

### **Chemical Week**

# Safety and stewardship

**Responsible Care evolves for a sustainable future** 

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### Safety and stewardship

Responsible Care continues to evolve for a sustainable future

Responsible Care—American Chemistry Council's (ACC) signature environmental, health, safety, and security initiative—is undergoing a significant evolution as stewardship moves beyond factory gates and into communities, with a focus on the impact of industry's products on human health and the environment. Most notably, this includes establishing industry as a leader in mitigating the plastic waste crisis. Though among industry's most life-improving products, plastics have more recently become the subject of public scrutiny as society's disposable behavior and a lack of infrastructure in developing regions have led to unchecked volumes of waste plastics in the environment. The development of chemical recycling innovations that increase the value of mixed or otherwise unrecyclable plastics is key to industry's plastic stewardship efforts and a challenge it has already mobilized its significant innovation capabilities to address.

### ■ Rebecca Coons

CC president and CEO Cal Dooley says Responsible Care is at the most important period of development in its more than 30-year history, as substantial investment is flowing into the US market but there are growing threats of product deselection over waste concerns and consumer pressure. He is also determined to position industry as a leader in addressing the plastics crisis and optimistic that the combined R&D power of member companies is up to the monumental task. "Ultimately, the plastics waste problem is solvable because it is by and large, an engineering problem," Dooley says. "Our industry is populated by engineers and we have the capacity and ability to develop solutions to one of the world's most concerning environmental challenges."

The importance of sustainability was underscored by ACC changing the name of its annual Responsible Care Conference & Expo to the Responsible Care & Sustainability Conference, as well as the introduction of sustainability principles in 2017. The principles highlight the chemical industry's commitment to promote the safe use of chemicals and address the health and environmental impacts of industry's operations and products-including circulareconomy solutions to keep plastics out of the environment. While specifics surrounding measurement are still being hashed out, ACC believes creating a platform for member companies to demonstrate industry's commitment to sustainability is a natural extension of Responsible Care and necessary to improve public perception.

"Responsible Care and sustainability are part of the same family," says Andy Piper, chair of ACC's Responsible Care committee and global Responsible Care manager at Ashland. "Companies are executing sustainability strategies and publishing sustainability reports. Investors are interested, and consumers are making purchasing decisions based on sustainability."

The sustainability principles broadly include developing new ways to measure and promote the safe and sustainable use of chemicals, committing to industry sustainability practices, holding the industry accountable, and exceeding government regulations; elevating the quality of life for people around the world through technologies that improve health and wellness, enable food security, increase access to clean water, and provide comfortable shelter; improving the availability, performance, and cost-effectiveness of renewable energy and energyefficient technologies enabled by chemistry; reducing greenhouse gas emissions in the manufacture and use of industry products; protecting the environment by supporting efforts to reduce and manage waste so oceans and water sources are not polluted with mishandled plastic or other materials; and promoting innovations in product design, product re-use, repurposing, and recycling to extend the useful life and value of all products.

Last month, ACC's board approved the first six sustainability metrics to capture and quantify industry progress at the group's annual meeting in Colorado Springs, Colorado. The metrics include community engagement and empowerment, greenhouse gas impact, air quality, energy efficiency and energy diversity, diversity and inclusion, and responsible management of hazardous waste. The first set of metrics focuses primarily on what industry does inside the fence line, while the next set will demonstrate the broader contributions to advancing global sustainability.

Jerry MacCleary, CEO of Covestro LLC and current ACC board chair, expects the second

set of metrics to be approved at ACC's November board meeting. "These will show that chemistry is really the science behind sustainability."

The metrics need to not only measure progress, but also chart a course forward and show industry's commitment to continuous improvement, Dooley says. "If we don't demonstrate that we are providing solutions in the short term, we are going to see regulatory and consumer pressure," he adds. Deselection is being driven by consumer perception that industry is not fully committed to sustainability and safety. "Our industry is not seen as a leader in sustainability," Dooley says. "And the tragedy is, few industries are [as] at the forefront of producing technologies and products essential to consumers leading more sustainable lifestyles."

