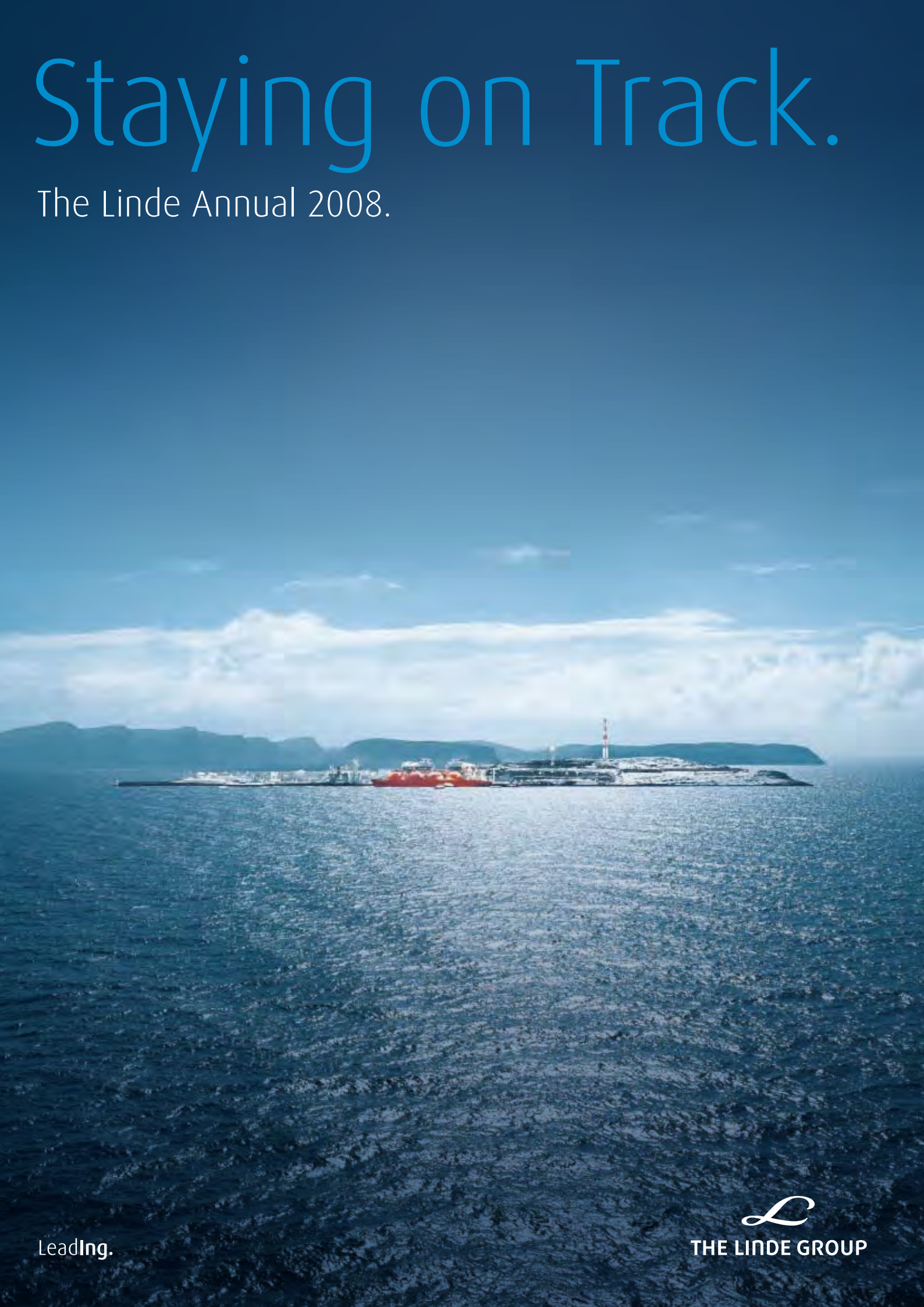


Staying on Track.

The Linde Annual 2008.



