

Annual 2012

Determination

Leading.


THE LINDE GROUP

LINDE FINANCIAL HIGHLIGHTS

[2012]

<i>Linde Financial Highlights</i>		<i>January to December 2012</i>	<i>2011</i>	<i>Change</i>
Share				
Closing price	€	132.00	114.95	14.8%
Year high	€	136.15	125.80	8.2%
Year low	€	114.20	96.16	18.8%
Market capitalisation (at year-end closing price)	€ million	24,445	19,663	24.3%
Adjusted earnings per share ¹	€	7.89	7.71	2.3%
Earnings per share – undiluted	€	7.03	6.88	2.2%
Number of shares outstanding	(in 000s)	185,189	171,061	8.3%
Group				
Revenue	€ million	15,280	13,787	10.8%
Operating profit ²	€ million	3,530	3,210	10.0%
Operating margin	in %	23.1	23.3	-20 bp ³
EBIT	€ million	1,992	1,910	4.3%
Profit for the year	€ million	1,324	1,244	6.4%
Number of employees		61,965	50,417	22.9%
Gases Division				
Revenue	€ million	12,591	11,061	13.8%
Operating profit	€ million	3,403	3,041	11.9%
Operating margin	in %	27.0	27.5	-50 bp ³
Engineering Division				
Revenue	€ million	2,561	2,531	1.2%
Operating profit	€ million	312	304	2.6%
Operating margin	in %	12.2	12.0	+20 bp ³

¹ Adjusted for the effects of the BOC purchase price allocation.

² EBITDA including share of profit or loss from associates and joint ventures.

³ Basis points.

CORPORATE PROFILE

[1]

THE LINDE WORLD CUSTOMER SEGMENTATION WITHIN THE GASES DIVISION

[2/3]

OUR VISION OUR COMPANY VALUES

[4/5]

CORPORATE PROFILE

[1]

THE LINDE GROUP

The Linde Group is a world-leading gases and engineering company with approximately 62,000 employees working in more than 100 countries worldwide. In the 2012 financial year, it generated revenue of EUR 15.280 bn. The strategy of The Linde Group is geared towards long-term, profitable growth and focuses on the expansion of its international business with forward-looking products and services. Linde acts responsibly towards its shareholders, business partners, employees, society and the environment – in every one of its business areas, regions and locations across the globe. The company is committed to technologies and products that unite the goals of customer value and sustainable development.

ORGANISATION

The Group comprises three divisions: Gases and Engineering (the two core divisions) and Gist (logistics services). The largest division, Gases, has three reportable segments – EMEA (Europe, Middle East and Africa), Asia/Pacific and the Americas. These are divided into eight Regional Business Units (RBUs). The Gases Division also includes the two Global Business Units (GBUs) Healthcare (medical gases and related maintenance and advisory services) and Tonnage (on-site supply of gases to major customers), as well as the two Business Areas (BAs) Merchant & Packaged Gases (liquefied and cylinder gases) and Electronics (electronic gases).

GASES DIVISION

The Linde Group is a world leader in the international gases market. The company offers a wide range of compressed and liquefied gases as well as chemicals, and is the partner of choice across a huge variety of industries. Linde gases are used, for example, in the energy sector, steel production, chemical processing, environmental protection and welding, as well as in food processing, glass production and electronics. The company is also investing in the expansion of its fast-growing Healthcare business (medical gases), and is a leading global player in the development of environmentally friendly hydrogen technologies.

ENGINEERING DIVISION

Linde Engineering is successful throughout the world, with its focus on promising market segments such as olefin, natural gas, air separation, hydrogen and synthesis gas plants. In contrast to virtually all competitors, the company can rely on its own extensive process engineering know-how in the planning, project development and construction of turnkey industrial plants. Linde plants are used in a wide variety of fields: in the petrochemical and chemical industries, in refineries and fertiliser plants, to recover air gases, to produce hydrogen and synthesis gases, to treat natural gas and in the pharmaceutical industry.

THE LINDE WORLD

[2]

The Gases Division has three segments – EMEA (Europe, the Middle East and Africa), Asia/Pacific and the Americas. These are divided into eight Regional Business Units (RBUs). The Gases Division also includes the two Global Business Units (GBUs) Healthcare (medical gases) and Tonnage (on-site), as well as the two Business Areas (BAs) Merchant & Packaged Gases (liquefied and cylinder gases) and Electronics (electronic gases). Active the world over, the Engineering Division specialises in olefin, natural gas, air separation, hydrogen and synthesis gas plants.



■ NORTH AMERICA ■ SOUTH AMERICA ■ AFRICA & UK ■ CONTINENTAL & NORTHERN EUROPE
 ■ EASTERN EUROPE & MIDDLE EAST ■ SOUTH & EAST ASIA ■ GREATER CHINA ■ SOUTH PACIFIC

CUSTOMER SEGMENTATION WITHIN THE GASES DIVISION

[3]

FOOD & BEVERAGES	CHEMISTRY & ENERGY	METALLURGY & GLASS	MANUFACTURING INDUSTRY	ELECTRONICS	HEALTHCARE	OTHERS
Aquaculture & water Beverages Food Other F & B	Energy Fine & petro-chemistry Pharma Other chemistry	Glass & fibre optics Heat treatment Non-ferrous Steel Other M & G	Aerospace Automotive Heavy construction & machinery Light metal fab. & prod. Other manufacturing	Solar Semi-conductor Chip packaging	Hospital Care Homecare Gas Therapies Care Concepts REMEO®	Education & research Retail Distributors

OUR VISION

[4]

We will be the leading global gases and engineering company, admired for our people, who provide innovative solutions that make a difference to the world.

OUR COMPANY VALUES

[5]

PASSION TO EXCEL.

INNOVATING FOR CUSTOMERS.

EMPOWERING PEOPLE.

THRIVING THROUGH DIVERSITY.

Foreword: Professor Dr Wolfgang Reitzle [Page 2]

Statements: Five employees share their insights and views. [Page 4]

AGILITY

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Homecare: Independence is very important to me [Page 15]

Hospital Care: Tailored consultation and supply Solutions [Page 20]

REMEO®: For better quality of life [Page 22]

EFFICIENCY

Modular Design: Raising the bar [Page 27]

Cylinder Supply Chain Management: Automatically getting better [Page 30]

Remote Operation Centre: Remote control with pinpoint accuracy [Page 36]

INNOVATIVE DRIVE

LNG: Clean sailing [Page 43]

Linde/BASF: 2 Teams + 1 Idea = New energy [Page 50]

Aquaculture: Fresh Fish [Page 54]

Statements: Five customers explain what they value most about Linde. [Page 60]

Review of the year / Imprint [Page 68]

»ESPECIALLY IN THESE TURBULENT TIMES,
WE HAVE TO GRASP EVERY OPPORTUNITY TO
EQUIP OURSELVES FOR THE FUTURE.«

PROFESSOR DR WOLFGANG REITZLE

Ladies and Gentlemen,

Every day, we strive to position our company for lasting success in a challenging economic environment. More than ever, the market calls for fast, flexible and determined action. I see three success factors in this new playing field. Firstly, we need the right people with the right attitudes in the right places. Secondly, efficient processes that have been standardised Group-wide are a must. And thirdly, a culture that fosters new ideas and innovation is essential.

In this year's Linde Annual, we will be introducing some of our people so you can see how they bring passion to their work. They invest and engage, drive their projects forward to success and enthusiastically step up to responsibility. We will also be presenting new technologies and markets and explaining how they translate into opportunities for Linde. In addition, you will see how we continue to improve process efficiency to keep our performance, agility and responsiveness on an upward path. And – last but not least – you will discover how it is just as important as ever to systematically grasp (acquisition) opportunities in order to be fully equipped for the future.

Executed with determination and vigour, all of our actions are inspired by the desire to deliver the value that our customers, employees, shareholders and other stakeholders have come to know and expect from Linde.



PROFESSOR DR WOLFGANG REITZLE
CHIEF EXECUTIVE OFFICER OF LINDE AG

[E M P L O Y E E S]

»WHAT SKILLS AND QUALITIES
POSITION US FOR LONG-TERM SUCCESS?«

FIVE EMPLOYEES SHARE THEIR INSIGHTS AND VIEWS.

[PULLACH/GERMANY]

Dedication

DR NICOLE SCHÖDEL [HEAD OF CHEMICAL DEVELOPMENT AND SERVICES]

»When developing new products, it obviously takes creativity and technical expertise to venture into new terrain. For me, however, strength of purpose is the key – that is what successfully transitions new technologies to market maturity.«

[SHANGHAI/CHINA]



DETERMINATION

NA LI [CUSTOMER ADVISOR, SERVICE CENTRE]

»For me, the most important success factor in my work is a positive attitude. That is the best foundation to build trusting relationships with our customers. Everyone has their own way of doing things. I believe in continuity and commitment – straight down the line.«

[BUENOS AIRES/ARGENTINA]

A man with dark, wavy hair and a light beard is standing in a brightly lit room. He is wearing a light grey suit jacket over a purple shirt. He is looking slightly to the right of the camera with a neutral expression. The background is a plain, light-colored wall with large windows on the right side, creating a soft, natural light. The word "Principles" is overlaid in large white text across the center of the image.

Principles

JORGE CARLINO [PROCUREMENT MANAGER, SOUTH AMERICA REGION]

»I always try to align my actions with the goals of our company, making Linde's values and principles my own. Just ticking the boxes is probably enough to win a 100-metre sprint. But the right mindset will win a full marathon.«

[R I G A / L A T V I A]



D E T E R M I N A T I O N

JĀNIS PĀVULIŅŠ [DRIVER, GAS FILLING STATION]

»Working for a large, international company is both an honour and a call to action. I feel a strong sense of responsibility towards the company, so I make sure that I do my work as carefully and precisely as possible. After all, that's the best way of meeting our customers' expectations and forging strong business relationships that will stand the test of time.«

[CHARLOTTE/USA]



N'JGHAMENIA WOODSON [RESPIRATORY THERAPIST]

»I love my work and always do everything I possibly can to ensure that we offer our patients the premium quality of care that Lincare stands for.«

AGILITY, EFFICIENCY AND INNOVATIVE DRIVE –
THE THREE SUCCESS FACTORS THAT
TRANSFORM A GOOD COMPANY
INTO AN EXCELLENT ORGANISATION.

AGILITY – EFFICIENCY – INNOVATIVE DRIVE

Agility

WE LIVE IN A RAPIDLY CHANGING WORLD. TO REMAIN COMPETITIVE OVER TIME,
COMPANIES MUST QUICKLY AND FLEXIBLY ADAPT TO SHIFTING MARKET DYNAMICS.
AGILITY IS THE DEFINING SUCCESS FACTOR.