### **Targeting plastics**

ACC's plastics-management goals, introduced last year, including a target of recycling or recovering

100% of plastic packaging in the US by 2040. ACC also intends to make 100% of plastics packaging recyclable or recoverable by 2030 and have all US manufacturing sites operated by the council's plastics division members participating in Operation Clean Sweep Blue—a stewardship program for facilities that handle plastic materials to keep them out of waterways—by 2020, with all their sites across North America in the program by 2022.

Kimberly Kipin-McDonald, head of Sustainable Development, North America at Covestro, says that there is no silver bullet when it comes to plastics waste. "If we stopped all production of plastics production today, deforestation and fuel emissions would skyrocket. Change needs to take place but plastics will continue to be used. Suppliers, product manufacturers, and designers need to figure out the solution."

To achieve the goals, plastic resin producers plan to focus on six key areas: designing new products for greater efficiency, recycling, and reuse; developing new technologies and systems for collecting, sorting, recycling, and recovering materials; making it easier for more consumers to participate in recycling and recovery programs; expanding the types

> of plastic collected and repurposed; aligning products with key end-markets; and expanding awareness that used plastics are valuable resources awaiting their next use.

ACC helped organize the Alliance to End Plastic Waste (AEPW), a not-for-profit organization that started with 28 corporate members and has grown to nearly 40 in the six months since its launch. Together the companies have committed more than \$1 billion to eliminate plastic waste, especially in the ocean. Much of the plastic waste crisis is due to a lack of waste management infrastructure in developing communities, but Dooley says the chemical industry will not take the easy way out and point fingers. "We have to be developing the innovations and reformulations and in packaging to ensure less is used, and that what is used is more easily recyclable or reused."

MACCLEARY: Chemistry is the science behind sustainability.

The idea behind AEPW, which was announced in January, was

AEPW now has nearly 35 members, including participants across the supply chain, such as converters, brand owners, and waste handlers.

An early focus for the alliance will be on Asia, which faces challenges around ocean waste. "It's not an advocacy body," Dow CEO Jim Fitterling said at ACC's annual meeting last month. "It will solve problems and prove out solutions." Early projects include a city partnership to advance integrated waste management and technologies, an effort to curb waste in India's Ganges river, and a global information project that will enable data collection and sharing to help governments, companies, and NGOs to make more-informed choices about projects to





### **Cover story**

address the challenge, Fitterling says.

AEPW has already received 350 project submissions even before a formal call for project submissions. "It shows the number of people that are stepping up and want to be part of the solution," Fitterling says. "We can showcase to the world what you can do with the plastics, that there is value at the end of life, and that plastics shouldn't go into waste streams. I think we can not only stem the tide, but create innovation opportunities and high-value products that can drive future investment."

### Scaling recycling solutions

From a waste management standpoint, the chemical industry has historically focused attention on technical achievements that reduce the initial consumption of plastic used to produce and package products, says Robin Waters, director, plastics planning and analysis at IHS Markit. "However, the lack of a more robust and circular approach by value chain stakeholders has led to a crisis of plastics pollution, which has become a disruptor for the chemical industry," Waters says.

Near 50% of the virgin demand growth between 2018 and 2030 for polyethylene (PE) and polypropylene (PP) is viable for recycle or displacement for the major demand centers, according to a recent IHS Markit study. This represents over 20 million metric tons (MMt) tons of PE and 20 MMt of PP. Nearly 20% of polyvinyl chloride (PVC) virgin demand growth is also viable for recycle or displacement for the major demand centers over the same period.

Current mechanical recycling processes have scale and economics limitations while processes such as chemical recycling are in their development infancy. The issue also represents a mismatch in scale for now, Waters adds. "The scale of current commercial [recycling] solutions is orders of magnitude smaller' than polymer potentially available for recycling, Waters says.

Challenges around plastics recycling and the need for new technologies and scale to advance rapidly, was an overriding theme at IHS Markit's PEPP 2019 polyolefins conference held in Berlin, Germany late last month.