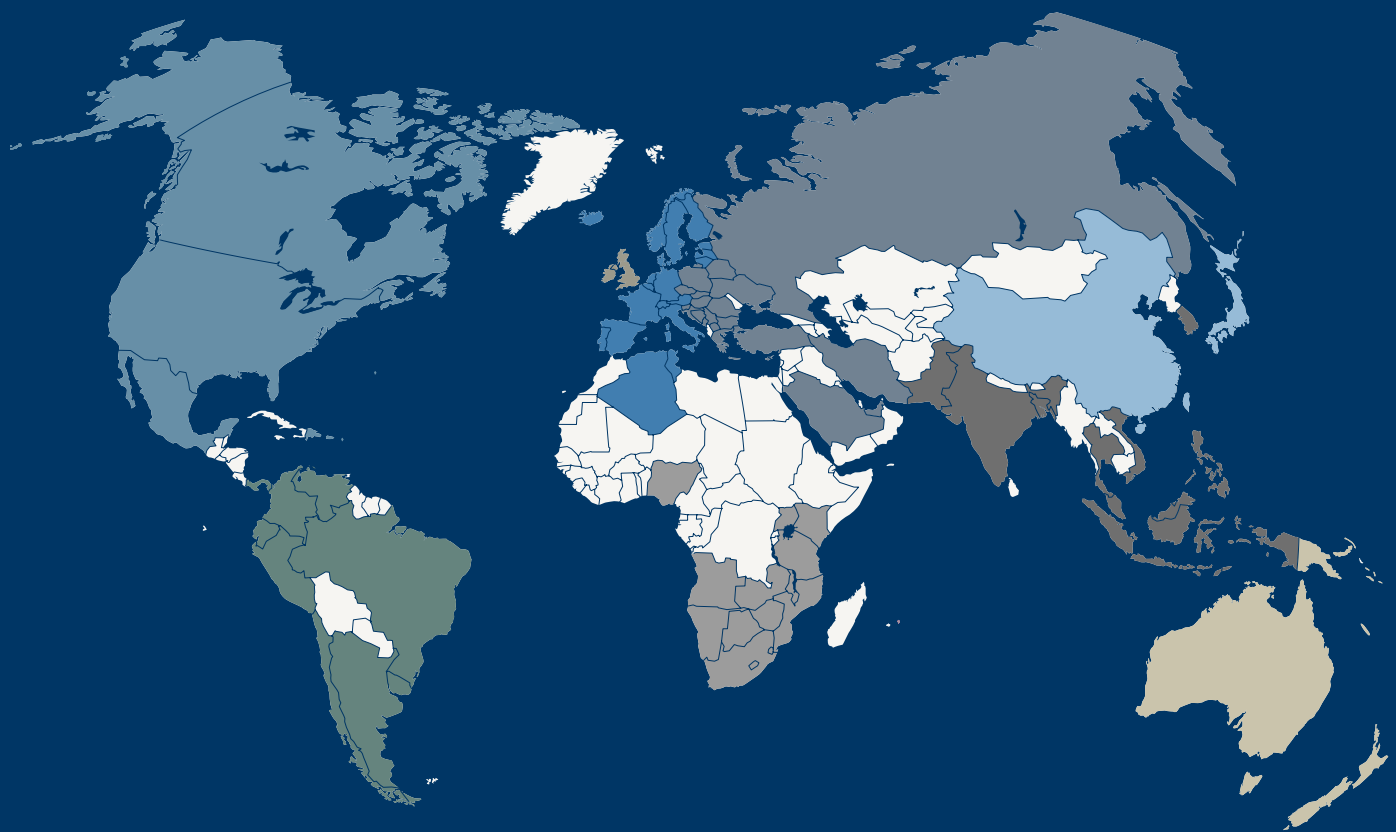
Leading.



THE LINDE GROUP

The Linde world

The Regional Business Units of the Gases Division: The Gases Division has four operating segments – Western Europe, the Americas, Asia & Eastern Europe, and South Pacific & Africa – which are subdivided into nine Regional Business Units (RBUs). The Gases Division also includes two Global Business Units (GBUs) – Healthcare (medical gases) and Tonnage (on-site) – and two Business Areas (BAs) – Merchant & Packaged Gases (liquefied and cylinder gases) and Electronics (electronic gases).



