangdong China

LyondellBasell announced the opening of the plastics recycling joint venture (JV) in Zhaoqing, Guangdong Province in Southern China with Genox Recycling (Genox), using mechanical recycling technology to recycle plastic waste and produce new polymers, adding to the Lyondell Basell Circulen Recover product portfolio.

Leverage the advantages of LYB and Genox to lead the development of plastics recycling.

Solution

On April 18, 2024, LyondellBasell (NYSE: LYB) announced the opening of the plastics recycling joint venture (JV) in Zhaoqing, Guangdong Province in Southern China with Genox Recycling (Genox). The plastic recycling plant will use mechanical recycling technology to recycle plastic waste and produce new polymers, adding to the LyondellBasell CirculenRecover product portfolio. This joint venture is linked to LYB's commitment to support a Circular Economy for plastics and is part of our strategy to expand our circular polymer offering in China. This partnership with Genox enables us to create local recycling solutions for customers and brand owners in China in support of their ambitious targets.

Benefit

This new JV is an execution of LyondellBasell's strategy of building a strong and profitable Circular and Low Carbon Solutions business in Asia. The JV combines the strengths of both shareholders to deliver the result we see today, including partnering with Genox through an off-take business, developing innovative products to meet customer's needs, growing our capability into the entire plastics recycling value chain. This new joint venture will help develop the local plastics recycling infrastructure in China and contribute to a Circular Economy.

Merck China

As a vibrant science & technology company, Merck has always been committed to advancing the human progress on the basis of sustainability, we create long-term value through our core business practices while seeking to balance environmental, social and governance aspects –for us, for our stakeholders and for society at large.

Bullet Point: Material Innovation

Region: China

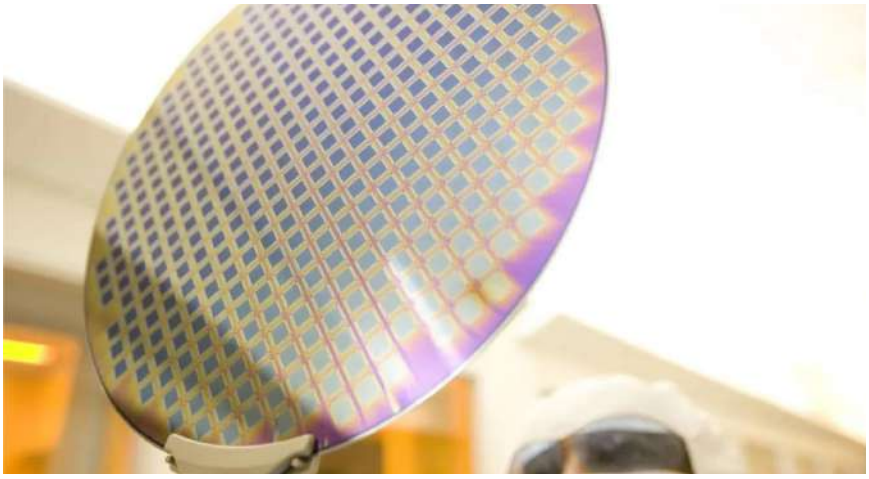
In the Circular Economy, we are looking for ways to close the loop throughout the value chain. Our strategy is not simply to recycle as thoroughly as possible, but to prevent waste at all the time. We take this approach from the very beginning of our processes, including procurement and product design.