Plastics waste will be become a "new feedstock for producing plastics in the future," according to Günter Stephan, head of mechanical recycling/circular economy solutions at Borealis. The company has two post-consumer polyolefin recycling operations in Europe, having acquired



ALLIANCE TO END PLASTIC WASTE: Industry-led initative has already received 350 project submissions.

Germany-based mtm Plastics in 2016 and Ecoplast Kunststoffrecycling (Wildon, Austria) last year.

"For a producer with 50 years of heritage of designing and engineering plastics, we know a lot about polymers. But it's amazing how little we at Borealis knew when it came to recycling. We were capable of building high-pressure plants in the desert, but we did not really understand what it's like to recycle plastics. So, this was and is still a learning curve," he said. A combination of mechanicaland chemical-recycling solutions is needed "until chemical recycling is on top of the technology," Stephan said.

Resin makers are already developing technologies for mixed plastics, Dooley says, including BASF, LyondellBasell, Sabic, Shell, ExxonMobil, and Dow Chemical. "If we demonstrate the financial viability of these new technologies to capture value in the waste stream, there will be greater incentives in the developing world to collect it," Dooley says.

Dooley says he would define success for AEPW as continued introduction of innovations that add value to the plastic waste stream in five years' time. "There is [currently] a ceiling on how much plastic can be recycled based on the cost of sorting," he added. "The value chain needs to come together with the chemical industry as the leader to improve value [with technologies] that can be deployed to the developing world in their waste management infrastructure."

Plastics stewardship and sustainability

also dominated discussion at this year's ACC Responsible Care & Sustainability Conference, held in April in Fort Lauderdale, Florida. Participants reflected on the importance of environmental, health, and safety considerations in their operations and discussed how to report sustainability metrics in a way that promotes the credibility of chemical industry. Discussion treated sustainability as both a moral and business imperative-there is no "planet B," noted Barry Dyer, chief executive of Responsible Care New Zealand-and focused on how industry could maximize its impact and best demonstrate to the public that it is integrating sustainability into all levels of operations.

Michael Graff, chairman and CEO of American Air Liquide Holdings, Inc., who also chairs ACC's board-level committee on Responsible Care, noted that, if the chemicals industry is going to build credibility around sustainability, it needs clear, CEO-level commitment. "But, as much as each of us do, if we don't create an ecosystem where everyone is [operating] safe[ly] and working on sustainability, those outliers will define the industry. As CEOs we have a responsibility to our company but also that our entire industry is credible."

Graff says there is no doubt in his mind some of the sustainability metrics will eventually become part of Responsible Care. "Responsible Care will continue to be the brand of ACC going forward and it will be

### **Cover story**



A NEW VALUE CHAIN: Plastics waste will be become a new feedstock for producing plastics in the future.

clearly important that these metrics are aligned with [the program]." More than a dozen industry CEOs participated in writing the principles and ensuring they had the breadth necessary but also the clarity and simplicity to be doable.

Another key piece to solving sustainability challenges will be changing the way materials are produced. "Covestro's polycarbonate production process goes back to the 1930's," Kipin-McDonald says. "But you can still rethink the way things are manufactured to consume less energy and water and produce less waste." For example, Covestro has developed a CO<sub>2</sub>-based process for polyurethane foam, the idea being that you can take an "atmospheric albatross" and use it as feedstock. "That's a game changer," she adds.

Libby Bernick, managing director and global head of corporate business, S&P Global's Trucost unit, laid out the financial case for sustainability. "ESG [environmental, social and governance] data is becoming mainstream in capital markets, and the chemical industry needs to be prepared," she says. Bernick notes that about one quarter of all investments have an ESG mandate and, at 12%, are growing faster than the market. "By the end of 2030, we are looking at \$23 trillion in assets that will be transferred to millennials who value environmentally or socially optimized funds. Sustainable portfolios outperform S&P 500 benchmark. It had long been a perception that you had to trade financial performance for ESG

investing, but now the question has changed from 'why would I do this' to 'why should I not do this?'"

Bernick also noted that, over the past two years, environmental and climate concerns affected S&P corporate ratings in 717 cases, approximately 10% of corporate ratings assessments, and resulted in an impact upgrade, downgrade, outlook revision, or CreditWatch placement—in 106 cases.