AGILITY

HEALTHCARE – A GROWING MARKET [PAGE 13]

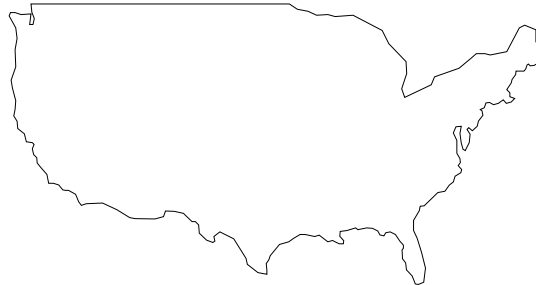
INDEPENDENCE IS VERY IMPORTANT TO ME [PAGE 15]

TAILORED CONSULTATION AND SUPPLY SOLUTIONS [PAGE 20]

FOR BETTER QUALITY OF LIFE [PAGE 22]

AUGUST 2012:
ACQUISITION OF LINCARE
CLEARWATER, USA

/
11,000 EMPLOYEES
800,000 PATIENTS
ANNUAL REVENUE OF EUR 1.5 BILLION



USA

[STRATEGIC ACQUISITIONS]

AGILITY

HEALTHCARE – A GROWING MARKET

THE HEALTHCARE MARKET IS GROWING. AND LINDE IS GROWING WITH IT.
IN THE 2012 FINANCIAL YEAR, TWO STRATEGIC ACQUISITIONS STRENGTHENED
LINDE'S POSITION IN THIS PROMISING BUSINESS, ESTABLISHING THE COMPANY
AS THE LEADING HEALTHCARE PROVIDER IN THE GASES INDUSTRY.

APRIL 2012:
ACQUISITION OF AIR PRODUCTS
CONTINENTAL EUROPEAN
HOMECARE BUSINESS
BELGIUM/GERMANY/France/SPAIN/PORTUGAL

/
850 EMPLOYEES
260,000 PATIENTS
ANNUAL REVENUE OF EUR 200 MILLION



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GER

Looking at the growth markets of the future, Linde has identified emerging economies, energy and the environment, and the healthcare business as the drivers offering the biggest potential. In view of demographic shifts, in particular, the healthcare market is emerging as a global megatrend promising relatively stable growth rates. The healthcare market share relevant to the gases industry is currently worth around EUR 12 billion and this figure is rising. Two thirds of that share are attributable to the homecare segment.

And it is precisely in this fast-growing business that Linde strengthened its position last year through strategic acquisitions. In April, Linde completed the purchase of Air Products Continental European Homecare business, gaining 850 employees, 260,000 new patients and additional annual revenues in excess of EUR 200 million. August saw an even bigger milestone for Linde in this profitable and resilient market, when it acquired US homecare company Lincare. Lincare is the undisputed market leader in the States – by far the largest regional homecare market in the world. With 11,000 employees and around 800,000 patients, Lincare last reported revenue equivalent to around EUR 1.5 billion. Through the purchase of Lincare and Air Products Homecare business, Linde is now the only gases company with a global footprint in the homecare business. Even more to the point, these acquisitions have propelled Linde to the forefront of the healthcare space in the gases industry. In other words, the company is excellently positioned to capitalise on the huge opportunities that the healthcare megatrend is set to unfold.



[0 7 : 3 0 A M]



[0 9 : 3 0 A M]



JOÃO MENDES

LUISA BRANCO

[HOMECARE]

INDEPENDENCE IS VERY IMPORTANT TO ME

AGILITY

LUISA BRANCO HAS A CHRONIC LUNG DISEASE. YET DESPITE HER ILLNESS, THE 59-YEAR-OLD PORTUGUESE WOMAN IS ABLE TO LIVE AN INDEPENDENT LIFE ON HER OWN TERMS - ALL THANKS TO LINDE'S MOBILE OXYGEN SERVICES.

LUISA BRANCO: PATIENT
JOÃO MENDES: HOMECARE SPECIALIST AT LINDE
[LISBON/PORTUGAL]



[11 : 00 A M]

LUIZA BRANCO CAN LIVE
INDEPENDENTLY IN HER OWN
APARTMENT THANKS TO
OXYGEN SUPPLIED BY LINDE.



[0 2 : 0 0 P M]

LINDE EMPLOYEE JOÃO MENDES
SENDS LUISA BRANCO'S
HEALTH UPDATE DIRECTLY
TO HER DOCTORS.

Last summer, Luisa Branco could once again be found enjoying one of her much-loved pastimes: daily walks along the beach of her favourite bay. "I had to carry the oxygen cylinder above my head to stop it from getting wet in the sea," she enthuses. Today, sitting in her apartment in the old quarter of Lisbon, she breathes deeply and smiles at the memory. João Mendes nods happily as small pressure surges pump pure oxygen through Luisa's nose and into her lungs. João is a 28-year-old homecare specialist from Linde Portugal. He has come to measure the amount of oxygen in Luisa's blood. Her levels are stable and João enters the data into a portable computer so that her doctors can access the latest information online. "I know the bay," he says. "It really is a beautiful place."

Mendes is carrying out a routine check-up at Luisa Branco's home. Approximately every ten days, someone from his team comes by to personally check her general health and her oxygen unit. Branco, a qualified psychologist who retired early, only needs to go to hospital two or three times a year – something that the elegant lady is very grateful for. "I don't like hospitals. My independence is too important to me," she adds. 14 percent of Portugal's population suffers from chronic obstructive pulmonary disease (COPD). Luisa Branco is one of these. COPD prevents Luisa's lungs from extracting sufficient oxygen from her bloodstream and so she carries a small oxygen canister – or her "handbag", as she calls it – with her 24 hours a day. The device automatically recognises when she inhales and directly supplies her with the pure oxygen she needs to breathe.

Previously, Luisa Branco had to be treated as an in-patient. These days, however, she can live a largely independent life in her own home thanks to the services provided by Linde. Worldwide, the homecare market is growing due to shifting demographics. As life expectancy rises, so too does the risk of age-related diseases, many of which adversely affect patients' airways. Home-based treatment means better quality of life for patients and enables specialists such as João Mendes to deliver individualised therapies at much lower cost than in a clinical environment. Mendes only recently joined Linde. After graduating from university, he started working with Air Products, and in April 2012, Linde acquired Air Products Homecare activities in Continental Europe. João Mendes' job has not altered with the change in employer: "Homecare is all about getting patients the help they need," he explains.



[0 2 : 1 5 P M]

DESPITE HER ILLNESS,
THE 59-YEAR-OLD
PSYCHOLOGIST USES A
TREADMILL TO KEEP FIT.

A quick glance at his calendar reveals exactly what this involves. This morning, for example, he made a brief stop at the office to finalise his appointments for the day. Mornings are reserved for hospital visits, where he discusses various therapy options with doctors. In the afternoon, he visits five or six of the approximately 2000 patients that he and his twenty-strong team care for. When asked what attracted him to this line of work, he says: "I just want to help our patients lead a good life despite their health issues." Patients such as Luisa Branco are almost like family to him. He sees himself as a partner who is always on hand to listen and help whenever his patients need him. "I like my work," he adds. "It certainly never gets boring."

"I can trust João and his colleagues," explains Luisa Branco, who is also head of the patient organisation Respira. "That trust is essential, especially in critical situations," she adds. Just last weekend, for example, Luisa needed help from the Homecare team when her oxygen cylinder broke during a trip to the countryside. She kept her cool, drove home and called Linde. A service technician came by immediately and replaced the cylinder.

Luisa Branco is proud of her mobility. "It takes me a lot longer to do things, of course – it's like switching from a Ferrari to a small car. You need to have a lot more patience, which isn't always easy," she admits. In her "Ferrari" days, Branco worked with people who had Down's Syndrome. In the evenings, she enjoyed life. For 28 years she smoked two and a half packets of cigarettes daily until one day, she was admitted to hospital. A bout of flu had weakened her so much that she had to spend two weeks in intensive care. In order to leave the hospital, she needed a permanent supply of oxygen. Branco has stopped smoking since starting the therapy. "I'm not embarrassed about the oxygen unit," she says. "I spent my whole life working with people who had to deal with health constraints of one kind or another. And I always said that it doesn't matter how people see you from the outside," she continues. In Luisa's eyes, there is no difference between reading glasses and oxygen tubes.

"Patients have rights, but they also have duties," she sighs, as she walks on the treadmill in her apartment. The exercise test enables João Mendes to check her cardiovascular fitness. Her garden stretches out behind the exercise room, filled with roses, hydrangeas and bougainvillea in full bloom. "I love being around people but I also like being alone here," she admits. And she treasures her freedom. "Luisa would have had to return to hospital a long time ago without the therapy," explains João.

Luisa Branco makes the most of every day, going shopping and visiting cafes, for example, to watch the world go by. She also invites friends round for dinner and organises Respira from her computer at home. The oxygen cylinder is always with her, hanging on the back of her chair next to an impressive stack of CDs. Almost all of them are by the band Queen. It's no surprise to hear that one of her favourite songs is "Don't Stop Me Now".



[0 2 : 3 0 P M]

JOÃO MENDES AND
LUIZA BRANCO
CHECK THE PORTABLE
OXYGEN EQUIPMENT.



[0 4 : 5 5 P M]

HOMECARE EXPERT MENDES
CHECKS THE SLEEP AND
VENTILATION DEVICES BEFORE
CONNECTING THEM FOR HIS
PATIENTS.



[HOSPITAL CARE]

TAILORED CONSULTATION AND SUPPLY SOLUTIONS

ONE THING EVERY HOSPITAL HAS IN COMMON IS THE NEED FOR MEDICAL GASES.
AROUND THE CLOCK AND AROUND THE HOSPITAL, THEY ARE USED
EVERYWHERE FROM THE EMERGENCY DEPARTMENTS THROUGH INTENSIVE CARE
UNITS TO PATIENTS' ROOMS ON THE WARDS. UNDER ITS QI MEDICAL GAS SERVICES
UMBRELLA, LINDE HAS DEVELOPED A WIDE-RANGING HOSPITAL PROGRAMME
THAT CAN BE TAILORED TO THE NEEDS OF INDIVIDUAL HEALTHCARE FACILITIES.

CENTRE HOSPITALIER INTERCOMMUNAL
[CASTRES/FRANCE]



As a market leader in the medical gases industry, Linde provides hospitals and clinics with a reliable supply of gases that comply with both legal requirements and stringent medical and pharmaceutical standards. The company complements this with a broad service and support offering under the q1 Medical Gas Services brand. These services extend from risk audits and training programmes to the design and engineering of medical installations, supply systems and medical air compressors.

'q1' stands for quality improvement, as well as being the Chinese term (also spelt 'chi') for breath and energy flow – or, in other words, life force. "Our offerings have a direct impact on patients' lives," confirms Kenth Drott, Head of Hospital Care at Linde. "With our q1 Medical Gas Services, we deliver gases of high quality and ensure that the supporting systems function to perfection, so the patients can look forward to effective, safe care."