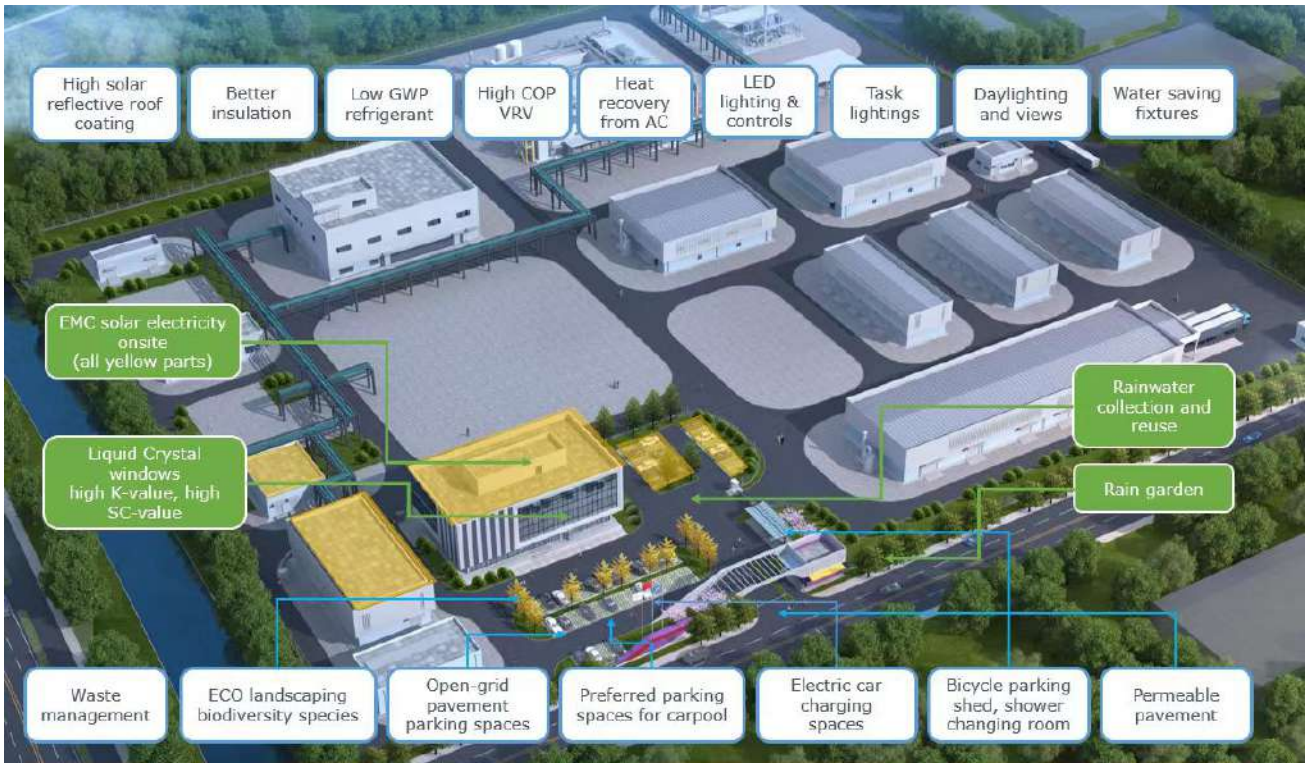
Solution

In Electronics business, we prioritize new green and innovative materials and continue to provide innovative and sustainable products. Our Remover is based on a new, special chemical formulation that does not contain NMP (N-methyl pyrrolidone). This Remover removes photoresist in less than three times the amount of solvent, saving costs and reducing the environmental impact of scrap.

Benefit

Extremely economical, environmentally friendly and widely applicable.





Bullet Point: Green Manufacturing, Recycling and Reuse

Region: China

Solution

Merck China's Electronics Integrated Semiconductor Solutions Site in Zhangjiagang obeyed strict environmental health and safety standards, implementing initiatives such as full wastewater recycling, procurement of green energy, solar panel power systems, and rainwater gardens to establish a national-level green factory.

Benefit

In 2024, the office building at the Zhangjiagang site attained LEED Platinum certification.

Mitsui Chemicals

Mitsui Chemicals, Inc.

A global chemical company that provides chemical solutions to social issues, from functional products such as healthcare materials to petrochemicals, industrial chemicals.

Bullet Point: Sustainable Packaging

Region: Global

Many chemical companies have contributed to solving social issues such as reducing food waste and improving energy efficiency by providing chemical products. However, those achieves use many fossil resources and emit GHGs, and in recent years, environmental pollution due to plastic waste has become a problem.

Solution

Our company group contributes to the realization of a Circular Economy through our carbon neutral strategy, biomass strategy, recycling strategy, and response to the problem of marine plastic waste.

Benefit

We believe that it is essential to shift from a one-way economy in which resources are consumed and discarded to a Circular Economy in which resources are recovered and reused to produce no waste, and we implement those concepts.