Process and product safety were also discussed at the meeting. Dooley noted that, on the process safety side, if the industry doesn't step up in a more aggressive way to demonstrate its strong track record, it will begin to see impediments to expanding operations in the US. He points to three recent incidents in Texas, one of which resulted in a fatality. Others caused schools to be closed or forced community evacuations. "Responsible Care data shows that we are five times safer than the manufacturing sector at large," he says. "The challenge we face is that some of these incidences aren't happening at ACC member company facilities. But this doesn't really matter, because industry faces the same reputation harm whether the company is an ACC member or not."

ACC is also evaluating elements of the product safety code it added to the Responsible Care program in 2013 and how to strengthen it to further improve credibility with consumers. "The question now is, are we fully utilizing that data? And how do we show continuous progress?" Dooley asks. "Are we capturing the data we need under the revised Toxic Substances Control Act (TSCA), and are we reducing the number of chemicals that haven't been subjected to thorough review?"

The most challenging legislative issue is with perfluorooctanoic acid (PFOA) and polyfluoroalkyl substances (PFAS), Dooley adds. "Should we be using legacy chemicals no longer produced as a case study to ensure companies are ensuring it won't happen again? I'm not sure we, as an industry, can stand up and make a strong statement that we are doing everything that needs to be done to make sure it won't be repeated in the future." Industry needs to acknowledge that some chemicals might have a higher risk profile than others but are still safe for use, while also showing its commitment to developing safer alternatives, he adds. "We are in a new age. We must be looking at different ways to demonstrate our commitments. It is incumbent upon leaders in this industry."

Graff notes that the product safety code was an initial foray into extending Responsible Care into sustainability. "Everything we were hearing from the media and advocacy groups surveys suggested there was a lot of concern about what we produce and whether produce them in an environmentally friendly way," Graff says. "We have to make sure that those who use our products are safe, that we work very hard throughout supply chain to manage them the right way and promote credibility of what we do."

Ultimately, industry needs to generate and present data relevant and meaningful to the public. "Otherwise, there is a vacuum that could be filled with information that isn't science-based," Dooley adds.

"Today, we operate only by permission of society," Graff says. "Over time, constituencies have grown and evolved. Social media has created many groups who can take the message one way or another. We have to recognize that whatever we publish and commit to do, we will be held responsible for, and then we can tell our story."

John Paro, chairman and CEO of Hallstar, notes that given the speed at which information travels, there is a high potential for damage is the "voice of chemistry" is missing. "The audience is expanding, and you may not be able to completely predict everything. So, there has never been a better time to demonstrate what we measure, that we are continuously improving, and that we have the right story to tell."





### LyondellBasell is *advancing* the circular economy

LyondellBasell is one of the largest producers of chemicals and plastics in the world. From improving healthcare to enabling access to clean water to keeping food fresher longer to helping to manage emissions, LyondellBasell's products contribute to improving the quality of life. With that said, LyondellBasell is historically considered trash. The companies looking at strategic opportunities like the formation of the Alliance To End Plastic Waste to eliminate plastic waste in the environment and help advance the circular economy.

### Shifting mindsets and giving plastics a second life

It's hard to imagine a world without plastic because it plays such an important role in our lives. From the evolution of smartphones to making cars lighter and more fuel efficient to life-saving medical products, plastics have a far reaching and lasting impact.

Even with these benefits, everyone, including the plastics industry, agrees there's no place for it in the environment. Plastic waste is the most complex, global challenge of this generation and the solution requires a comprehensive approach and collaboration.

### Mechanical recycling collaboration helps keep travelers moving

Recycled plastics can have value and a purpose beyond their initial use when properly disposed of. LyondellBasell, Samsonite and SUEZ breathed new life into what was came up with a unique, innovative application that is a perfect use for recycled plastic materials with the creation of the "Green Grey" edition of S'Cure ECO, a new suitcase collection with the outer shell made 100 percent from recycled plastic waste.