- North America
- South America
- UK & Ireland
- Continental & Northern Europe
- Eastern Europe & Middle East
- Africa
- South & East Asia
- Greater China
- South Pacific

Corporate profile

The Linde Group

The Linde Group is a world leading gases and engineering company with almost 52,000 employees working in around 100 countries worldwide. In the 2008 financial year, it achieved sales of EUR 12.663bn. The strategy of The Linde Group is geared towards sustainable earnings-based 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. Linde 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 four operating segments, Western Europe, the Americas, Asia & Eastern Europe, and South Pacific & Africa, which are subdivided into nine Regional Business Units (RBUs). The Gases Division also includes the two Global Business Units (GBUs) – Healthcare (medical gases) and Tonnage (on-site) – and the two Business Areas (BAs) – Merchant & Packaged Gases (liquefied and cylinder gases) and Electronics (electronic gases).

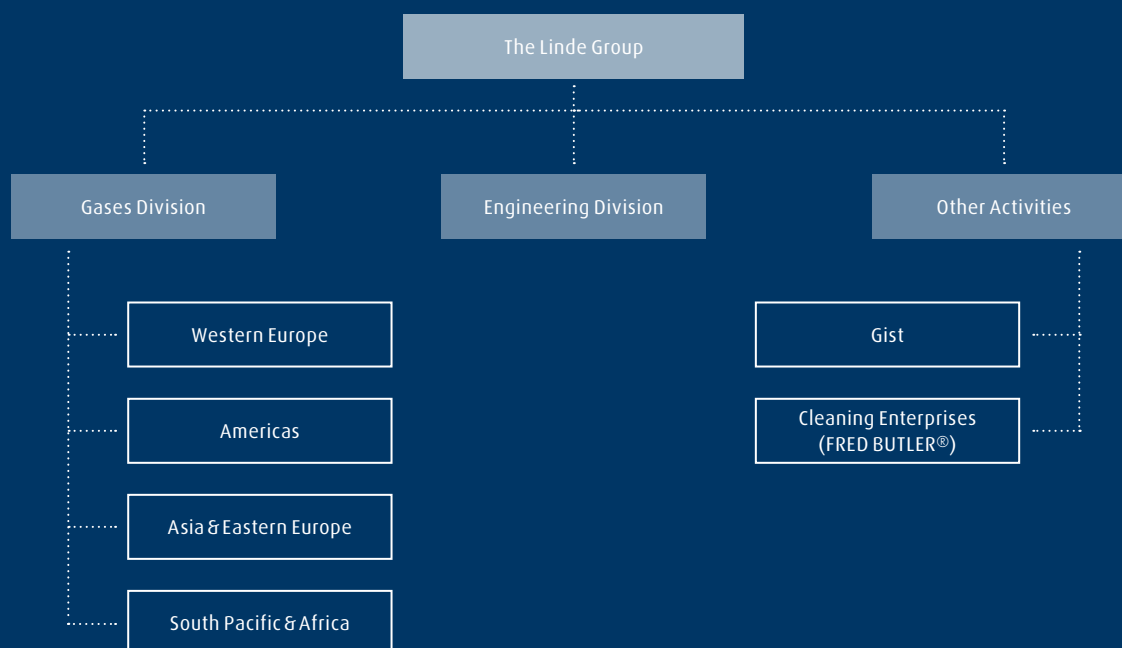
Gases Division

The Linde Group is a world leader in the international gases market. We offer a wide range of compressed and liquefied gases as well as chemicals and we are therefore an important and reliable partner for a huge variety of industries. Our gases are used, for example, in the energy sector, in steel production, chemical processing, environmental protection and welding, as well as in food processing, glass production and electronics. We are also investing in the expansion of our fast-growing Healthcare business, i.e. medical gases, and we are a leading global player in the development of environmentally friendly hydrogen technology.

Engineering Division

Our Engineering Division is successful throughout the world, with its focus on promising market segments such as olefin plants, natural gas plants and air separation plants, as well as hydrogen and synthesis gas plants. In contrast to virtually all our competitors, we are able to call on our 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.