This last financial year has seen Linde sign more than twenty new contracts with healthcare facilities all over the world. These agreements typically run for several years. Linde's collaboration with a hospital often begins before the foundations are even laid, as was the case with the Centre Hospitalier Intercommunal in Castres, near Toulouse (France). In many ways, this local general hospital is a reference project for the Hospital Care business. Each of the 400 beds at the facility has its own oxygen outlet. For this customer, Linde created a tailored solution covering everything from system design and installation to medical air supply and vacuum equipment. Linde now supports the hospital with operational and management services, flanked by a steady flow of medical gases.

Not every hospital needs all q1 Medical Gas Services building blocks in one go. "Many customers initially request the q1 Training and q1 Risk services," Drott reports. "After all, patient safety depends on whether hospital staff can handle gases and supporting equipment properly and respond to hazardous situations rapidly and appropriately." Following on from these services, though, the contracts are often gradually expanded. "Within two to six months, we identify the actual requirements in close collaboration with our customers and can then put together the appropriate range of offerings," continues Drott. "Our aim is to be the partner of choice when it comes to medical gases. We always work closely with our customers, making sure we jointly develop the right fit for their individual challenges."



[REMEO®]

FOR BETTER QUALITY OF LIFE

LINDE'S REMEO® OFFERING GIVES LONG-TERM VENTILATED PATIENTS
GREATER FREEDOM AND QUALITY OF LIFE. THIS INTEGRATED CARE CONCEPT
ALSO RELIEVES PRESSURE ON HEALTHCARE BUDGETS.

ANTJE KASSIN: CARE MANAGER
[BERLIN/GERMANY]



“Most patients who come to us are first looking forward to a spot of peace and quiet,” says Antje Kassin, care manager of the REMEO® centre in Mahlow near Berlin. She also manages five other Linde facilities in Germany. “They have come directly from an intensive care unit (ICU) and are generally just tired. When they get here, they can sleep properly and enjoy personal care again for the first time in a long while.” Derived from the Latin word “remeo” (meaning “I return home”), REMEO® is designed to make patients feel instantly welcome – starting with its home-like décor featuring warm, apricot-coloured walls and bright, inviting communal seating areas. The photos in the rooms show people in sociable settings. In fact, Mahlow doesn’t look at all like a care centre for seriously and chronically ill patients who require mechanical ventilation. “There are plenty of things we can do to make staying at REMEO® as attractive as possible for our patients – that’s the best way to build up their confidence,” adds Antje Kassin, who has been working in ventilatory care for 14 years now. The success of REMEO® is partly attributable to a higher staff/patient ratio than comparable facilities and the fact that Linde only employs highly qualified specialists who attend regular training courses. The centres also ensure that their hygiene standards meet those of an intensive care unit.

Helene M. (name changed to protect privacy) has been at the Mahlow REMEO® centre for two months. For many years, the 72-year-old has been suffering from chronic obstructive pulmonary disease. 90 percent of all patients requiring long-term ventilatory support are affected by this condition. Since coming to REMEO®, Helene M. has gained a new lease of life. Over the past few weeks, she has become a lot more independent and is now confident enough to run small errands on her own again. With her walking aid, to which she attaches her mobile ventilation device, she heads off to the local shops. “When other patients see that their neighbour has headed off with a rollator and can manage perfectly well without a fixed ventilation device for hours at a time, it encourages them to do the same,” explains Antje Kassin.

“Our aim is to liberate our patients from their medical devices. The more they trust in us, the faster they make progress.” REMEO® bridges the gap between an ICU and a patient’s own home. There are four steps in the integrated REMEO® care path, extending from specialised weaning clinics, through medical ventilation centres staffed with dedicated doctors, to specialised nursing homes typical of the German market. At the far end of this care spectrum is REMEO® Home, where specialists regularly visit patients who are well enough to live at home. If patients need or wish to reside permanently in a care facility, as is the case with Helene M., Linde ensures they receive professional in-house care in an attractive environment.

Although long-term ventilated patients only account for 10 percent or less of all ICU patients, they require up to 50 percent of ICU resources. A REMEO® centre offers a number of benefits over an ICU setting. In Germany, for instance, a day in a REMEO® centre costs approximately a quarter of the price of an ICU day. This ratio is similar in other countries. If the patient progresses to REMEO® Home, the cost savings are even greater. Ultimately, success in weaning translates into greater freedom and quality of life for the patient and – obviously – lower care costs.

Linde has been supporting ventilation beyond the clinical setting since 2005. The company operates REMEO® centres in four countries and REMEO® Home is available in three countries. Changing demographics mean that demand for REMEO® services is rising steadily.

AN ENTREPRENEURIAL STREAK PAYS
DIVIDENDS: THE ACQUISITION OF LINCARE
AND THE AIR PRODUCTS BUSINESSES
POSITIONS LINDE AS THE SOLE GASES
COMPANY IN THE HOMECARE BUSINESS
WITH GLOBAL REACH.

AGILITY

Efficiency

LINDE'S HIGH PERFORMANCE ORGANISATION [HPO] PROGRAMME IS A HOLISTIC CONCEPT AIMED AT CONTINUOUS AND LASTING PROCESS AND EFFICIENCY GAINS. THIS INVOLVES ESTABLISHING FIRST-CLASS STANDARDS ACROSS THE GROUP AND INCORPORATING BEST PRACTICES FROM OTHER INDUSTRIES.

EFFICIENCY

RAISING THE BAR [PAGE 27]

AUTOMATICALLY GETTING BETTER [PAGE 30]

REMOTE CONTROL WITH PINPOINT ACCURACY [PAGE 36]



24TH OCTOBER 2012

TEAM MEETING
IN HANGZHOU



[MODULAR DESIGN]

RAISING THE BAR

THE ONGOING DEVELOPMENT OF AIR SEPARATION UNITS AT LINDE CONTINUES TO REFLECT THE COMPANY'S UNFLAGGING COMMITMENT TO STANDARDISATION. INSPIRED BY THE MODULAR ASSEMBLY PROCESSES TYPICAL OF OTHER INDUSTRIES, LINDE IS USING MODULAR BUILDING BLOCKS TO DELIVER STANDARDISED TECHNICAL SOLUTIONS THAT CUT COSTS AND DELIVERY TIMES.

[HANGZHOU/CHINA]

Linde engineers in Germany and China are working flat out to develop standardised modules for air separation units (ASUs). Implementation teams are flanking these efforts in Pullach, Germany, and in Hangzhou, China. "This cross-border collaboration enables us to make the best possible use of our expertise and resources," explains Dr Christian Bruch, responsible for air separation units at Linde Engineering.

Building on existing platform concepts, Bruch and his team are developing a specific, medium-sized plant model for air gases with a capacity of around 30,000 normal cubic metres per hour. This model is intended for several projects in China. Based at Linde's Hangzhou site, Stefan Möller is coordinating efforts on the Asian side. "This project is not just about producing another plant," he clarifies. "More to the point, we are laying the foundation for a completely new approach to ASU engineering and a new dimension in design."

By standardising individual modules, Linde is strengthening its position in the face of increasingly fierce competition worldwide. Since these building blocks can then be used in various types of plants, the development outlay is spread across several products. And, according to Bruch, the benefits extend even further: "Alongside the savings we can realise on the engineering front, we anticipate significant cost efficiencies in other areas. By collaborating closely with our suppliers at an early stage in the process, we will be able to reduce costs for both us and our partners." Explaining the idea behind this approach, he continues: "Our concept is similar to the modular assembly process typically used in the automotive industry. There, identical building blocks are built into many different marques and models and these standardised components can make up as much as 80 per cent of any given car. Although economies of scale do not play such a prominent role in our industry, this approach will enable us to reduce the total cost of ownership of our plants. Close collaboration between Linde's Engineering and Gases Divisions is particularly instrumental in unlocking these benefits. We are now increasingly thinking product families rather than individual plants."

T E A M S

Linde has divided up the tasks involved. The Pullach team is responsible for modules containing components obtained from European suppliers. Meanwhile, the team in China is busy engineering the modules whose main components are sourced on the Chinese market. "Our sole aim is to maximise efficiencies," emphasises Wenjie Cha, Head of Engineering in Hangzhou.

M O D U L E S

The first pilot project started out by structuring the plant into 30 defined modules. 22 of these will always be identical throughout the entire plant series, with no changes to even the smallest detail. For five modules, the engineers have various options for specific parts and parameters. The Linde experts will be custom-developing just three modules on a project-specific basis to ensure that the resulting plants meet individual requirements on site.

P R O C E S S

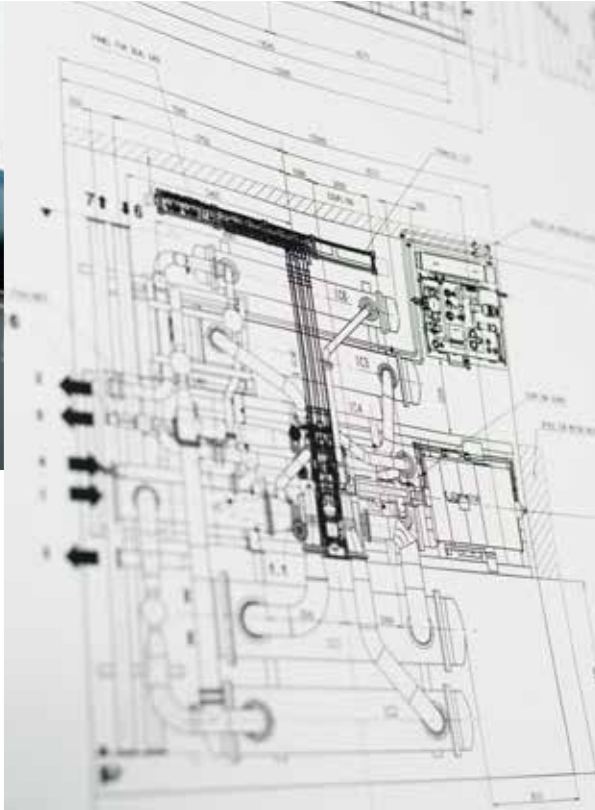
The project kicked off in spring 2012 and the engineers had around twelve months to complete the module design phase. Linde began the project by sounding the Chinese market to identify the right partner for the pilot facility. The first execution phase then got under way at the end of 2012. Final engineering work is set to conclude in March 2013. "We are comfortably on schedule. Assuming all goes smoothly, the first standardised air separation unit should go on stream in China in autumn 2014," Möller confirms.

P R O S P E C T S

With its standardised, modular designs, Linde is shaping the future of its own ASU portfolio. The market potential is certainly promising: global investment in air separation facilities totals around three billion euros each year, with Asia accounting for 75 percent of that sum.