LyondellBasell and SUEZ, through their mechanical recycling joint venture, Quality Circular Polymers (QCP), converted post-consumer plastic waste such as packaging into a high-quality polypropylene. Samsonite used this recycled plastic to create the outer shell of its new limited edition suitcase collection, which is currently being sold to the European market.

### Molecular recycling will be a game changer

An emerging technology called molecular recycling could be the key to fully achieving a circular economy. Not all plastics can be recycled using mechanical methods and applications are limited. But molecular recycling involves the chemical conversion of plastic waste into molecules for use as feedstock in the petrochemical production process, resulting in new plastic that can be used in all applications including food contact. LyondellBasell is collaborating with the Karlsruhe Institute of Technology (KIT) in Germany to develop a new catalyst and process technology to decompose postconsumer plastic waste, such as packaging into monomers for reuse in polymerization processes. As we look to the future, mechanical and molecular recycling will likely be complementary technologies.

### **Bio-based plastics from renewable** materials

LyondellBasell recently announced it created bio-plastics from renewable materials. It was the first parallel production of bio-based polypropylene and bio-based low-density polyethylene at a commercial scale.

The project successfully produced several thousand tons of bio-based plastics marketed under Circulen and Circulen Plus, the new family of LyondellBasell circular economy product brands. The new bio-based plastics are approved for the production of food packaging.

This achievement is extraordinary in that it combined a renewable agricultural waste material used as feedstock with LvondellBasell's technical capabilities. The end result was the creation of bio-based polyethylene and biobased polypropylene, which contains more than 30 percent renewable content.

### From waste to sustainable energy

Finding a second life for plastic materials is





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### Iyondellbasell Advancing Possible



140,000 metric tons

31,000 cars off the road

not the only circular economy effort being undertaken by LyondellBasell. In fact, sustainability for LyondellBasell means advancing solutions to address global challenges while meeting stakeholders' needs and maintaining the highest operational standards. For example, LyondellBasell and its joint venture partner, Covestro, are building a Circular Steam Project to convert treated waste water to energy for LyondellBasell's

Maasvlakte site. This will result in an estimated annual reduction of 140,000 metric tons of CO<sub>2</sub> emissions, which is equivalent to taking about 31,000 cars off the road.

Initiatives like this are important and are playing an instrumental role in determining the future for the next generation. There is an opportunity to affect real global change.



### MAIRE TECNIMONT'S GREEN ACCELERATION WITH NEXTCHEM

In recent years, Maire Tecnimont has focused its research and development efforts on creating a portfolio of technologies aimed at responding to the new demands imposed by the market, regulatory and natural constraints on traditional energy sources: Maire Tecnimont is working to support the on-going energy transition.

This portfolio contains a series of initiatives aimed at:

 mitigating the environmental impact of techologies used for oil and gas processing;
identifying oil substitutes to produce bio and renewable fuels from biomass feed-stocks;

 implementing effective circular economy process via mechanical and chemical plastics recycling;

• **industrializing bioplastics production** with the aim to address specific market requirements.

The main goal is to provide a complete roadmap that can accompany businesses in the path of the energy transition, hand in hand with the evolution of market demand and related regulation.

The various initiatives have been identified and pursued not only with the spirit of the researcher, but also with the view of the plant engineer and entrepreneur with the ability to evaluate comprehensively the possibility of developing, industrializing and marketing new solutions from validated technologies, backed by the experience of Maire Techimont, a leader in the technologies applied to the plastics industry and to the natural resources processing sector.





### NEXTCHEM'S MYREPLAST INDUSTRIES PLANT: PLASTIC RECYCLING WITH 95% EFFICIENCY

In this framework we created **NextChem**, a new company addressed to this specific task and on the 12th of June, the Group presented the new NextChem plant, **the most advanced and efficient in Europe for the recycling of plastics**.