Organisational structure



Linde financial highlights

in € million	January to December 2008	2007	Change (in percent)
Share			
Closing price	€ 59.85	90.45	-33.8
Year high	€ 97.90	91.75	6.7
Year low	€ 46.51	75.26	-38.2
Market capitalisation (at year-end closing price)	10,084	15,046	-33.0
Adjusted earnings per share¹	€ 5.46	5.02	8.8
Earnings per share	€ 4.27	5.87	-27.2
Number of shares outstanding (in 000s)	168,492	166,347	1.3
Sales	12,663	12,306	2.9
Operating profit²	2,555	2,424	5.4
EBIT before amortisation of fair value adjustments and non-recurring items	1,703	1,591	7.0
Earnings after taxes on income	776	1,013	-23.4
Number of employees	51,908	50,485	2.8
Gases Division			
Sales	9,515	9,209	3.3
Operating profit	2,417	2,314	4.5
Engineering Division			
Sales	3,016	2,750	9.7
Operating profit	267	240	11.3

¹ Adjusted for the effects of the purchase price allocation and non-recurring items.

² EBITDA before non-recurring items including share of income from associates and joint ventures.

Staying on Track.

Our stable foundation allows us to remain competitive even in economically challenging times. We have a solid business model coupled with a global footprint and a strong market position – especially in emerging markets. In addition, we benefit from the wide-ranging synergies between our Engineering and Gases Divisions and are ideally equipped to capitalise on the global megatrends in healthcare and energy.

Step by step, we are also turning Linde into a high performance organisation (HPO). This involves ongoing process optimisation and lasting efficiency gains within the company and will further strengthen our ability to weather stormy times.

In short, everything is in place to keep us on track as we move forward.





01

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02

52-37 INNOVATIONS Strong partner for the solar industry



03

38-51 GROWTH MARKETS Close to our customers, all around the world



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52-65 BROAD CUSTOMER BASE Serving a variety of industries



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66-79 SYNERGIES Tapping new markets together

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¹ Front cover.

² Back cover.



The Executive Board (from left to right): Dr Aldo Belloni, Georg Denoke, Professor Dr Wolfgang Reitzle, J. Kent Masters.

Foreword

Dear Stakeholders,

Figures tell us a lot about a company's financial performance. Just as important, however, are the facts behind the figures. In other words, the company's values and strengths, and the people who drive sustainable, successful growth. These are the pillars that create trust and will enable us to weather the storms that lie before us in 2009, and quite possibly beyond.

Our company is built on strong foundations. This solid basis, established over a number of years, enables us to remain competitive even in economically trying times. And we can back up this confident outlook with concrete examples. The best ones are showcased in this edition of the Linde Annual.

For example, we outline the synergies that exist between our Gases and Engineering Divisions. Our position as a technology leader in international plant engineering gives us a real competitive edge that we systematically use to our advantage. Over many years, the Engineering Division has established itself as a trustworthy partner, building an extensive network of business relationships in numerous countries, particularly in emerging markets. We are increasingly using these contacts to drive new business for our Gases Division.

Our confidence is also fuelled by a number of global megatrends from which we continue to profit. Growing demand for a sustainable, secure source of energy is just one example. Here, our products and processes are helping to make renewable sources of energy economically viable and cut fossil fuel consumption levels.

Stability is another key factor behind our excellent position in promising growth markets such as China. As the following example illustrates, the potential for growth in these economies is huge. In Western Europe, the annual per capita outlay for industrial gases totals USD 38. In China, this figure currently amounts to just USD 2. Furthermore, the acquisition of BOC has made us a true global player. We are now active in around 100 countries across the globe and enjoy a strong foothold in each of these markets.

Innovation is the engine that enables us to maintain our steady course. Thanks to our ongoing research and development activities, we can continually launch new gas applications for areas as diverse as healthcare and the photovoltaic industry. Our R&D experts are committed to developing new ideas – after all, we have only begun to unlock the true potential of industrial gases.