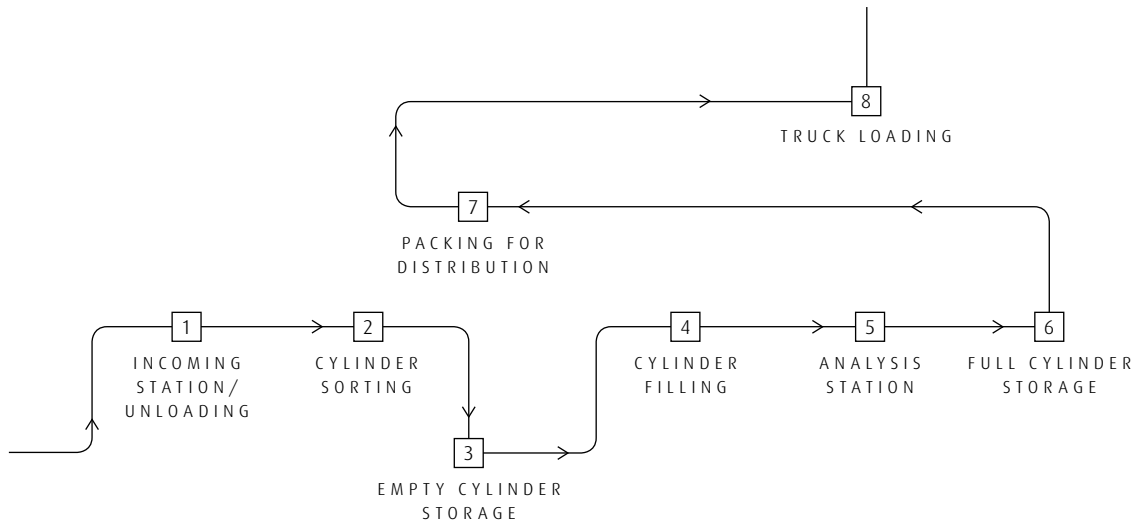
T E A M W O R K
22 OF THE 30 MODULES
DEFINED BY THE ENGINEERS
FOR AN ASU ARE
MANDATORY FOR ALL
PROJECTS IN THAT SERIES.



K N O W - H O W
REGULAR MEETINGS
AND WORKSHOPS ENSURE
SEAMLESS KNOWLEDGE
TRANSFER BETWEEN
THE TEAMS AND ENABLE
PROJECTS TO ADVANCE
RAPIDLY, EVEN ACROSS
CONTINENTS.



L E A R N I N G C U R V E
BY DEVELOPING PRODUCT
FAMILIES, LINDE IS SETTING
NEW STANDARDS IN THE
WORLD OF PLANT ENGINEERING.



[CYLINDER SUPPLY CHAIN MANAGEMENT]

AUTOMATICALLY GETTING BETTER

LINDE'S CYLINDER GAS SUPPLY CHAIN IS NOW SAFER AND MORE EFFICIENT THAN EVER BEFORE - THANKS TO A GREATLY STREAMLINED AND MODERNISED PROCESS FLOW. NEW PLANTS IN LATVIA AND AUSTRALIA ARE FLAGSHIP EXAMPLES OF THE NEW GLOBAL SUPPLY CHAIN STRATEGY.

[RIGA/LATVIA]

2

[CYLINDER SORTING]



A ROBOT CHECKS AND SORTS THE DELIVERED CYLINDERS,
ENSURING THEY ARE IN THE RIGHT PLACE AT THE RIGHT TIME FOR REFILLING.

Late afternoon in Riga, Latvia. The extensive grounds of the new gas filling plant are buzzing with activity. One after another, lorries swing into the site and pull up to one of six parking bays outside the entrance to the main building. Forklifts instantly swarm along the non-intersecting traffic lanes towards them, ready to haul large pallets of empty gas cylinders from the load beds. Varying in size, these empties are then neatly set down in designated areas outside the sorting warehouse.

Meanwhile, on the other side of the building, dozens of pallets of freshly filled gas cylinders are lined up and ready to go. Thanks to their electronic lists, the lorry drivers know exactly which lot is theirs. In fact, even the precise set-down position on the load bed is defined, with pallets for the nearest customers or distribution hubs loaded last.

The next day, work at Linde's newest filling plant begins at daybreak, as the vehicles loaded the night before head for the road. Each one now follows its pre-calculated route – directly to customers in Riga or nearby, or to one of six transfer stations for the Baltic states of Latvia, Estonia and Lithuania. There, local carriers pick up the gas cylinders for rapid onward transport to individual customers.

STREAMLINED PROCESSES

While the drivers spend the day distributing the full gas cylinders and collecting empties throughout the region, the thirty or so employees at the filling station ensure the next day's deliveries are ready on time. At Riga, they can do this with a minimal level of heavy manual labour. Opened towards the end of 2012, this new Linde plant shows how an automated workflow for heavy cylinders can greatly increase handling and filling efficiency across the board. "The automation of mechanical processes has made us more cost-effective," confirms Ashley Mills, responsible for cylinder supply chain management at Linde. "And, just as importantly, we are making work easier for our colleagues in the filling plants."

However, there is no one-size-fits-all automation solution that would work across every region and market. The infrastructure, competitive environment, job market, labour costs and customer requirements vary too much from one region to another.

The Riga filling plant is one of the locations where partial automation makes sense. The station that checks and sorts the empty cylinders is fully automated. A robot controlled by an SAP-based computer program makes short work of this step: as soon as the operator hits the start button, the crane-like machine moves along rails fixed to the roof until it is directly above one of the cylinders, which it then lifts from the pallet. At the same time, a camera built into the robot registers the visual condition of the container, while a scanner reads all the data from the barcode attached to every cylinder. The computer determines which gas or gas mixture the cylinder is supposed to contain, and then the robot places it in the preassigned position on the relevant pallet. Heavily soiled cylinders are placed on a separate pallet and transported to the washing facility.

The sorted cylinder pallets are initially transported by forklift to a designated interim storage area. Then, according to demand, they are moved to the filling area, where employees attach the filler necks by hand. The filling process itself is automated again: a computer with access to all the necessary information specifies the type of gas, the ingredients needed for a given mixture and the quantity required.

The plant engineers built a separate room for medical gases, which are subject to extremely strict purity requirements. Dry ice production from liquid carbon dioxide also takes place in a dedicated room at the plant.

4

[CYLINDER FILLING]



THE HOSES ARE ATTACHED TO THE CYLINDERS BY HAND FOR
COMPUTER-CONTROLLED, ELECTRONIC REFILLING.

5

[ANALYSIS STATION]

EFFICIENCY



THE CYLINDERS ARE THOROUGHLY INSPECTED AT THE ANALYSIS STATION AND THE CONTENTS CAREFULLY CHECKED.

INVESTING IN THE FUTURE

“We always have to take potential future demand into account when planning new filling stations,” Mills explains. “These facilities still need to be fit for purpose in ten years’ time.” Which is why capacity in Riga is deliberately generous. Working around two and a half times faster than its predecessor, the new station can handle up to 900,000 cylinders a year in shift mode. Experts estimate that the total market in the three Baltic countries will reach around 700,000 cylinders in the coming three to four years. Linde invested approximately 8.5 million euros in this new Latvian plant and is confident that it will quickly pay for itself. “The new facility replaces four older plants in the region,” confirms Harijs Teteris, responsible for cylinder gas management in the Baltic region at Linde. “Bundling our business at a single location and leveraging a high degree of automation translate into significant cost efficiencies.”

However, efficiency is not the only design consideration in Riga. The new facility also ensures the greatest possible level of safety for employees. Alongside non-intersecting traffic lanes across the site, a new transport and loading system plays an important role here: the pallets are now only transported by covered trucks and trailers. This not only protects the cylinders from heavy soiling but, most importantly, enables loading and unloading using an on-board forklift. It is thus no longer necessary for the driver to use a crane on open load beds, eliminating all the risks this entailed. So in this regard, too, Latvia’s new filling plant establishes an important reference for other facilities in similarly structured markets and regions.

INNOVATION BENCHMARK

Opened in February 2011, Linde’s new Cylinder Maintenance Center in Sydney, Australia, marks another key milestone on the journey towards automated gas management. Colin Isaac, responsible for Linde’s gas business in the South Pacific region, describes this cylinder maintenance and repair facility as: “A new benchmark for plant technology and innovation, where efficiency, occupational safety and customer value are the top priorities.” The plant is equipped with robots, state-of-the-art electronics, high-tech optical devices and a pioneering powder-coating system for steel and aluminium cylinders. It has the capacity to handle and recondition around 240,000 gas cylinders per year.

Shunted through the plant’s individual stations by robot, the cylinders are inspected for damage using cameras and ultrasound, before being repaired or rejected. Using powder coating instead of the standard liquid paint extends maintenance intervals to between eight and nine years, as well as being significantly more eco-friendly. By contrast, a traditional paint job needs refreshing at least every three years. Despite the long distances cylinders are transported from far-flung parts of the continent to the Sydney maintenance centre, transit both ways and all the tests take no longer than four days altogether. Just one of the many details that establish Sydney as a flagship project.

[REMOTE OPERATION CENTRE]

REMOTE CONTROL WITH PINPOINT ACCURACY

LINDE IS COMMITTED TO EXPANDING ITS EUROPEAN
REMOTE OPERATION CENTRE (ROC) IN THE LEUNA CHEMICALS HUB.
THIS PIONEERING CONCEPT NOT ONLY CUTS ENERGY COSTS
BUT ALSO RAISES SAFETY LEVELS AT AIR SEPARATION UNITS
MANAGED FROM THE CENTRE.

REMOTE OPERATION CENTRE [LEUNA/GERMANY]
CLARIANT PRODUCTS [MUTTENZ/SWITZERLAND]

04:00 AM

L E U N A

05:00 AM

06:00 AM

07:00 AM

08:00 AM

09:00 AM

10:00 AM

11:00 AM

12:00 PM

01:00 PM

02:00 PM

03:00 PM

T I M E



R O C
L I N D E

M U T T E N Z



C L A R I A N T P R O D U C T S
C U S T O M E R

THE AIR SEPARATION UNIT SUPPLYING
SPECIALTY CHEMICALS COMPANY
CLARIANT PRODUCTS IN SWITZERLAND
IS MANAGED AND MONITORED FROM
THE ROC IN LEUNA.

L E U N A

04:00 PM

DR JOACHIM PRETZ (RIGHT) AND HIS THIRTY-STRONG TEAM WILL SOON BE MANAGING UP TO 30 ASUS AND OVER 90 ECOVAR® FACILITIES ACROSS EUROPE FROM THE LEUNA HUB.



