

Time to celebrate!

At last, we reveal the winners of this year's ICIS Innovation Awards. All have shown superb innovation, but also concern for the environment and social responsibility

JOHN BAKER/LONDON

NOW IN its fifth year, the ICIS Innovation Awards, sponsored by US silicones supplier Dow Corning, has again produced a clutch of superb winners – listed in the panel below. Everyone at ICIS congratulates them all.

The winning innovations illustrate the resourcefulness of the chemical industry in meeting the needs of its customers, end consumers and, increasingly, the environment.

In fact, environmental and social benefits formed a strong theme in this year's entries, regardless of which category was being entered. This is an encouraging trend, highlighting the fact that companies are taking wider issues into account when planning and prioritizing innovation projects.

The best product category went to ExxonMobil Chemical, of the US, and its Japanese affiliate Tonen Chemical for their development of polymer-based separator films for use in lithium-ion batteries – a technology that may bring about a new generation of hybrid and electric vehicles.

But it was a closely fought category, and the judges (see panel on page 20) were also impressed by Brazilian petrochemical firm Braskem's development of a route to polyolefins from sugar, via ethanol. They even asked for more information from both companies to help their decision-making.

Both innovations have already received much publicity and look set to make substantial commercial advances.

Rob Kirschbaum said the ExxonMobil innovation is a truly new product, arrived at by combining inventions from several internal and external sources. "The value and contribution to society is potentially huge as it enables the automotive industry to shift

away gradually from the combustion engine." Given its size and newly found drive to develop alternative energies, he adds, "ExxonMobil has the power to lead this change."

The category for best innovation by a small and medium-sized enterprise (SME) was also extremely closely fought, but the judges unanimously decided to award the prize to US-based Virent Energy Systems for its development of a novel route to biofuels and chemicals from plant-derived sugars, with the possibility of using cellulosic biomass, rather than food-use crops. The scale of the market potential was the deciding point in the end.

But the judges decided to give the runner up, SiGNa Chemistry, also US, a special mention in this category, for its technology that encapsulates powerful alkali metal catalysts at the nanoscale to make them both safer and easier to use. Kirschbaum noted that "in terms of innovation this is a real beauty – offering a greener, safer and lower-cost technology that is really new."

On the Virent entry, Rodney Townsend said the market potential was huge because the *BioForming* technology offers an alternative fuel to gasoline for automobiles without replacement of the engine. "The big leap and real gain," he notes, "will be the development of fuels from sugars derived from various forms of cellulosic biomass, rather than from food-use crops." The judges also pointed to the interest in Virent by global oil major

AND THE 2008 WINNERS ARE...

BEST PRODUCT INNOVATION

ExxonMobil Chemical/Tonen Chemical

Polymer-based battery separator film for lithium-ion batteries

BEST INNOVATION BY AN SME

Virent Energy Systems

Production of hydrocarbon fuels and chemicals from plant sugars

BEST BUSINESS INNOVATION

DSM Nutritional Products

Sight and Life project with the UN World Food Programme

MOST INNOVATIVE CSR PROJECT

Dow Chemical

City wastewater effluent for industrial reuse project

Read the interviews with the people behind the innovations on pages 22–25



FROM OUR SPONSOR



Stephanie Burns
Chairman, president and CEO
Dow Corning

WEAVING INNOVATION THROUGHOUT THE CORPORATE CULTURE

In today's challenging economic environment, it may be tempting for corporations to slow down and scale back, but it is actually more important than ever to innovate. Innovation enables companies to be competitive, differentiate themselves and challenge the status quo, turning new ideas into winning products, processes and solutions.

The chemical industry is challenged by dramatic changes in the global business environment and the evolving expectations of our customers. In this new environment, research and development that focuses narrowly on products is no longer enough to satisfy customers. This is particularly true with the rise of low-cost options and technological advancements in markets around the world.

Companies can differentiate themselves by understanding global trends, and aligning innovation with societal needs, rather than innovating first, then seeking a market.

Innovation is a major component of Dow Corning's corporate DNA and we use this to fuel our sustainable development engine. By making both innovation and sustainability top corporate priorities, we have focused our people, processes and products on new solutions that improve economic, environmental and social conditions all over the world.

This year's ICIS Innovation Award winners represent a robust mix of top-notch companies and people putting innovation first in business, products and corporate social responsibility.

My congratulations to the 2008 winners who are taking innovation beyond the laboratory and making it a part of everything they do, every day.