Our relative resistance to economic turbulence is further bolstered by our extensive product portfolio, serving customers from a wide range of industries. Naturally, we are also affected if, for example, fewer orders for welding gases are placed by customers in the automotive industry. Yet this has to be seen in the context of a diversified business base with segments such as the beverages industry, where demand for our gases remains at a stable high.

The world of Linde is an exciting place – which is why we are keen for you to take a closer look. But this is not the only reason. You also have the right to find out how well prepared we are to face what may well be the most serious economic crisis in decades. However, even the best strategies and business models will come to nothing without a dedicated workforce willing to do their utmost to realise these plans every single day.

We have set ourselves the clear goal of becoming an all-out high performance organisation (HPO). In other words, a company where everyone gives 100 percent and continuously strives for improvement. And where processes are examined and optimised whenever and wherever necessary. This approach will enable us to significantly drive efficiency and productivity levels over the coming years and further improve our overall competitive position. Although we can only present just a few of the people who are passionate about Linde in this edition of the Annual, you can rest assured that they represent the dedication and positive mindset of each and every member of our nearly 52,000-strong team.



Professor Dr Wolfgang Reitzle
Chief Executive Officer of Linde AG

Executive Board

Professor Dr Wolfgang Reitzle

Born 1949

Doctorate in Engineering (Dr.-Ing.)

Degree in Economics and Engineering

Chief Executive Officer

Responsible for Gist and the following global and central functions: Communications & Investor Relations, Corporate Strategy, Group Human Resources, Group Information Services, Group Legal, Innovation Management, Internal Audit, SHEQ (Safety, Health, Environment, Quality), Six Sigma

Member of the Executive Board since 2002

Dr Aldo Belloni

Born 1950

Doctorate in Chemical Engineering (Dr.-Ing.)

Responsible for the Engineering Division, the operating segments Western Europe and Asia & Eastern Europe, the Global Business Unit Tonnage (on-site) and the Business Area Electronics (electronic gases)

Member of the Executive Board since 2000

J. Kent Masters

Born 1960

BS Chemical Engineering, MBA Finance

Responsible for the operating segments Americas and South Pacific & Africa, the Global Business Unit Healthcare and the Business Area Merchant & Packaged Gases (liquefied and cylinder gases)

Member of the Executive Board since 2006

Georg Denoke

Born 1965

Degree in Information Science

Degree in Business Administration (BA)

Responsible for the following global and central functions: Capital Expenditure, Financial Control, Group Accounting & Reporting, Group Treasury, Growth & Performance, Mergers & Acquisitions, Procurement, Risk Management, Tax
Human Resources Director

Member of the Executive Board since 2006

Supervisory Board (As at 31 December 2008)

Members of the Supervisory Board

Dr Manfred Schneider

Chairman
Chairman of the Supervisory Board
of Bayer AG

Hans-Dieter Katte¹

Deputy Chairman
Chairman of the Pullach Works Council,
Engineering Division, Linde AG

Michael Diekmann

Second Deputy Chairman
Chairman of the Board of Management
of Allianz SE

Dr Gerhard Beiten

Lawyer

Dr Clemens Börsig

Chairman of the Supervisory Board
of Deutsche Bank AG

Gernot Hahl¹

Chairman of the Worms Works Council,
Gases Division, Linde AG

Thilo Kämmerer¹

Trade Union Secretary on the Executive
Board of IG Metall Frankfurt

Matthew F. C. Miao

(appointed on 3 June 2008)
Chairman of the MiTAC-SYNNEX Group,
Taiwan

Klaus-Peter Müller

Chairman of the Board of Managing Directors
of Commerzbank AG

Jens Riedel¹

Chairman of the Leuna Works Council,
Gases Division, Linde AG

Xaver Schmidt¹

(appointed on 8 September 2008)
Trade Union Secretary on the Executive
Board of IG Bergbau, Chemie, Energie,
Hanover

Josef Schregle¹

Manager responsible for Finance and Finan-
cial Control, Engineering Division, Linde AG

Supervisory Board committees (Members as at 31 December 2008)