Nouryon

Nouryon

Nouryon is a global, specialty chemicals leader. Markets and consumers worldwide rely on our essential solutions to manufacture everyday products, such as personal care, cleaning goods, paints and coatings, agriculture and food, pharmaceuticals, and building products. Furthermore, the dedication of approximately 8,200 employees with a shared commitment to our customers, business growth, safety, sustainability and innovation has resulted in a consistently strong financial performance. We operate in over 80 countries around the world with a portfolio of industry-leading brands.

Bullet Point: Material Innovation

Region: Zhejiang China

Assist customers to enhance the recyclability of their products.

Solution

Nouryon products can assist our customers in enhancing the recyclability of their products. For instance, we provide polymer catalysts that can modify the properties of mechanically recycled polymers, enabling them to be upscaled and used in applications currently reserved for new virgin polymer streams. Our products also help maintain high quality in finished products made from recycled plastics.

Benefit

These two products produced at the Ningbo site can enhance the properties of recycled polypropylene, allowing for its use in applications previously limited to virgin plastics.

Bullet Point:
Recycling and Reuse

Region:
Jiangsu China

Establishing a Chlorine Recycling Green Industry Chain within the Park.

Solution

Chlorine is a fundamental raw material in the chemical industry; however, its use presents challenges such as maintaining a chlorine-alkali balance and disposing of chlorinated waste. Within the Taixing Economic Development Zone, SP Chemical, Nouryon, and Yangzi Pharmaceutical Chemical have collaborated through industrial chain cooperation to successfully establish a green industrial chain for chlorine recycling.

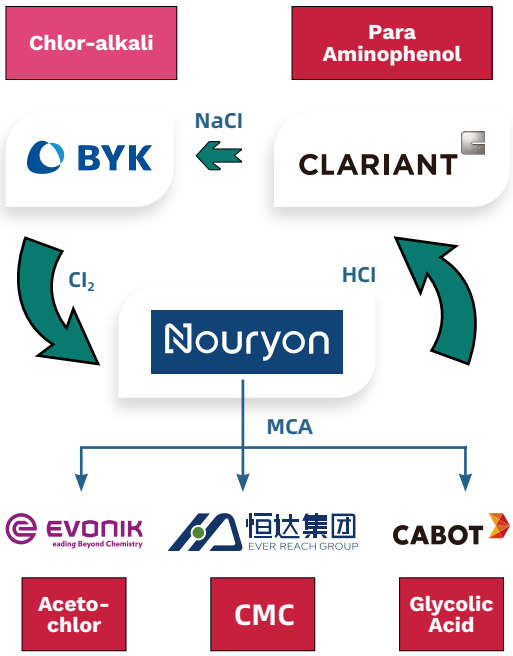
SP Chemical produces chlorine by electrolyzing salt (NaCl) and transports it via pipeline to Nouryon Taixing site, where it serves as the key raw material for Monochloroacetic Acid (MCA). The hydrochloric acid, a by-product of MCA production, is then transported to Yangzi Pharmaceutical Chemical, where it is utilized as an important reagent in their production process. The brine, containing NaCl and generated during the transformation process at Yangzi Pharmaceutical Chemical, is sent back to SP Chemical to be reused as a raw material for producing chlorine gas.

Benefit

This innovative recycling model has established a complete green industrial cycle within the park. By employing this method, the scale of recycled chlorine has reached 20,000 tons annually, which significantly reduces the carbon emissions of the entire industrial chain and makes a substantial contribution to environmental protection.

MCA cluster in Taixing city

(TEDZ)>20% of MCA, and>50% HCl solutionis sold within the chemical parkThe green supply cycle of CL has beensetup



诺力昂在五家生产基地实现碳中和

Nouryon

Bullet Point: Recycling and Reuse

Region: Brazil

Closed-loop supply chain

Solution

Five of the manufacturing plants Nouryon operates in Brazil are carbon neutral: Imperatriz, Eunápolis, two sites in Três Lagoas, and Jacareí. These are part of Nouryon's Integrated Manufacturing Model (IMM). Modern pulp mills normally generate excess utilities (such as steam and water from the pulping process) that can be used as fuel in other manufacturing processes. Nouryon uses renewable energy from our customers, sourced primarily from biomass.