Stephanie Burns
CHAIRMAN, PRESIDENT AND CEO
DOW CORNING

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» Shell, Japanese carmaker Honda and US agricultural giant Cargill as impressive for an SME at this stage of development.

There was a clear winner in the best business innovation category, as the judges (excepting Kirschbaum, who stood aside because he works for Netherlands-based life sciences group DSM) were tremendously impressed by DSM Nutritional Products' development of *MixMe* sachets of micronutrients for use in home fortification of foods in developing countries.

This development was undertaken in partnership with the UN World Food Programme and was acknowledged as an innovative approach to developing what has the potential to become a major business line for the company, while at the same time meeting an urgent humanitarian need.

Monty Alger noted that this was a great example of innovation, opening up potentially big new markets for DSM. "They have found a way to enter the market at a difficult cost point, and to provide a huge and worthwhile benefit at the same time." It was, he explained, a "base of the pyramid"-type project in that the market served is very wide, as it addresses the needs of the world's poor, but these have very little spending power.

Townsend added that it was "a low-cost solution to an incredibly important need, and an elegant way of supplementing diet

THE JUDGES THIS YEAR WERE...

DR MONTY ALGER

is vice president and chief technology officer at Air Products and Chemicals, of the US

LARRY KEELEY

is president and cofounder of US innovation strategy firm Doblin

ROBERT KIRSCHBAUM

is vice president of innovation at Netherlands-based life sciences firm DSM

PROFESSOR RODNEY TOWNSEND

is director of science and technology at the UK's Royal Society of Chemistry and chairman of the EU's SusChem sustainable chemistry platform

DR GREGG ZANK

is vice president, chief technology officer and executive director of science and technology at US silicones supplier Dow Corning

and health in the developing world." In a phrase, he noted it was "nice thinking and widely applicable."

In the best innovation in corporate social responsibility (CSR) category, there was also a clear winner in the form of US-based Dow Chemical and its project at Terneuzen, the

Netherlands, to reuse the city's municipal wastewater in its process plants, first for steam raising and then in the cooling tower.

The judges felt this project brought important benefits to the company, the environment and the public but, more importantly, was usable in many other similar situations globally. As Alger said: "This was easy to understand and solved a real problem using practical, basic technology. The innovation is in working with the municipal authorities and creating company and public benefits."

CSR is assuming much greater importance in many chemical producers. Alger and Kirschbaum both pointed to programmes in their own firms (US industrial gases supplier Air Products and DSM, respectively), to stimulate its acceptance and use.

I hope you find the profiles of the winners on the following pages interesting. Innovation today is vital, not only for a company's prosperity and sustainability but also to solve the myriad social and environmental issues the world is facing. When innovations can simultaneously address both sides of this equation, the chemical industry really is a winner and shows itself to be part of the solution, not the problem. ■

» For more on the Awards, go to www.icis.com/awards or email john.baker@icis.com

Emerging innovation

Dow Corning applies its global innovation frameworks to develop markets in emerging geographies. Tom Cook explains how this is working for the company in China

JOHN BAKER/LONDON

ALL TOO often, US and EU chemical producers view innovation as a way to stay one step ahead of lower-cost, more commodity-oriented competitors, notably from Asia.

But benefits can be gained from innovating in emerging geographies, either by ensuring a global approach to innovation is adopted and/or by developing local initiatives in these markets. At Dow Corning, both approaches are endorsed and practised.

Corporate vice president Tom Cook, who acts as president for Greater China and for Asia, believes the company has created an innovation culture among its employees.

"Innovation at Dow Corning is one of a small set of key priorities that has brought about a major transformation over the past five or six years, doubling turnover to close to \$5bn (€3.5bn). By developing a series of innovation frameworks, we have laid a really good foundation and created a common language to talk about innovation, whether in emerging or developed economies."

These three frameworks provide various ways to think about the process and planning of innovation. The first says that innovation is not just about products, but business models and processes, branding, customer experience, and so on.

MULTIPLE HORIZONS

The second framework sets out three time horizons for innovation: the first brings research and development to bear on core businesses, seeking to improve products and processes; the second seeks to stimulate a deliberate shift from core business to real growth opportunities, such as electronics, life sciences and personal care; and the third looks even further out to create new options for the company. The third framework sets out to divide innovation into sustaining and disruptive innovation.

Cook describes how these have successfully helped the US silicones supplier inno-

vation drive in emerging economies. "We usually find at least two customer segments in these markets," he explains.