05:00 PM

06:00 PM



07:00 PM

08:00 PM

09:00 PM

10:00 PM

11:00 PM

12:00 AM

E F F I C I E N C Y

M U T T E N Z



01:00 AM

02:00 AM

03:00 AM

CLARIANT PRODUCTS
C U S T O M E R



R O C
L I N D E

T I M E

The six a.m. shift change at Linde's Remote Operation Centre (ROC) in the Leuna chemicals hub is a calm and focused affair. Twelve operators sit in front of sixteen small and two large screens. Six of them are just about to finish their shift. They carefully check the entries in the electronic logbook from the previous night before handing over five industrial-scale air separation units and ten to fifteen smaller ECOVAR® facilities to their colleagues who are on the next shift. Curved lines, tables and coloured graphs are lit up on the screens, while real-time video streams display and record operational activities at the sites – stretching across Europe from Hamburg and Worms down to Basel. The six shift operators focus on the screens and sometimes call customers who source industrial gases from the plants under supervision. The operators enter any changes in demand projected over the next few hours and organise maintenance work and inspections with the Linde experts on the ground. Conversations are brief – the operators keep it short and to the point.

Linde now controls a network of around fifteen air separation units and over fifty ECOVAR® facilities in Germany, Austria, Switzerland and the Benelux countries from the ROC in Leuna. In the next two years this number will increase to 30 air separation units and over ninety ECOVAR® facilities. Operators monitor and control processes over highly secure Internet connections.

S K I L L E D P E R S O N N E L

“Before we can connect a new facility to the ROC, there is a lot of groundwork to be covered on the technical and staffing fronts,” explains Dr Joachim Pretz, Head of the ROC in Leuna. These preparations include aligning the operating and management processes and installing various video cameras plus an alarm management system. Engineers harmonise documentation and optimise control and management

systems at the very outset. When a facility hooks up to the ROC, remote and on-site operations initially run in parallel. The operators at the ROC have to know “their” plants inside out. To ensure this is the case, they also spend time training at the relevant locations. Linde has put together an extensive training programme for ROC employees. For all units in the European ROC network to run smoothly, easy cross-border communication is essential. Language skills are therefore just as important as technical know-how, so Linde has also developed special language courses for its staff. “The success of this concept is 80 percent down to the skills of our employees and 20 percent down to technology,” confirms Pretz.

Centralised control through the ROC has allowed Linde to bundle exceptional depth and breadth of expertise at a single location. If a problem arises anywhere in Europe, one of the Leuna-based experts is always able to help. Accelerated know-how transfer, uniform processes and rapid alignment with customer needs have enabled the ROC to raise efficiency and safety levels at the plants it manages.

E F F I C I E N T, F U T U R E - P R O O F C O N C E P T

Efficiency gains also translate into lower energy consumption – a key success factor for air separation units, as energy accounts for 60 to 70 percent of running costs. “Our aim is to cut energy consumption at the individual plants in the ROC network by one percent,” states Pretz.

Linde intends to continue expanding this central control concept. In 2013, the Group plans to connect further industrial-scale facilities in the cities of IJmuiden (Holland), Duisburg and Bremen (Germany), and Graz (Austria) to the ROC in Leuna. By the end of 2014, plants in other European countries will also have joined the network. In the medium term, Linde expects to control around 70 air separation units and over 200 ECOVAR® facilities in Europe from its centre in Leuna. And the global figure will be even higher. “We currently operate around 450 industrial-scale units. In the future, around 330 of these will be connected to a ROC,” explains Rudolf Lamm, Head of Global Operations in the on-site line of business. These facilities will be operated and managed from five ROCs located in Europe, North and South America, Asia and Australia.

BETTER PROCESSES – GREATER EFFICIENCY –
LOWER COSTS.

PROCESS EXCELLENCE CREATES
MORE VALUE – FOR CUSTOMERS AND FOR
THE COMPANY AS A WHOLE.

EFFICIENCY

Innovative Drive

THE ABILITY TO INNOVATE CALLS FOR A STEADY STREAM OF NEW IDEAS. LINDE IS CONTINUOUSLY DEVELOPING INNOVATIVE PRODUCTS AND TECHNOLOGIES THAT HELP ENHANCE QUALITY OF LIFE. DEVELOPMENT EFFORTS CONCENTRATE IN PARTICULAR ON ENERGY AND THE ENVIRONMENT.

INNOVATIVE DRIVE

CLEAN SAILING [PAGE 43]

2 TEAMS + 1 IDEA = NEW ENERGY [PAGE 50]

FRESH FISH [PAGE 54]



[LNG]