Benefit

These reused resources effectively lower the carbon footprint of the site significantly, while making production more efficient. Simultaneously, on-site production reduces transportation requirements.

SABIC

SABIC is a global diversified chemicals company, headquartered in Riyadh, Saudi Arabia. Since the 1980s, SABIC has been a growth partner for China. Today, SABIC operates in 17 cities across Greater China. The company has established a technology center in Shanghai, three plants in Shanghai, Guangzhou and Chongqing, a customer service center in Guangzhou, and two joint ventures in China, one with SINOPEC in Tianjin - SINOPEC SABIC Tianjin Petrochemical Co. Ltd., and the other one with Fujian Energy and Petrochemical Group in Fujian - SABIC FUJIAN Petrochemicals Co. Ltd.

Bullet Point: Material Innovation

Region: China

Microsoft's Surface Dock and power supply unit required a housing material that offered equivalent performance to that of virgin plastic in terms of safety and reliability.

Solution

SABIC was able to meet these performance requirements with an ocean bound resin solution from its TRUCIRCLE™ portfolio that will help advance industry efforts to increase recycled content use for plastics.

•Dock and power-supply enclosures made with certified circular flame retardant (FR) polycarbonate resin with 20% mass balance-attributed recycled ocean bound plastic (OBP).

•Application demonstrates feasibility of converting OBP into high-performance material used in consumer electronics, using advanced recycling.

•Material offers UL94 V0 flammability and achieves EPEAT eco-labelling goals and is certified circular by ISCC PLUS.

Benefit

By using SABIC's material, Microsoft's dock and power supply not only boasts enhanced aesthetics, but also contributes to protecting our environment by using ocean bound plastics that could otherwise end up in our oceans and waterways and helps promote the development of a circular plastic economy. This solution won a gold award at 2024 Edison Awards.

Bullet Point:
Circular Packaging

Region:
Saudi Arabia

Solution

The collaboration between SABIC, Napco National and FONTE has successfully launched the first circular packaging project in Saudi Arabia. FONTE, a major player in the Kingdom of Saudi Arabia's (KSA) bakery industry, has introduced bread bags for their Oat Arabic Bread made with SABIC's certified circular polyethylene (PE). These bags are manufactured by Napco National, a Saudi-based manufacturer of flexible film and packaging products, using two food-contact certified circular polyethylene resin grades (LLDPE) from SABIC's TRUCIRCLE™ portfolio.

Following the initiation of the joint project in March 2023 and the successful completion of the trial phase at Napco, FONTE has begun rolling out these new flexible bread bags in stores across Saudi Arabia.

The new FONTE bread bags incorporate 100% mass-balanced certified recycled content derived from mixed post-consumer plastics that are converted into pyrolysis oil through a chemical recycling process. SABIC then utilizes this oil to produce new polymers with the same purity and quality as traditional virgin plastics at its facility in Jubail, KSA.

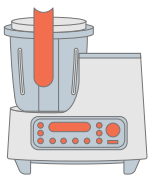
Benefit

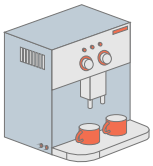
This project not only demonstrates the feasibility of a circular plastic economy but also meets Saudi Arabia's demand for more sustainable food packaging, marking the country's first application of such circular packaging.

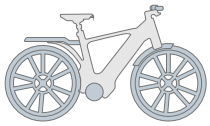
SYENSQO

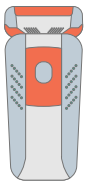
Syensqo

Syensqo is a global specialty chemical company that demerged from Solvay. we're explorers: experts in science and passionate about all its possibilities. Our knowledge, expertise and forward-thinking approach enable us to deliver on the ambition of a Circular Economy and explore breakthrough technologies. Our market-leading materials and chemical science contribute to safer, cleaner, and more sustainable products across a wide range of applications. From EV battery materials and biotech to sustainable seed care and green solvents – we drive transformation. With a diverse global team of more than 13,000 employees in 30 countries, 62 sites and 12 R&I centers, we work together to advance science.