"Multinationals and leading local companies that are looking for globally consistent materials and to do business on a global basis; and a local base of customers setting out to meet the basic needs of the local market and looking for minimum performance at best price. These approaches provide challenges, and we need to adjust our business to meet both."

He points to Dow Corning's development of Xiameter, an online market platform for selling basic silicones, as one innovation to

with them to train personnel and to increase their expertise; in return, they use our materials and cobrand their products and we share in the profits."

Entering emerging markets, of course, brings other, unique ways to innovate. "From the beginning in emerging geographies, there is a real opportunity to align behind the development of the region. For example, in China, the company has aligned itself behind several of the government's priorities in its 11th Five-Year Plan, including environmental and energy concerns."

Cook illustrates how this works with the example of a new product that acts as a



"From the beginning in emerging geographies, there is a real opportunity to align behind the development of the region"

Tom Cook, president for Greater China and for Asia, Dow Corning

meet the needs of the latter type of customer. It allows Dow Corning to serve at low cost those customers that are willing to order in bulk on standard terms.

Cook gives some further examples from Dow Corning's experience in China. This autumn, the company will start a brand awareness campaign for its silicones by launching a public advertising campaign on billboards, newspapers and online portals in China.

"These advertisements will talk about fascinating facts of silicones and their ability to improve the quality of our lives. They will intrigue the curiosity among people and drive them to the Dow Corning Silicone Discovery Center website in English or Chinese. We do not do this in developed economy areas but feel it is the right thing to do here to raise the level of awareness of both silicone and Dow Corning."

Also, he points to the establishment of a downstream partnering program with silicone formulators in China. "We are working

softer for denim during the manufacture of jeans. The granulated product makes it possible to combine several steps in the manufacturing process and thus reduce the amount of water needed and therefore the amount of energy used to heat the water.

WATER SAVING

China produces more than one-third of the world's output of 1.5bn pairs of jeans a year. The new product can save between 15 and 50 liters per pair of jeans, or 7.5bn–25bn liters of water a year in China, where water is not in huge supply. Energy savings could amount to 20m kW/year.

Cook explains that Dow Corning has worked with government agencies, textile industry associations and companies to develop the new processing aid, which is now being tested in Chinese textile factories. Now, the government is encouraging the uptake of the innovative technology by calling for companies to cut water use by 30% over the next two years.



Innovation drive

ExxonMobil Chemical and TonenGeneral Sekiyu have triumphed in the product innovation category, with coextruded films that bring electric cars closer to reality

JOHN BAKER/LONDON

THE QUEST to improve the fuel efficiency of cars and trucks takes in a variety of approaches. Among these today is the multi-faceted effort to build lithium-ion batteries equal to the task of expanding energy storage capacity, power and lifetime, as well as reducing weight and improving safety.

With their development of an advanced coextruded battery separator film (BSF), global major ExxonMobil Chemical and Japanese affiliate TonenGeneral Sekiyu are playing a key role in achieving these goals.

"ExxonMobil's BSF technology has successfully demonstrated critical technical properties and characteristics that are key to meeting increasingly demanding requirements for powering next-generation vehicles with smaller and lighter lithium-ion batteries," says Jim Harris, senior vice president at ExxonMobil Chemical. "This advancement will help put more hybrid and electric vehicles on the road, which means improved energy efficiency and fewer emissions."

The BSF also has applications in such portable power uses as notebook computers, power tools, uninterrupted power supplies, and motorbikes.

HOW IT WORKS

The charge and discharge cycles of a lithium-ion battery are accompanied by movement of lithium ions between the battery electrodes in an electrolyte. The ions must pass through a thin, microporous, electrically insulating membrane that separates the anode from the cathode.

The separator allows the battery to function efficiently and safely with low resistance to ion transport through very small, uniform pores that are about 100 nanometers wide.

"Getting the pores right is basically what allows the battery to breathe," says Patrick

Brant, chief polymer scientist at ExxonMobil Chemical. "The more porous the separator is, while still retaining good toughness characteristics, the more work you can do with the electrons in the external circuit."

The separator, typically a highly engineered polyolefin film, should:

- be chemically inert, uniform, free of flaws and strong



"We are currently working with industry-leading battery manufacturers to expand the boundaries of... electric vehicle applications"

Jim Harris, senior vice president, ExxonMobil Chemical

- insulate the cathode from the anode
- be permeable enough to allow ready ion transport, and
- ideally, serve as a safety device by shutting down the flow of ions in the event of thermal abuse, and maintain this capability over a wide temperature range.