CLEAN SAILING

INNOVATIVE DRIVE

DEMAND FOR LIQUEFIED NATURAL GAS (LNG) IS ON THE RISE. THIS ENERGY CARRIER IS ALREADY BEING USED AS AN ENVIRONMENTALLY FRIENDLY ALTERNATIVE IN MANY INDUSTRIAL APPLICATIONS AS WELL AS FOR POWER GENERATION. IN SOME MARKETS, LNG IS ALSO GROWING IN POPULARITY AS AN ALTERNATIVE VEHICLE FUEL, DISPLACING PETROL AND DIESEL. A CHANGE IN ENVIRONMENTAL REGULATIONS IN THE SHIPPING INDUSTRY, MEANS THAT ANOTHER NEW MARKET FOR LNG IS EMERGING - AND LINDE IS SPEARHEADING ITS DEVELOPMENT.

~~~~~  
[PORT OF HAMBURG/  
GERMANY]



Demand for natural gas is higher than ever. It is cheaper and more environmentally sound than other fossil fuels. With growth rates in excess of ten percent per year, the global market for LNG is expanding at a particularly dynamic pace. Linde's technical expertise covers the entire value chain here, from liquefaction through storage to delivery to the end consumer.

The company adapts its LNG business model to local market requirements. The recently opened LNG terminal in Nynäshamn in the east of Sweden, for example, primarily fuels local industries and public transport and taxi fleets, while in the UK, Linde mainly supplies LNG to heavy goods vehicles and fleet operators such as Eddie Stobart. In Asia, Linde is working on the development of smaller and mid-size LNG plants capable of efficiently extracting natural gas reserves that are not connected to pipeline networks. In this region, LNG is increasingly being used in industry and power plants as a replacement for diesel. In the US, sizeable shale gas reserves are providing a further boost to the country's LNG market.

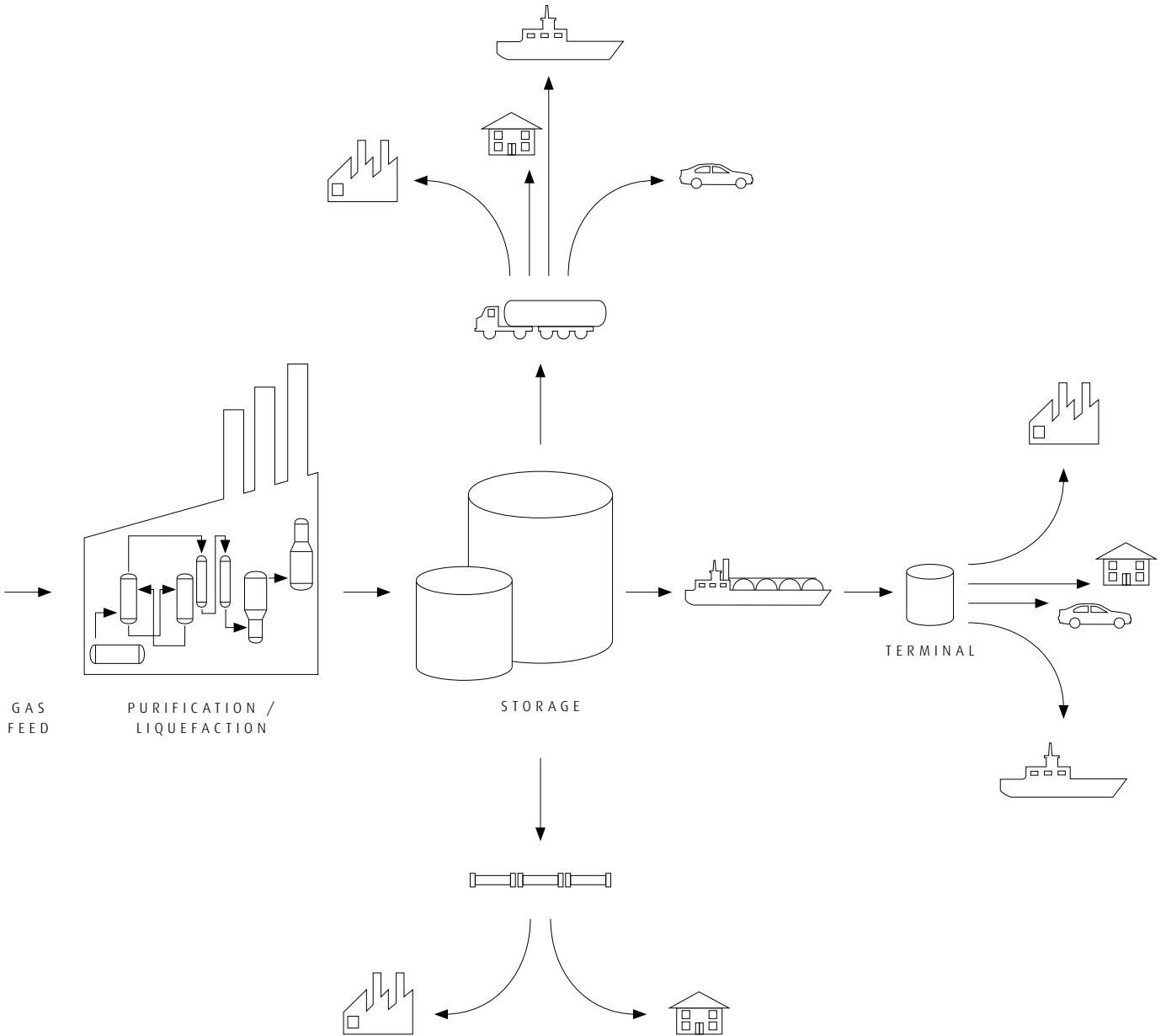
The shipping industry is a particularly promising market for LNG, especially in the North Sea and Baltic Sea. These waters are designated Emission Control Areas (ECAs), and as such will be subject to new environmental regulations from 2015 on. The new rules state that the proportion of sulphur in marine fuel in northern Europe must not exceed 0.1 percent. To meet this stringent threshold, shipping companies will have to turn to cleaner alternatives such as LNG. And the first pioneering ships are already making waves. Powered by LNG from Linde, the Viking Grace ferry, for example, has been running from Stockholm (Sweden) to Turku (Finland) since January 2013.

Linde took steps early on to meet rising demand for LNG in ECAs, founding a Hamburg-based joint venture with marine fuel specialist Bomin back in August 2012. The new company aims to speed the transition to this low-carbon fuel by building an enabling infrastructure comprising smaller LNG terminals in ports such as Hamburg and Bremerhaven. At the port of Hamburg, Mahinde Abeynaike, Managing Director of Bomin Linde LNG GmbH, and Olof Källgren, Head of Clean Energy Merchant LNG, Linde Gases Division, explained the challenges involved in building an effective LNG infrastructure across Europe's ports.

[SEE DISCUSSION ON PAGE 48]

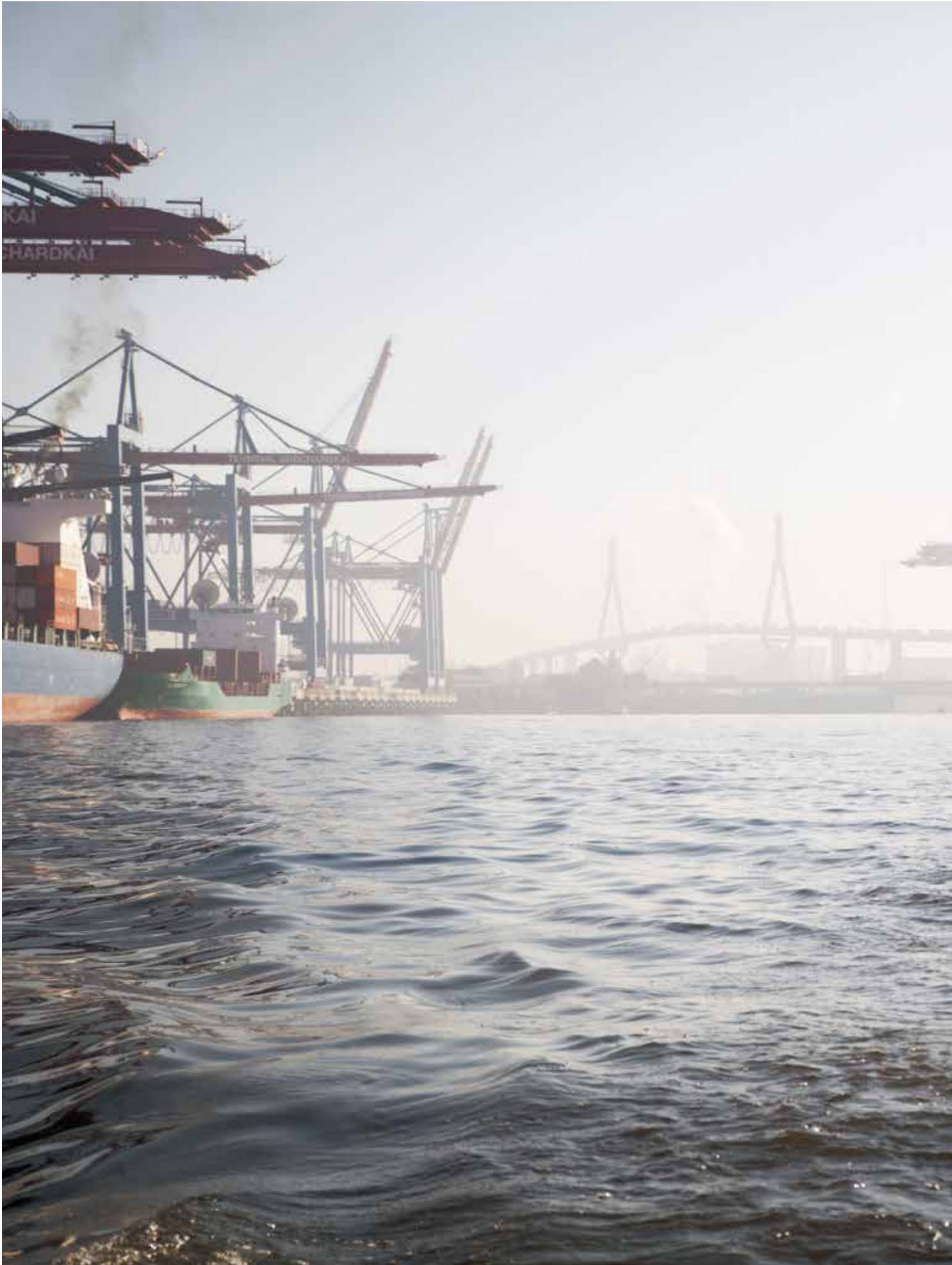
LNG  
LIQUEFACTION AND TRANSPORT

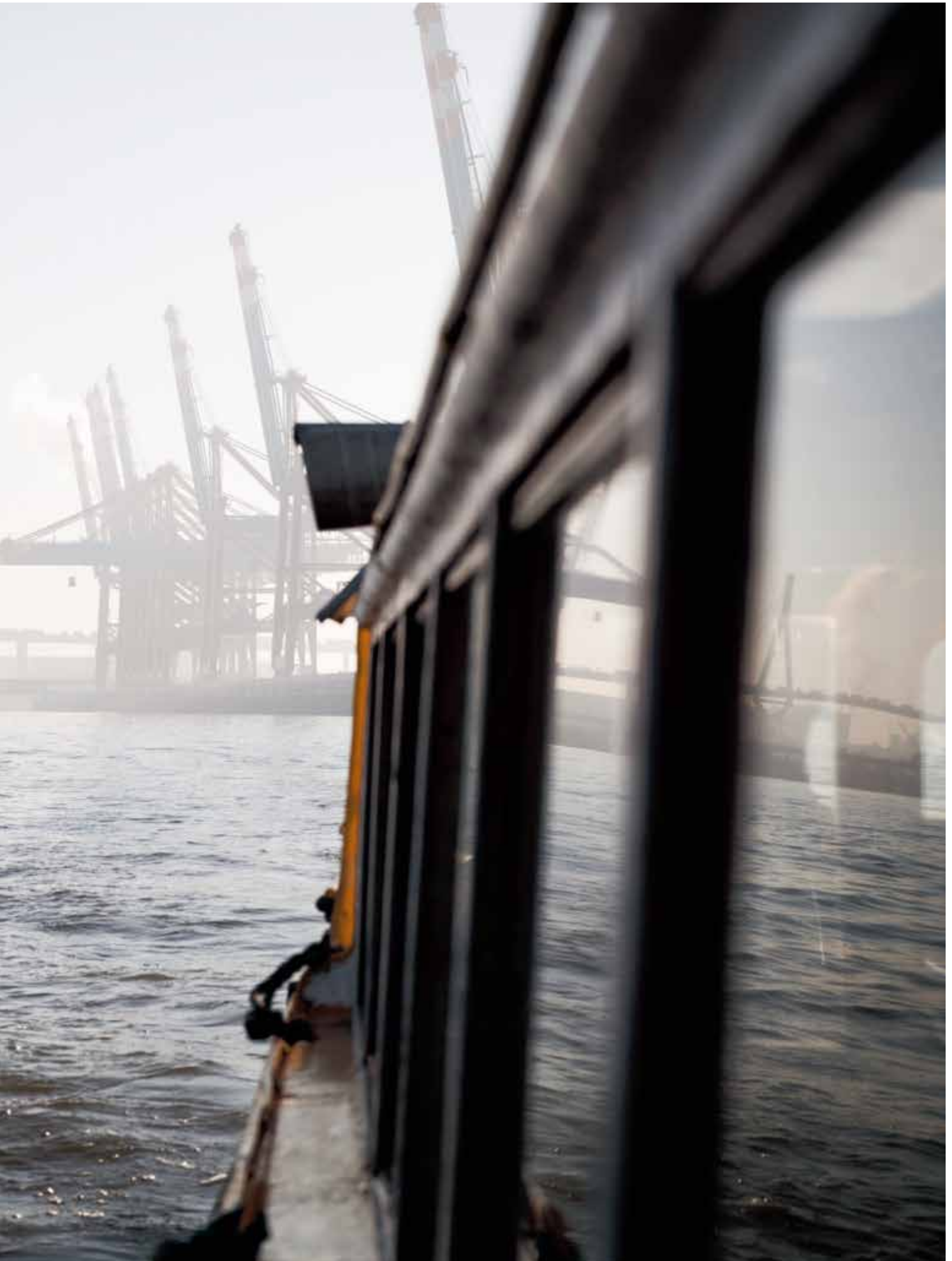
ONCE IT IS LIQUEFIED,  
NATURAL GAS CAN BE STORED  
IN COMPRESSED FORM. DEPENDING  
ON THE LOCATION, LINDE THEN  
TRANSPORTS THE LNG BY TRUCK,  
SHIP OR PIPELINE.



LNG  
APPLICATIONS

AS AN ECO-FRIENDLY ENERGY  
CARRIER, LNG CAN BE USED BOTH TO  
FUEL SHIPS AND CARS AND  
TO REPLACE DIESEL IN INDUSTRY  
AND POWER PLANTS.









INNOVATIVE DRIVE



*HAMBURG-BASED BOMIN LINDE LNG GMBH IS A JOINT VENTURE BETWEEN LINDE AND MARINE FUEL SPECIALIST BOMIN. ITS AIM IS TO ESTABLISH LNG AS A CLEAN ENERGY OPTION FOR THE SHIPPING INDUSTRY.*

MAHINDE ABEYNAIKE  
MANAGING DIRECTOR OF BOMIN LINDE LNG GMBH

[ABEYNAIKE] Our joint venture is primarily about logistics – in other words, storing LNG at ports and transporting it by ship. Linde is an experienced specialist in this area and Bomin – as a leading provider of marine fuels – has the requisite marine industry contacts and space for setting up the needed LNG infrastructure.

OLOF KÄLLGREN  
HEAD OF CLEAN ENERGY MERCHANT LNG,  
LINDE GASES DIVISION

[KÄLLGREN] This partnership is the perfect fit for us as it gives us direct access to potential LNG customers and enables us to cover the complete value chain. In fact, we were already looking at ports in northern Europe that were of interest to us as a result of the new environmental regulations but together we will be a much stronger entity, with the ability to offer a complete supply solution.

[ABEYNAIKE] We are now faced with the classic “chicken and egg” dilemma. The shipping companies have to react to the new emission thresholds. But before they invest in ships with LNG engines, they want to be sure that an extensive infrastructure is already in place.

[KÄLLGREN] Which is why we are looking to build a supply network in ports such as Bremen and Hamburg. We want to give ship owners the assurance they need to equip their ships with LNG engines. This is not something that will happen overnight. The transition will take time, but we are already seeing the first signs of success.

[ABEYNAIKE] We will initially be focusing on pilot projects, showing our partners that we are committed in the long term. Sustainability is a must. This new technology means that shipping companies have to choose a model to power their ships for the next 30 to 40 years.

[KÄLLGREN] We also have to factor in different regional regulations governing LNG storage and fuelling. We need a well-structured, international legislative framework here.

[ABEYNAIKE] We have a long road ahead of us. In the end, however, we are confident that LNG will emerge as the technology of choice – it is a superior solution from both an ecological and a financial perspective.

[KÄLLGREN] I agree completely. We have already seen that oil and gas prices will no longer be so closely tied to each other in the future, specifically not in North America and Europe. And when you actually come here to Hamburg and see just how big the potential market is, you can't help but feel optimistic.

[ABEYNAIKE] I saw a container ship today with a huge cloud of black smoke coming out of its smokestack. With LNG that would change. LNG will help protect the environment and raise the air quality for people in harbour cities like Hamburg.

[LINDE/BASF]

2 TEAMS  
+  
1 IDEA  
=  
NEW  
ENERGY

INNOVATIVE DRIVE

SCIENTISTS FROM LINDE AND BASF ARE ENGAGED IN A JOINT RESEARCH PROJECT TO GENERATE A FUEL FOR THE FUTURE. THIS INVOLVES DEVELOPING A PRODUCTION PROCESS THAT PROMISES TO BE MORE ENVIRONMENTALLY FRIENDLY AND COST-EFFECTIVE THAN OTHER TECHNOLOGIES NOW AVAILABLE.

LINDE [PULLACH/GERMANY]  
BASF [LUDWIGSHAFEN/GERMANY]



[ FACTS ]



*PROJECT MANAGER  
LINDE ENGINEERING*

*/  
DR HARALD SCHMADERER*

» FOR ME, THE MAIN APPEAL OF THIS COLLABORATIVE VENTURE IS THE FACT THAT IT IS SIMPLY THE PERFECT FIT. IT IS THE IDEAL BLEND OF PARTNER EXPERTISE.«

**LINDE  
PULLACH**

*RESPONSIBLE FOR  
/  
PROCESS  
ENGINEERING*

**LINDE  
+  
BASF**

*LINDE AND BASF  
PROJECT FOR  
DME SYNTHESIS*

*/  
START  
2012*

*PROJECT STAGE  
2013*

*CURRENT STATUS  
TOTAL HYDROCARBON  
COMPOUNDS MARKET:  
200 MILLION TONNES  
DME SHARE:  
10 MILLION TONNES*

*POTENTIAL BY 2020  
DME SHARE:  
20 MILLION TONNES*



*HEAD OF CATALYSIS  
FOR SYNGAS PRODUCTION  
AND PROCESSING  
BASF*

*/  
DR EKKEHARD SCHWAB*

» IT QUICKLY BECAME APPARENT THAT BASF AND LINDE WERE HEADING IN SIMILAR DIRECTIONS.«

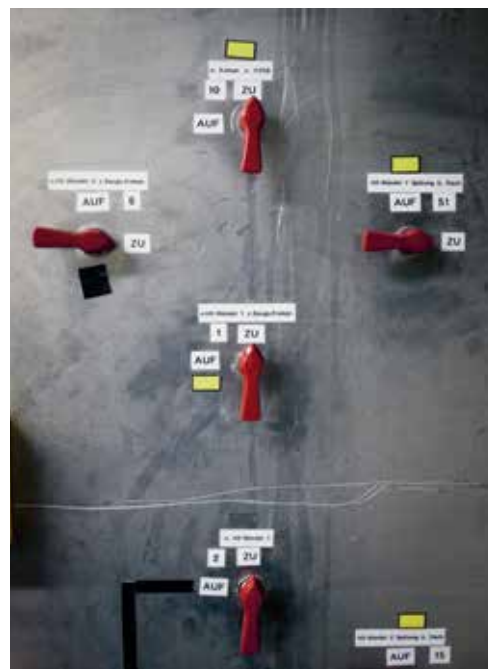
**BASF  
LUDWIGSHAFEN**

*RESPONSIBLE FOR  
/  
CATALYST  
DEVELOPMENT*

[ TEST PHASE AT LINDE ]



LED BY DR HARALD SCHMADERER (BELOW), THE LINDE TEAM IS OPTIMISING THE TEST LAB SET-UP



## [ PROJECT OVERVIEW ]

The smallest details speak volumes about the success of a partnership. Details such as how and when a partnership came into being. When asked who took the first step in the partnership between Linde and BASF, for instance, Dr Nicole Schödel, Head of Chemical Development & Services at Linde, explains that “Both companies were independently following comparable approaches – the alliance simply fits.” Ultimately, the cooperation between Linde’s chemical process engineers and BASF’s catalysis experts evolved naturally through a dynamic of its own. Under a development project supported by the German Federal Ministry of Education and Research, the two companies – in collaboration with the AG Heidelberg, Technische Universität München (TUM), MPI für Kohlenforschung Mülheim and Fraunhofer UMSICHT – are working to manufacture the liquid gas dimethyl ether (DME) from carbon monoxide and hydrogen. As a fuel, DME is considered an environmentally aware alternative to conventional diesel and can also be used in petrochemical processes.

Particularly given the limited reserves of fossil fuels, experts view DME as an energy carrier with huge potential. Dr Harald Schmaderer, leading the project for Linde, estimates that DME will become increasingly important in the fast-growing market for alternative fuels, with annual production volume doubling from the current 10 million tonnes or so to around 20 million tonnes by 2020.