**Mediation Committee in accordance with
§ 27(3) of the German Codetermination
Law (MitbestG)**

Dr Manfred Schneider
(Chairman)

Hans-Dieter Katte¹
Michael Diekmann
Gernot Hahl¹

Standing Committee

Dr Manfred Schneider
(Chairman)

Hans-Dieter Katte¹
Michael Diekmann
Gernot Hahl¹
Klaus-Peter Müller

Audit Committee

Dr Clemens Börsig
(Chairman)

Gernot Hahl¹
Hans-Dieter Katte¹
Klaus-Peter Müller
Dr Manfred Schneider

Nomination Committee

Dr Manfred Schneider
(Chairman)

Michael Diekmann
Klaus-Peter Müller

The following members retired from the Supervisory Board in the 2008 financial year

Dr Karl-Hermann Baumann

(retired on 3 June 2008)
Former Chairman of the Supervisory
Board of Siemens AG

Siegfried Friebel¹

(retired on 3 June 2008)
Chairwoman of the Works Council
of Linde-KCA-Dresden GmbH

Gerhard Full

(retired on 3 June 2008)
Former Chairman of the Executive Board
of Linde AG

Josef Schuhbeck¹

(retired on 3 June 2008)
Chairman of the Schalchen Works Council,
Engineering Division, Linde AG

Professor Dr Jürgen Strube

(retired on 3 June 2008)
Chairman of the Supervisory Board
of BASF SE

Wilfried Woller¹

(retired on 31 August 2008)
Member of the Managerial Board
responsible for management sector 5,
IG Bergbau, Chemie, Energie²

¹ Employee representative.

² Until 31 July 2008.

01



Megatrends

A reliable supply of energy is crucial for economic growth. This is especially evident in emerging economies such as China, India or Brazil, where energy consumption is increasing at a particularly rapid rate. At the same time, however, fossil-fuel-based greenhouse gases such as carbon dioxide (CO₂) are continuing to exacerbate global warming. Consequently, one of the greatest challenges of the 21st century lies in meeting increasing energy needs while significantly reducing greenhouse gas emissions. This global megatrend towards a low-carbon economy represents a massive growth opportunity for Linde, as our technologies and processes can help align these seemingly conflicting objectives. Our natural gas liquefaction plant at Hammerfest, Norway, is a prominent example of our activities in this area.

Cold gas in a cold climate – the Arctic Princess LNG tanker docked at the natural gas liquefaction plant on the Melkøya peninsula off Hammerfest. Here the gas, cooled to -163 °C, is pumped into three spherical tanks and transported to customers in France, Spain and the US – without having to pipe it through politically unstable countries. Just one example of Linde's contribution to securing global energy supplies.