ExxonMobil and TonenGeneral started work in 2005 to bring together a host of technologies, including TonenGeneral's wet process fabrication technology and formulation know-how, and ExxonMobil's coextrusion and polymer design capabilities.

At Baytown, Texas, ExxonMobil developed high-heat resistance polymers tailored to TonenGeneral's process, while in Japan, TonenGeneral improved its film-making process, which combines multiple polymers into a single, 20 or 25 micrometer-thick porous sheet.

In a typical example, three layers are coextruded, with each layer designed for a different function. The core layer performance can be tailored with polyethylene (PE) and ultrahigh-molecular weight polypropylene (PP), while the skin layers can have other

compositions. Such designs, says Brant, "help optimize permeability and thermal stability while retaining existing valued proprietary separator characteristics."

ExxonMobil has now commercialized four grades of its battery separator film for the demanding requirements of hybrid and electric vehicles. It will also tailor the design to meet specific OEM/battery manufacturer

requirements, making lithium-ion battery adoption faster and easier.

"We are currently working with industry-leading battery manufacturers to expand the boundaries of current hybrid and electric vehicle applications," says Harris. For example, the company has collaborated with Canada-based Electrovaya, a developer and manufacturer of portable power solutions, to incorporate BSF into its proprietary *Lithium Ion SuperPolymer* battery system targeted at the automotive industry.

Electrovaya uses this battery system in the *Maya-300*, a zero-emission, low-speed electric vehicle with an extended range of up to 120 miles (193km). Electrovaya technology will also be used in plug-in hybrids from Visionary Vehicles and electric vehicles from Phoenix Motorcars, both US-based.

The separator film is produced at TonenGeneral's manufacturing plant in Nasu, Japan. A new TonenGeneral plant is being built in Gumi, South Korea, and will use advanced polymer and process technologies to produce superior quality and performance battery separator films. ■



Icing on the cake for Virent Energy

Virent Energy Systems wins the Best Innovation by an SME award for its *BioForming* process to turn plant sugars to biofuels and chemicals

MARK WHITFIELD/LONDON

VIRENT ENERGY Systems' winning entry takes biofuel technology a big step forward toward the production of functional fuels in a single process.

Such is the novelty of the *BioForming* process from the company, based in Madison, Wisconsin, US, that it has attracted the interest of oil major Shell. The two companies have entered a joint research and development agreement to continue developing the process further, for the conversion of sugars directly into gasoline and gasoline-blend components, rather than ethanol.

US agriculture giant and biofuel producer Cargill has also invested in Virent, although it is not technically involved, along with Japanese carmaker Honda, which was initially interested in hydrogen generation but now concentrates on liquid fuels.

As well as gasoline, the process can generate diesel, jet fuel and molecules that can be used in petrochemical processes.

Randy Cortright, Virent's chief technology officer, executive vice president and a cofounder, says that since the company was established in 2002, "we have proved our technology using different sugars, being able to use mixtures effectively to develop routes to biomass deconstruction and achieving a product that is closer to gasoline."

THE PROCESS

The process uses catalysts that are similar to those found in traditional processes and refineries. Cortright says that the catalysts provide a wider processing window for cellulosic and mixed sugar streams and are orders of magnitude faster than enzymatic processes like fermentation, taking minutes rather than days. This increases throughput and reduces capital costs.

It operates at moderate pressures of 500–

600 pounds per square inch and combines aqueous phase reforming with catalytic processing. Following processing, the hydrocarbon product can be easily removed from the water using phase separation.

A range of feedstocks, including corn stover, switchgrass, wheat straw and sugarcane pulp, can be used for the process and

Cortright says. "Our biogasoline has the same range of molecules and properties as petroleum-based gasoline. We've proved the chemistry works, and are now in the detailed design phase for a larger-scale demonstration system."

Virent's work was initially directed toward hydrogen generation using the aque-



"We're looking to replace feedstocks with biomass that can be produced with low fertilizer requirements and low tillage"

Randy Cortright, chief technology officer, executive vice president and cofounder, Virent

Cortright says that reducing energy consumption and the overall carbon footprint of the process is very important.

CUTTING CO₂ FROM THE START

"The food-versus-fuel issue is also a priority," Cortright adds. "We have not focused on corn starch, which can be used as food. Sugarcane is a viable alternative that has a good carbon footprint. We are looking at using wood waste as an alternative, and are planning an integrated project with paper pulp plants in Wisconsin."