The present partnership was inspired by a research project launched by the two companies in 2010. It involves dry reforming methane and carbon dioxide to generate a synthesis gas mixture containing carbon monoxide and hydrogen, which now form the basis of DME production.

THIS NEW FUEL CAN BE USED  
AS A GREEN ALTERNATIVE TO DIESEL AND IN  
PETROCHEMICAL PRODUCTION PROCESSES.

To achieve their ambitious economically viable manufacturing goals, the Linde and BASF experts are working in parallel: while BASF develops the catalyst to accelerate the chemical reaction, Linde is already devising the enabling production process. However, “This approach is actually quite rare,” highlights Schmaderer. Usually, he explains, you would start with a catalyst and then develop the corresponding process. “That’s why it’s so important to stay in constant contact with each other. We need to be always up to speed so we can supply our colleagues with the data they need at any given time.” Any decision taken by one team affects the other.

These closely dovetailed workstreams are succeeding because the people behind the project know, appreciate and trust each other. “BASF has a wealth of expertise in producing catalysts,” confirms Schödel. Dr Ekkehard Schwab, Head of the Catalysis for Syngas Production and Processing research group at BASF, adds: “We appreciate Linde’s impressive technology and engineering know-how – but the crucial success factor is the open and constructive working environment.”

With all this in place, the successful development and commercialisation of DME synthesis technology should only be a matter of time. Even though the fuel markets, in particular, qualify for different subsidies from region to region and are subject to political developments that are sometimes difficult to predict, the potential of this clean energy carrier is self-evident. This has already been demonstrated by initial pilot projects in Japan and Sweden that successfully harnessed DME as a fuel. In conjunction with dry reforming, a production process could even emerge using both harmful waste gases from coal-fired power plants and biomass as feedstock. This would be cleaner and more cost-efficient than all the other DME-generating technologies currently available – and a major success for the whole research partnership.



[AQUACULTURE]

# FRESH FISH

FISH IS THE NUMBER-ONE SOURCE OF PROTEIN IN THE WORLD. SO AS THE GLOBAL POPULATION EXPANDS, FISH FARMING IS ALSO GROWING IN IMPORTANCE. AT LINDE'S RESEARCH CENTRE IN ÅLESUND, NORWAY, EXPERTS ARE BUSY DEVELOPING OXYGENATION SYSTEMS FOR NEXT-GENERATION WATER TANKS – WITH THE AIM OF SUPPORTING ONSHORE AQUACULTURE.

INNOVATION CENTRE  
[ÅLESUND/NORWAY]



LINDE'S PATENTED SOLVOX® OXYSTREAM TECHNOLOGY IS AN EFFICIENT, ENERGY-SAVING SYSTEM THAT PROVIDES FISH WITH THE OXYGEN THEY NEED TO THRIVE.



*INNOVATIVE DRIVE*

THE RECENTLY OPENED RESEARCH CENTRE IN THE NORWEGIAN TOWN OF ÅLESUND  
WILL ALSO BE USED FOR EMPLOYEE TRAINING.



#### FISH FARMING

The print on packaged supermarket salmon may be small, but the message is big – “farmed fish originating from Norway.” And that small label conveys huge progress in aquaculture – a fast-growing market which is invisible to most consumers. Linde already holds a strong position in this promising segment. Aquaculture is now expanding by six to eight percent each year and experts view it as an important tool in the fight to combat world hunger.

Natural reserves alone have long since been unable to meet global demand for fish. Marine catches have been stagnant since the 1980s, with many stocks depleted or overfished. Fish farms are the alternative. However, increased demand also raises the bar for scale and operating efficiency. Open-water facilities, in particular, are hitting their limits. This farming method accounted for around half the 128 million tonnes of fish available for human consumption worldwide in 2012. However, fish reared in offshore farms tend to be more susceptible to disease. They are easily infected by germs from their surroundings and can also pass on illnesses to wild fish outside the enclosures. So the future of fish farming lies on shore.

#### SOLVOX® OXYSTREAM

Launched last year, Linde’s solvox®OxyStream process technology enables cost- and energy-efficient oxygenation of water tanks in inland fish farms. The company has also opened its own innovation centre in Ålesund, Norway – the world’s technology leader in fish farming. Here, Linde offers both internal and external training and conducts its own research.

The centre allows employees to test how oxygen is distributed through water containing 500 fish per cubic metre, for instance, or what kind of current is needed to create a slight schooling effect among salmon, as though they were hovering in the water – thus mimicking their natural habitat.

#### CLOSE TO CUSTOMERS

Even more importantly, the new centre enables Linde to work with the world’s largest fish farmers on ongoing improvements to tank oxygenation. “Together with our customers, we are developing new solutions here to make the oxygen supply even more energy-efficient,” explains Dr Stefan Dullstein, Head of Industrial Segment Aquaculture & Water Treatment at Linde. “Normally, pressure of one to two bar is required to force the oxygen into the water,” continues the experienced process engineer, “but our system works with just 0.2 bar. Every millibar less conserves resources and lowers costs for our customers.” With Linde’s innovative solution, a low-pressure stream of tiny bubbles is released through nozzles set into a curved plastic tube, distributing the oxygen evenly throughout the tank.

Linde’s aim is to apply findings from the Norwegian research centre to various different fish types, waters and temperatures, ensuring the company can offer solutions tailored to the needs of its customers – whether in Scotland, Australia or Chile.

#### THE FUTURE

Marine Harvest, one of the world’s largest fish producers and a Linde customer, is already developing next-generation aquaculture projects. One plan is to build covered pools of up to 40 metres in diameter at a disused quarry near the Norwegian coast, meaning salmon could then be farmed on shore throughout their entire lifecycle. At its Ålesund centre, Linde is already working on the necessary technology to provide environmentally friendly and cost-effective oxygenation for the super-sized tanks.

INNOVATIVE DRIVE

LINDE HAS ESTABLISHED ITSELF IN NORWAY, AT THE HEART OF GLOBAL AQUACULTURE. WORKING WITH CUSTOMERS, LINDE EXPERTS ARE DEVELOPING NEW TECHNOLOGIES FOR THIS GROWTH MARKET.







THE TANKS SIMULATE THE NATURAL CONDITIONS THAT FISH SUCH AS SALMON OR COD WOULD EXPERIENCE IN DIFFERENT TYPES OF WATERS.

[CUSTOMERS]

» WHAT DO YOU RATE MOST ABOUT LINDE? «

FIVE CUSTOMERS NAME THE KEY FACTORS THAT  
DEFINE SUCCESSFUL COLLABORATION.

[BERGEN/NORWAY]

# Pioneering

CATO LINGØY [HEAD OF TECHNOLOGY AND THE ENVIRONMENT, MARINE HARVEST]

»It is reassuring to know that Linde is always a step ahead when it comes to pushing the technical boundaries. Partnering with the innovation leader gives us a clear advantage.«

[CASTRES / FRANCE]

DETERMINATION



# Responsiveness

ALAIN GOURC [TECHNICAL DIRECTOR, CENTRE HOSPITALIER INTERCOMMUNAL]

»Medical gases are constantly subject to new standards and regulations. With Linde, we have a trusted partner at our side who can respond with exceptional speed to new and evolving needs.«

[ C U M M I N G / U S A ]



# Reliability

JAMES C. MACIAS [PLANT MANAGER, KOCH FOODS INC.]

»We picked Linde because the company offers all the technology we need – at a fair price.  
Having been a customer for 14 years, we know we can rely on Linde.«



[SHANGHAI/CHINA]

DETERMINATION

# Partnership

AN JILIN [HEAD OF SURFACE MOUNT DEVICE DIVISION, KYOCERA ELECTRONICS CO LTD]

»We have been working closely with Linde for ten years now. We look forward to growing together and deepening our partnership in the future.«

[ MUTTENZ / SWITZERLAND ]



RENAUD SPITZ [COUNTRY HEAD SWITZERLAND, CLARIANT PRODUCTS]

» Linde has years of experience in the supply of high-quality industrial gases and backs this up with excellent service. The company's decision to set up operations in the Infrapark Baselland industrial park is a key success factor in the ongoing development of this chemicals hub. «

DETERMINATION

LINDE IS FIRMLY  
ON THE PATH TO BECOMING AN  
EXCELLENT ORGANISATION.

AGILITY – EFFICIENCY – INNOVATIVE DRIVE



# Further Information

REVIEW OF THE YEAR / IMPRINT

## JANUARY

[ 1 / 1 ]

Linde signs an agreement to acquire the Continental European homecare business of the gases company Air Products at enterprise value of EUR 590 m. The transaction comprises Air Products' homecare operations in Belgium, France, Germany, Portugal and Spain. The Group is laying good foundations for the development of new treatment methods and care plans.