Bullet Point: Recycling and Reuse

Region: Global

Customers and manufacturers aim to minimize the carbon footprint of their products while not compromising their processability, dimensional stability, stiffness, impact strength, or appearance.

Solution

The ECHO product portfolio integrates biobased, recycled resin, and mass balanced raw materials to reduce the carbon footprint of materials while providing the same level of performance.

The high-performance ECHO new material has a mass balance (MB) distribution of recycled materials (including recycled fibers) from post consumer/industrial recycling (PCR/PIR) sources, with a content of 33-98%, which can significantly reduce the carbon footprint of the product. At the same time, its mechanical properties and flowability are comparable to PA6 and PA66 pure new material substrates.

1000 ECHO Series
The quality balance distribution method is used for production, with a recycled material content of up to 98%, which can reduce the product's carbon footprint (PCF) by up to 56%. It is an ideal substitute for traditional polyamide resins.

6000 ECHO HPPA Series (Food Contact Certification)
Exceeding the performance of existing PA new materials, including the industry's first HPPA modified material certified for food contact, with a recycled material content of 33%, it can reduce the carbon footprint of products by 34%.

6000 ECHO HPPA series (nonfood contact)
The performance is superior to that of polyamide PA6 or PA66 substrate materials, produced by mass balance distribution method, with a recycled material content of up to 83%, which can reduce the carbon footprint of the product by 45%.

The new ECHO series is mainly suitable for household appliances and consumer goods, such as drip coffee machines and capsule coffee machines, food processors and slow cookers, ovens and air fryers, kitchen stir fry robot chassis and kitchen utensils, as well as razor racks. The expanded ECHO product portfolio further consolidates Syensqo's industry-leading position as an innovator in the field of Sustainable Development.

Benefit

It can significantly reduce the carbon footprint of the product, and its mechanical properties and flowability are comparable to PA6 and PA66 pure new material substrates.

Bullet Point: Material Innovation

Region: Global (Including China)

The beauty industry is in the early stages of green chemistry transformation, and biodegradability is one of the most urgent challenges that the industry urgently needs to address. Our biobased material could provide the quality performance while helping the beauty industry reach the green targets as well.

Solution

As one of the global leaders in natural derived polymers for beauty care formulas, Syensqo adheres to the development philosophy of “focusing on beauty and caring for the earth” and has launched a new brand_ Naternal ™. The bio based biodegradable polymer product line can be used to create customized hair and skin care solutions.

Through the power of nature and technology, Naternal is a biodegradable polymer produced from guar and other natural ingredients, suitable for beauty care formulas. The various components it contains conform to the concept of “biodegradable design method”, aiming to integrate product scrap management into the early stages of research and development, ensuring that new product development is driven by both application and scrap performance. Laying a technological foundation for future technological innovation.

Benefit

Assist clients in developing a new generation of biodegradable hair and skin care products that can meet consumer expectations and upcoming regulatory requirements with peace of mind.

TRINSEO™

Trinseo

Trinseo is a specialty material solutions provider that partners with companies to bring ideas to life in an imaginative, smart and sustainability-focused manner. Combining premier expertise, future-focused innovations and best-in-class materials, Trinseo unlocks value for companies and consumers alike.

From design to manufacturing, Trinseo taps into decades of experience in diverse material solutions to address our customers' unique challenges across a wide range of industries, including building and construction, consumer goods, medical and mobility.

Bullet Point: Material Innovation

Region: China

Customer demand and consumption trends. Sustainable Product Portfolio – Mass Balance Approach & PCF.

Solution

Development of mass-balanced acrylonitrile butadiene styrene (ABS) medical solutions, such as bio-based and recycled products.
Developed engineering resins with at least 30% recycled content.
The PC series is enriched with more than 50% mechanically recycled content.