"We're looking to replace feedstocks with biomass that can be produced with low fertilizer requirements and low tillage, reducing carbon dioxide (CO₂) release to the atmosphere."

Other energy-saving elements of the process include using bagasse to produce electricity and employing hydrogen produced in the process in the hydrotreating of the biomass before processing.

"In two laboratory-scale pilot plants, we are now producing high yields of gasoline using different sugars, including mixtures of sugars derived from cellulosic biomass,"

ous phase reforming (APR) process that Cortright and cofounder Eric Apfelbach developed while at the University of Wisconsin-Madison.

"We discovered that with the right catalyst, process parameters and sugars, we could produce hydrogen. However, the market for renewable hydrogen was rather limited, so in 2005, we began to look at ways to extend the APR process to produce hydrocarbons."

DIFFERENT ROUTES

"Virent researcher Paul Blommel and I then discovered numerous routes to produce biogasoline, diesel, jet fuel, and chemicals from APR-generated chemical intermediates, and ultimately that resulted in the relationship with Shell," Cortright says.

"We now believe we can compete head to head with petroleum-based processes. We found the technological solutions and the macroeconomics went in our favor. By making a broad range of renewable hydrocarbon molecules, we have the potential to significantly impact the use of fossil hydrocarbons," Cortright says.

A little goes a long way

DSM has worked with the UN's World Food Programme to develop an innovative solution that delivers dietary supplements to the world's most needy people

MARK WHITFIELD/LONDON

THE DEVELOPMENT of a sachet of micro-nutrient powder that will reach 250,000 beneficiaries in 2008 has led to DSM Nutritional Products winning the ICIS Best Business Innovation award.

The DSM project with the UN's World Food Programme (WFP) is presently delivering vitamins and minerals to refugees in Nepal and Kenya, and to victims of Cyclone Sidr in Bangladesh. It is looking to increase its coverage massively in the coming years.

DSM has called the initiative a "social innovation" that can help the WFP improve food quality, which is very important for its beneficiaries, who number more than 70m. It is aimed at target groups with higher needs, particularly children between six months and five years old and pregnant and lactating women.

The *MixMe* sachets, each containing 1 gram of micronutrients and measuring just 4cm by 6cm, can be targeted at specific groups, as the content of one sachet is added to an individual portion before consumption, avoiding processing or cooking losses.

The DSM and WFP partnership, which began in April 2007, faced challenges in the development of the sachets, including producing a stable and tasteless, water-dispersible product in packaging able to withstand elevated temperature and humidity.

A year's supply of 150 sachets costs only €2.75 (\$3.77) but the polyethylene terephthalate (PET)/aluminum/polyethylene (PE) composite foil represents around 80% of the production cost. The specification for the packaging material is currently being reviewed, says Klaus Kraemer of the Netherlands-based life sciences company's Sight and Life humanitarian initiative.

"We are trying to optimize the packaging to reduce costs and are looking at biodegradable alternatives. The present solution was chosen to protect the ingredients and it outperforms everything else on the market, but further innovation is required. We tried a number of types of packaging during devel-

also be tailored to suit local conditions. "In areas where malaria is widespread we reduce the amount of iron in the supplement as it can cause increased morbidity in combination with malaria infection," explains Saskia de Pee, a nutrition and HIV/AIDS consultant with the World Food Programme.



"We are trying to optimize the packaging to reduce costs and are looking at biodegradable alternatives"

Klaus Kraemer, Sight and Life humanitarian initiative, DSM

opment," Kraemer said.

Identifying a packaging facility with the capacity to produce large quantities of the sachets in a short time frame proved another issue. The work is currently carried out in Bulgaria, but Kraemer believes packaging will ultimately be done closer to the point of use, using a supplied concentrated premix of micronutrients that can be diluted.

OVERCOMING HURDLES

Another hurdle that has to be cleared is obtaining approval for the use of the sachets from the countries' governments. "In Bangladesh, for example, the sachets are considered as pharmaceutical products rather than food supplements. There can be a lot of bureaucracy involved, and we worked closely with WFP to obtain approvals," says Kraemer.

"There is also a lot of cultural and educational training to be done. In many countries the father eats first, followed by boys, women, then girls. However, the requirements for the supplement are far greater for children and pregnant women."