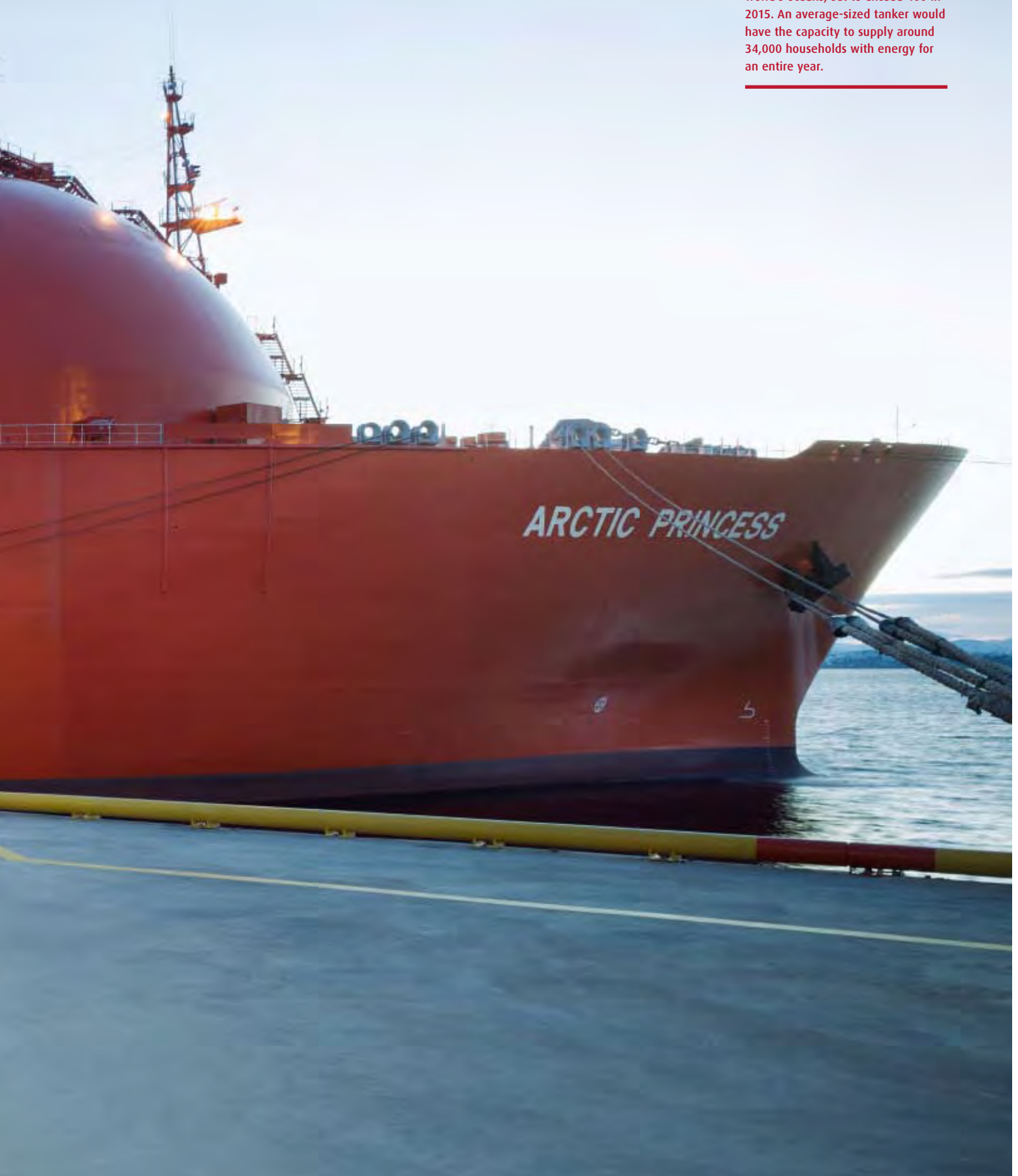
Tapping natural gas reserves in far-flung regions with extreme environmental conditions poses major technical challenges. Transporting the gas to customers is one of them, and this involves liquefaction. This major gas liquefaction plant designed and built by Linde Engineering in northern Norway is our pioneering response to these challenges.







Loading the Arctic Princess—12,000 m³ of liquid gas flows into the tanks per hour. This was the first LNG tanker to leave the Hammerfest plant, setting sail in October 2007 with 145,000 m³ of liquid gas on board. There are currently around 280 LNG tankers on the world's oceans, set to exceed 400 in 2015. An average-sized tanker would have the capacity to supply around 34,000 households with energy for an entire year.



Situated far from the capital, Oslo, Hammerfest is Europe's northernmost city. The LNG plant (visible in the background on the right) is a key pillar of the local economy.





Megatrends. Pioneering work north of the Arctic Circle.

01

Liquefied natural gas (LNG – see glossary) is already a key enabler in the drive to secure a clean supply of future energy. Demand is set to remain on its current above-average growth path, pushing the search for natural gas fields into ever more isolated regions with extreme environmental challenges. The major LNG plant built by Linde on the island of Melkøya near Hammerfest, Europe’s most northerly city, is a prime example of how projects of this kind can bring both economic and ecological benefits.

Economic growth is intrinsically linked to increased energy consumption – an equation seemingly at complete odds with the need to reduce global emissions of greenhouse gases such as CO₂ by 50 percent. We can only hope to reconcile these conflicting objectives by implementing complementary strategies. On the one hand, state-of-the-art technologies must be deployed to minimise greenhouse gas emissions resulting from electricity and heat generated from the world’s limited fossil fuel reserves. On the other hand, we must also focus on generating energy from all renewable resources available to us.