[ 2 / 1 ]

Linde launches GENIE®, its groundbreaking cylinder range. The Group has developed the first cylinder of its type for

compressed gas (300 bar) made from sustainable high-tech materials. The cylinder comes in three sizes. With its compact dimensions and extremely low weight, the system presents opportunities for new applications in various fields: in welding, boiling and the carbonation of drinks, and in numerous processes in the research laboratory.

## FEBRUARY

[ 1 / 2 ]

Linde concludes a major on-site contract in New Zealand with the steel-producer New Zealand Steel. The agreement comprises a new air separation unit (ASU) and the installation of gas supply systems. In addition to supplying air gases

to the steelworks, the ASU will also produce large quantities of liquefied oxygen, nitrogen and argon for the regional market in New Zealand.

[ 2 / 2 ]

Linde and the Hamburg Port Authority are looking to advance the use of liquefied natural gas (LNG) as an environmentally friendly fuel in the port of Hamburg. The aim is to conduct an extensive feasibility study there on the cost-effective use of LNG. The two organisations want to promote LNG as an alternative fuel for ships and for other applications, such as trucks.

# REVIEW OF THE YEAR

[ 2 0 1 2 ]

## MARCH

[ 1 / 3 ]

Linde is to supply gases to the chemical company Dahua Group at its site on Songmu Island in Dalian in north-eastern China. Under this EUR 70 m on-site contract, Linde will acquire two existing air separation units (ASUs) from the customer in Dalian and assume their operation. In addition, Linde's Engineering Division will construct a new ASU on the site with a production capacity of 38,000 normal cubic metres of oxygen per hour.

[ 2 / 3 ]

The Chinese LED manufacturer Kaistar is expanding the scope of its existing gas supply contract with Linde. Under the new agreement, Linde will supply the company with liquefied gases and high-purity ammonia on its production site in Xiamen, China. Kaistar requires the high-purity ammonia for the manufacture of high-grade LED devices.

## APRIL

[ 1 / 4 ]

Linde is to invest around USD 380 m to provide Sadara Petrochemical Company with long-term supplies of carbon monoxide, hydrogen and ammonia at its site in Jubail, Saudi Arabia. Linde expects this major project at one of the world's largest chemical complexes to generate considerable momentum for the

continuing expansion of its gases and engineering businesses in the Near and Middle East.

[ 2 / 4 ]

tüv süd certifies the hydrogen generated from biodiesel by-products at Linde's pilot plant in Leuna, Germany. This is another milestone in Linde's journey to produce hydrogen from sustainable sources.

## M A Y

[ 1 / 5 ]

Linde is to supply electronic gases to Samsung Electronics for its newest TFT-LCD factory in the Suzhou Industrial Park in China. It will invest around EUR 50 m in the project, which involves the construction of a turnkey liquefied gas supply system. Linde will also build a new nitrogen generator for Samsung, supplying nitrogen to the company via a pipeline. This project will strengthen Linde's position as a leading producer of gases for the TFT-LCD industry.

## J U N E

[ 1 / 6 ]

Linde, the German Ministry of Transport and other industrial partners sign a joint declaration of intent to expand the hydrogen filling station network in Germany. According to this declaration, there will be at least 50 public hydrogen filling stations in Germany by 2015. Already pioneers in this field, Linde and Daimler agreed back in summer 2011 to build 20 hydrogen filling stations in Germany over the coming years.

## J U L Y

[ 1 / 7 ]

Linde announces its acquisition of us-based homecare company Lincare Holdings Inc. In view of demographic changes, the healthcare market is a global megatrend, in which Linde will be able to participate to an even greater extent in its new set-up. Lincare, a market leader in the us, provides Linde with the ideal platform to roll out its innovative products and services (which are already very successful, particularly in Europe) into the us, the world's largest healthcare market.

[ 2 / 7 ]

Linde is to build two large air separation units (ASUs) for Tata Steel Limited, one of the world's largest steel companies, at its site in the Kalinganagar industrial complex in Odisha, India. Around EUR 80 m will be invested in the project. This investment will enable Linde to strengthen its position as a leading supplier of gases in the growth market of India.

[ 3 / 7 ]

Linde AG successfully concludes a capital increase with exclusion of subscription rights. The capital increase is one component of the financing of its prospective acquisition of Lincare Holdings Inc. This capital measure raises proceeds of around EUR 1.4 bn. The new shares are fully entitled to dividend for the 2012 financial year.

## A U G U S T

[ 1 / 8 ]

Linde forms a joint venture with Bomin, one of the leading suppliers of shipping fuels, to create an LNG infrastructure for shipping in north-western Europe. The aim of the new joint venture is to establish a reliable LNG supply chain to provide a safe and environmentally friendly fuel to ship owners and ship operators.

[ 2 / 8 ]

Linde is to provide long-term supplies of industrial gases to the Vietnamese steel-producer posco ss-Vina. To do so, it will build the largest air separation unit in the country in the Phu My Industrial Park in Ba Ria, Vung Tau province. The proposed investment is around EUR 40 m. With the largest single investment it has ever made in Vietnam, Linde will strengthen its position in this rapidly growing South-East Asian economy.

[ 3 / 8 ]

Linde completes the acquisition of Lincare Holdings Inc. Lincare becomes an indirect wholly-owned Linde subsidiary. Prior to this, Linde had completed the tender offer for Lincare within the specified time.

## S E P T E M B E R

[ 1 / 9 ]

Linde AG is added to the global Dow Jones Sustainability Index (DJSI World) in acknowledgement of continued progress in its sustainability performance. Analysts at the Sustainable Asset Management Group recognised in particular The Linde Group's activities in the areas of climate change strategy, environmental management systems, and risk and crisis management. The internationally renowned share index for sustainability performance selects the top 10 percent of companies for sustainability from the 2,500 largest companies listed on the Dow Jones Global Index.

## O C T O B E R

[ 1 / 10 ]

omv opens the first public hydrogen filling station in Austria, a turnkey construction by Linde for the company. This will make it possible to operate emission-free hydrogen-powered fuel-cell vehicles in Vienna.

[ 2 / 10 ]

The new Fraunhofer Centre for Chemical-Biotechnological Processes (CBP) in Leuna is opened. As the main contractor, Linde was responsible for engineering the process units, and for the supporting infrastructure and necessary media and utilities. The aim of the CBP is to upscale innovative biotechnological and chemical processes to an industrial level to enable companies to manufacture basic chemical products from renewable raw materials.

## N O V E M B E R

[ 1 / 11 ]

Linde is to build a mid-scale natural gas liquefaction plant for Malaysia LNG Sdn. Bhd., a subsidiary of Malaysia's state-owned oil and gas company PETRONAS. The new boil-off gas reliquefaction facility has a maximum design capacity of 1,840 tonnes of liquefied natural gas per day and will be located in the Bintulu LNG complex in Sarawak, East Malaysia.

[ 2 / 11 ]

Linde is commissioned by the Norwegian company Skangass AS to build a mid-scale import terminal for liquefied natural gas. The LNG terminal will be located at Lysekil on the west coast of Sweden, 100 kilometres north of Gothenburg. The engineering, procurement, construction and installation (EPCI) contract is worth around EUR 44 m.

## D E C E M B E R

[ 1 / 12 ]

Linde signs an agreement to acquire the homecare company Calea France SAS, Sèvres, France. The company generated revenue in the 2011 financial year of EUR 28 m with around 200 employees. Calea will complement the European homecare operations acquired by Linde in the spring from Air Products. This acquisition will significantly improve the Group's position in the French homecare market.

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The Linde Annual and the Financial Report of The Linde Group are available in both German and English and can also be downloaded from our website at [www.linde.com](http://www.linde.com). In addition, an interactive online version of the Annual Report, comprising the Financial Report of The Linde Group and The Linde Annual, is available at this address. Supplementary information about Linde can be obtained from us free of charge