The "recipe" of vitamins and minerals can

"The standard 10milligram iron dose in *MixMe* was too high so we asked for a different formulation with a lower iron content and with additional components to improve the bioavailability and absorption of the iron"

"The idea of providing vitamins and minerals in powdered form to mix with food was developed in the late 1990s by Stanley Zlotkin, professor of pediatrics and nutritional sciences at the University of Toronto, to treat anemia in children," says de Pee, "because iron folic acid tablets provided to pregnant women were not suitable for young children." The first large-scale program of micronutrient powder distribution was implemented in Aceh, Indonesia, following the 2004 tsunami.

"It was clear that there was room for further development," says de Pee. "*MixMe* is a very suitable solution for providing vitamins and minerals to specific groups of WFP beneficiaries and DSM's experience and innovation ensures that the formulation and packaging used are appropriate for the often challenging environmental and climatic circumstances."

Waste not, want not



Dow Chemical's award-winning entry saves water and energy through an innovative collaboration to recycle municipal wastewater

MARK WHITFIELD/LONDON

THE ICIS Best Innovation in CSR Award was won by Dow Chemical for its project to reuse wastewater from the town of Terneuzen, the Netherlands, at its Dow Benelux site. This proves that nontraditional wastewater streams can be viable and affordable sources for industrial use, delivering value to both Dow and the community.

Since February 2007, 7,500m³ of cleaned wastewater from the Terneuzen community has been reused daily.

"This project is critical to the Terneuzen site and a demonstration of how sustainability goals can be achieved through collaboration," says Margaret Walker, vice president, engineering solutions and technology centres at Dow. "Water is an essential component in the running of Dow's plant and is scarce in the region. We have looked at how things can be done differently and built a solution on previously nonviable wastewater."

The US chemical giant's Terneuzen site uses 60,000m³/day of water. Half of this is provided by recycling water streams, process water and rainwater. As part of Dow's 2015 sustainability goals, the facility is seeking to reduce freshwater intake by 35% compared with 2005.

EVIDES PARTNERSHIP

Evides is the utility company in the region responsible for treating and supplying water to industry and for domestic use. It acts as the intermediate between Dow Benelux and the Zeeuws-Vlaanderen waterboard, which owns and operates the public water infrastructure in the 1,200km² (463 mile²) region.

Dow Benelux began collaborating with Evides and the Zeeuws-Vlaanderen waterboard in 1990 to address the scarcity of freshwater in the region. The collaboration

provides a sustainable water supply through the reuse of municipal wastewater from the 55,000 inhabitants of Terneuzen.

Wastewater is recycled by Evides into demineralized water and passed to the Dow Benelux site, where it is used twice – first to produce steam and, second, as recycled

says Walker. "Once we find something that's going well, then we look for opportunities to leverage the experience in other areas. We're looking to get things to work in novel ways through collaboration and involving the community. Private-public partnerships can work successfully in other regions."



"This project is critical to the Terneuzen site and a demonstration of how sustainability goals can be achieved through collaboration"

Margaret Walker, vice president, engineering solutions and technology centres at Dow Chemical

water in the cooling tower.

Many additional benefits have accrued from the project, including a 65% reduction in energy use by avoiding the need for Evides to desalinate seawater; reduced environmental impact through less frequent chemical cleaning of membranes; reduced effluent discharge into the River Scheldt; and affordable production and distribution of demineralized water through the use of existing regional piping infrastructure and adapting existing membrane equipment.

According to Niels Groot, water/wastewater specialist at Dow's environmental technology center, around one-third of the 35% target reduction has already been achieved through the municipal wastewater project and through increased internal recycling of rain and stormwater. "The project has been presented to the public in Terneuzen emphasizing the collaboration between the three distinct organizations. The work has been well received and all of the community is behind the initiative," Groot adds.

"The approach is now being expanded to other Dow locations, for example in Louisiana, in the US, and in Argentina,"

For example, Dow Water Solutions recently worked on the 2008 Olympic Games in Beijing to maximize the use of water, where it looked for original and useful alternative solutions. Filmtec membranes were installed at three wastewater reclamation and reuse facilities, treating an estimated 45,000m³/day of water, the largest volume of municipal wastewater in Olympic-related projects.

POLLUTION REDUCTION

The Terneuzen site has been working actively on its water strategy for many years and successfully reduced the discharge of organic pollutant equivalents into the Scheldt from 950,000 in 1971 to 50,000 20 years later. "We have made huge steps in the past in reducing organic loads by a factor of 20. This is one of the keys to success. We need to control the whole of the water chain both internally and externally," says Groot.

"Sustainability goals have engendered a culture of continuous improvement," says Walker. "Raising the bar is part of the culture at Dow and we are looking for further collaborations to achieve even more."



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