Benefit

The factories in Mainland China and Hong Kong have passed the ISCC+ mass balance system certification.
· Market share growth, new market development
· Brand image enhancement
· Technological advancement and innovation
· 50% green electricity

Bullet Point: Material Innovation

Region: EMEA

Solution

• In Utrecht, The Netherlands, apply mechanical recycling technology (Recycling by re-melting after sorting and cleaning, unless not collected separately. (ISO/TR 23891)) to process PIR and PCR waste and get materials/production, such as rPC, rPS, rABS and rPMMA, etc.

• In Terneuzen, The Netherlands, apply physical recycling technology (Use solvent to extract the polymers and make new recycled polymers) to process PIR and PCR waste and get materials/production, such as rPC and rABS.

• In Rho, Italy, apply chemical recycling technology (Chemical reversion of a polymer to its monomer(s) or to a polymer of lower relative molecular mass (ISO 15270)) to process PIR and PCR waste and get materials/production such as rMMA.

Benefit

Supported Art Installation by Miguel Chevalier, built for a major 2024 sport event in Paris, with acrylic sheet containing 100% recycled feedstock.

Our next-generation PMMA depolymerization results in recycled methyl methacrylate (MMA) that has over 98% purity and can be a comparable replacement for virgin feedstocks.

Circular Economy related technology support Trinseo for Market share growth and New market development.

WACKER

Wacker

With more than 100 years of history, WACKER is a global leader in silicon and vinyl chemistry. WACKER forges ahead with technical innovations and the development of new products for the world's key industries;Offers solutions and innovations for a broad range of sectors.

Bullet Point: Sustainable Packaging

Region: China

Reduce scope 3 CO_2e emission

Solution

Use foldable IBC to partially replace traditional IBC in 2023.

Benefit

Reduce CO_2e emission about 967mt with ~CNY2M cost saving in 2023.

Bullet Point: Green Manufacturing

Region: China

Reduce scope 2 CO_2e emission

Solution

Buy green eneregy to replace 68% fossil based energy in 2023 which ratio will reach >70% in 2024.

Benefit

Reduce 14.5KMT CO_2e emission although increasing the cost about CNY551K in 2023.

Conclusion

Looking ahead, as the global consensus on environmental protection and Sustainable Development continues to deepen, the chemical industry, as one of the important pillars of the national economy, its development of a Circular Economy is not only related to the industry's own green transformation but also an important engine for achieving the "dual carbon" goals.

Faced with a situation where challenges and opportunities coexist, promoting the development of a Circular Economy requires the joint action of the entire value chain and all sectors of society. Enterprises need to increase their investment in R&D of key technologies for the Circular Economy, break through technological bottlenecks, and realize the industrial application of new technologies. Governments need to further improve and refine laws and regulations related to the Circular Economy, clarify the responsibilities and obligations of all parties, and establish a sound regulatory mechanism. At the same time, by formulating incentive policies, such as tax incentives, subsidies, and rewards, they guide enterprises to actively participate in the construction of the Circular Economy, forming a virtuous cycle with government guidance, market leadership, enterprise as the main body, and social participation.

As an important platform linking enterprises, governments, and communities, AICM has an inescapable responsibility in promoting the development of the Circular Economy in the chemical industry. On the one hand, we will focus on building a coordinated member enterprise cooperation network, gather industry strength, continuously promote circular technology innovation, and form more replicable and promotable circular economic development models and experiences. On the other hand, we will actively promote dialogue among government departments, Sustainable Development institutions, and stakeholders in the chemical industry value chain to jointly address issues and challenges encountered in the development of the Circular Economy and promote the formation of a more comprehensive and efficient circular economic system. At the same time, AICM will also strengthen the popularization of the concept of the Circular Economy, improve the public's awareness and participation in the importance of the Circular Economy, and create a favorable atmosphere for the whole society to jointly promote the development of the Circular Economy.

Acknowledgement

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This report is prepared on behalf of AICM and, like other AICM publications, is the result of a joint effort between the Working Group and member companies. Based on an analysis of member companies' questionnaires and a summary of public information reports, as well as the review of the draft by many members, this report is a true reflection and broadly represents the main views of AICM member companies on relevant issues. The report draws on the views and feedback of all members in a balanced manner.

The forward-looking statements contained in this report reflect information only as of the date of this report, and AICM undertakes no obligation to update any forecasts, expectations or statements made in this report.

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