The plant - located in Bedizzole in the province of Brescia in Italy - is based on proprietary technology and is managed by **MyReplast Industries**, a NextChem subsidiary. The plant, based on an economically-sustainable business model and without relying on any type of public incentives, is unique in Europe in terms of production capacity, processing flexibility and finished product quality. It can, in fact, produce over 40 thousand tons per year of recycled polymers, processing a range of incoming types of plastic waste, both post-consumption industrial (vehicle components, food and industrial packaging production waste) and from urban post-consumption (materials from the sorting of household waste). The treatment process ensures that the finished product - the recycled polymer - is of absolute top-quality, with recycling efficiency of 95%. Through an innovative approach based on product development, the MyReplast Industries plant improves the properties of the incoming plastics (up-cycling), enabling their use for products to be sold on high-added value "premium" markets.

Maire Tecnimont therefore focuses on a "from product development to waste management" approach: in fact, starting with the demands of the downstream market, the objective is to produce a secondary raw material with chemical-physical characteristics and mechanical properties which bridge the usual quality gap found between such materials and virgin plastics (sourced directly from fossil-origin hydrocarbons).

MYREPLAST INDUSTRIES PLANT KEY FIGURES

> 40Kta PRODUCTION

> > CAPACITY

95%

SELECTION



Detail of the MyReplast Industries Plant

### INTEGRATED TECHNOLOGY FROM SORTING TO COMPOUNDING

ADVANCED SORTING	Sorts all ranges of plastic materials, being PP, HDPE and LDPE, followed by PS, ABS and PA the major polymers of interest.
HIGH EFFICIENCY PROCESS	Mechanical Sorting, Grinding, Washing and Color Separation.
UPCYCLING PROCESS	Finishing plastic flakes to be upgraded into higher quality material by extrusion and compounding technologies.



Regenerated polymers with an example of finished product







## **SCG and Thailand;** Path towards circular economy

Why we should care about the circular economy > The worrying fact that natural resources and energy are dwindling from our planet indicates that the world economy may face the risk of shortages of raw materials in the near future. Moreover, pollution caused by manufacturing and consumption has affected the environment. With these pressing issues, the circular economy is now a solution that has caught the attention of international organizations, governments, and corporations. The philosophy of a circular economy is focused on making the most of resources throughout their life cycle, from planning and designing, manufacturing, and consumption, to waste management and reuse, all with the aim of promoting sustainability for the economy, society, and environment.



In SCG's view, the circular-economy model can be separated into two distinct parts: waste minimization, and management of waste/litter.

At Chemicals Business, SCG, one of the largest integrated petrochemical companies in Thailand, we feel that it is our responsibility to be a part of the movement that embraces the circular economy and reduces plastic waste, while giving back to society, to ensure sustainability for future generations. We put a tremendous effort into product development and research programs, to develop materials and innovative business models that support the circular economy. We also work with various organizations in the government and private sectors in Thailand, with the goal of making the circular economy common practice in Thailand.

### SCG's view of the circular economy

Waste minimization assumes complete use and utilization of resources to make finished products, ensuring that as little waste as possible is generated during the life-cycle of the goods. The very first step begins at the product-design stage where (1) through clever

design, added strength can be achieved to prolong the lifetime of the product; (2) minimal raw materials are processed and the amount of waste generated is reduced in the manufacturing process to achieve the required design and functionality; and (3) more, if not all, alternative or recycled material-which is more environmentally friendly—is used during manufacturing.

The waste-littering and waste-management flow in the bottom part of Figure 1 involves many stakeholders including households, infrastructure providers, and various other parties. This has proved to be one of the most difficult aspects of the circular economy as well as one of the most critical. Proper sorting is almost a must in waste management; consumers should first sort their waste into appropriate categories. This is the cheapest and simplest way to ensure that the waste collected is of high quality, and that subsequent management of the waste can be done easily whether it is recycled, incinerated, or sanitarily landfilled.

### SCG uses innovation to support the circular economy

We have recently introduced to the world, the higher-strength polyethylene (PE) resin breakthrough, SMX Technology™, using internally developed "multimodal" technology. It was created by our formulators and designers resulting in a resin with improved mechanical properties in all aspects compared with existing HDPE. Since our new HDPE has better mechanical properties than existing HDPE, it directly contributes to plastic-waste reduction in two ways:

### 1. Reduced material use/increased durability

When the new HDPE resin is used in place of existing HDPE resin, smaller amounts are required to achieve the same mechanical and



New HDPE by SMX Technology<sup>™</sup>; a higher strength polyethylene, using internally developed "multimodal" technology with improved mechanical properties.

chemical properties of finished goods. We have tested the new resin in blow-molding applications and found that it requires 10% less resin to create the finished product, in this case small HDPE bottles, with the same properties as those required by manufacturers.

### Upgrade and replacement

When used in conjunction with post-consumer recycled (PCR) resin in certain applications, our researchers have confirmed that the ratio of PCR resin that can be mixed with virgin resin increases significantly. We found that up to 2.5 times more PCR resin can be mixed with our new HDPE resin to create a finished product with the same properties as before.

Lastly, our research and development team is also developing the "CIERRA<sup>TM</sup>" line of performance materials. As we are all aware, mixed materials are difficult to recycle, if not impossible. In the near future, we plan to replace metallized and aluminum material in barrier layers, providing solutions for print and seal layers for mono-materials, which will allow much better recyclability.

### 2. Leading the way to become a key driving force through collaboration with other parties

SCG, as a leading company in Thailand, realizes the importance of developing a circular economy, which is key to achieving the goals of business and of global sustainability. For decades, we have participated in and initiated many programs with the private and public sectors. Some of the highlights of our recent ventures are outlined below.

SCG has been organizing the SD Symposium event since 2010 to (Left) Mr. Cholanat Yanaranop, Executive Vice President, SCG and promote awareness about the importance of sustainable develop-President, Chemicals Business, and (Right) Mr. Roongrote Rangsiyoment in various areas, as well as to encourage more practical pash, President & CEO, SCG at the 2018 SD Symposium, held in Bangkok solutions that will lead to sustainable growth for businesses, society, in July last year. and the environment. Last year, we held this global forum in Thailand with the theme of "Circular Economy: The future we create" with more than 1,000 attendees. Participants included monumental task for us all but if we persevere, we will succeed and leading global companies as well as the government sector, civil put the economy back on a path of growth and sustainability. society, SMEs, start-ups, and local communities. The aim of the event was to create awareness and foster understanding of the About SCG circular economy, to promote behavioral changes in manufacturing SCG was established in 1913 following a royal decree from His and consumption, and enhance collaboration among businesses, Majesty King Rama VI to produce cement, the main building material consumers, and the government in driving the nation toward a for infrastructure projects that greatly contributed to the progress of circular economy. This practice will eventually lead to business the country during that period. Since its founding, SCG has grown sustainability, while also raising the quality of life, and will result in continuously and diversified into three core businesses: global sustainability for many generations to come. Cement-Building Materials, Chemicals, and Packaging. SCG employs Additionally, SCG always promotes the building of collaborative 55,000 people with more than \$15 billion in annual revenue from sales. It collaborates through a global R&D network with 38 universities, 33 research institutions, and 140 industry partners.

networks with many parties in Thailand and beyond, to create complete circular economies. Some recent examples include a technology partnership with Dow Thailand to use recycled plastics as an ingredient in asphalt, helping to reduce ocean and community waste while also enhancing efficiency, as well as reducing carbon emissions from building roads.

To conclude, at SCG we believe that the circular economy will enable us to use sufficient resources to achieve the desired result of creating zero waste in production processes, consumption, and product end-of-life management. This certainly needs collaboration from all sides, and everyone needs to start building awareness to make it happen since it requires a fundamental redesign of business and our end-to-end value chains. The transition will be a





Chemicals Business, SCG, was established in 1983, and is now one of the largest integrated petrochemical companies in Asia and a key industry leader.



The chemicals business is a 100% subsidiary of SCG with revenue accounting for half of the group total. It is one of the largest integrated petrochemical companies in Thailand and a key industry leader in Asia. It manufactures and offers a full portfolio of petrochemical products ranging from upstream production of olefins to downstream production of plastic resins-polyethylene, polypropylene, and polyvinyl chloride-including fabricated products such as film, pipe, and fittings, as well as acrylic sheet. It strives to offer solutions that reflect customers' needs, by developing innovative and value-added products and services that offer the best quality while using fewer plastic materials, to promote the circular economy.