To ensure that increasing prosperity – particularly in developing and emerging economies such as China, India or Brazil – does not lead to serious or even irreversible damage to the climate and environment, industrialised countries must significantly raise energy efficiency levels and continue to cut emissions of harmful gases. At the same time, however, countries around the globe must have access to secure energy supplies. The key lies in an intelligent mix of fossil fuels and regenerative energy sources that aligns today’s economic demands with the current ecological challenges.

The Linde Group is stepping up to the table with cutting-edge plants and innovative processes that span all facets of energy production:

- Together with our industry partners, we develop technologies that enable CO₂ in the flue gases from coal-fired power plants to be separated and stored safely and indefinitely in layers of rock far below the earth’s surface.
 - We equip crude oil refineries with hydrogen production systems to purify and desulphurise the fuel. Linde also delivers CO₂ and nitrogen for efficient crude oil extraction. These gases can be used to extract significantly more oil from deposits than can be achieved with water pressure alone.
 - Our natural gas purification and liquefaction plants are crucial in making natural gas reserves economically viable – even in remote locations such as the Barents Sea – and ensuring that LNG can be transported by gas tanker to customers around the globe.
- Linde delivers the purification and liquefaction technologies required to generate electricity, heat and fuel from biogas that accumulates at landfill sites.
 - As a leading producer of hydrogen (H₂) and a pioneer in the further development of hydrogen technology, we are committed to pushing this environmentally friendly energy carrier as an alternative fuel. We are helping to set up a network of H₂ filling stations and are also focussing our efforts on the large-scale generation of hydrogen from regenerative energy sources.
 - Linde provides the purification and process gases required to manufacture solar cells. Our subsidiary Bertrams Heatec AG also engineers plants that store heat from energy generated in thermal solar power plants.

Bright future for natural gas

Natural gas is already an important source of energy and is set to play an increasingly significant role in the near future. At current consumption levels, experts predict that global reserves of this comparatively clean energy carrier should last at least another 150 years. In comparison, crude oil reserves are expected to dry up within the next 40 years.

However, many gas fields are located in remote regions such as beneath the Arctic Ocean. These fields are difficult to access and pipeline transport is economically and technically unviable. Pipelines are regarded as unprofitable for distances in excess of 3,000 kilometres. This problem is compounded by the fact that pipelines often have to run through politically unstable regions where a long-term secure supply simply cannot be guaranteed.

All of which makes shipping natural gas in tankers a reliable alternative to pipelines, especially as liquefied gas has 60 times less volume than its gaseous equivalent, making it a compact product to transport.

Europe’s largest LNG plant

This backdrop also played a major role in the strategic course taken by Norwegian energy company StatoilHydro following the discovery of natural gas deposits in the Barents Sea. The energy provider decided to pipe gas 140 kilometres from its Snøhvit seabed field to the island of Melkøya, off the coast of Hammerfest, where it could then be liquefied at Europe’s largest LNG plant, 600 kilometres north of the Arctic Circle. The gas, cooled to –163 °C and mainly comprising liquid methane, is then transported by tanker to customers in the US, France and Spain.

Headed by Statoil, the Snøhvit consortium commissioned Linde's Engineering Division with the engineering, procurement and supervision of this plant; a first for the company in a number of ways. The sheer size of the plant was not the only issue at stake – Linde had never before delivered a plant on this scale. Environment was also a crucial factor – at the start of the project, neither party could accurately assess the exact challenges this particular climate and remote location would involve.

Pioneering project

The first challenges soon became apparent during the engineering and assembly planning phases. Due to the extreme climate in the north of Norway, the most important plant components had to be preassembled in more southerly regions. To this end, a steel barge measuring 154 metres long and 54 metres wide, with a nine-metre-high hull was constructed in Cádiz, southern Spain. The majority of the plant's building blocks – some manufactured in France and Italy – were then loaded across multiple decks of this vessel.

Once the 30-metre-high plant structure was mounted and made sea-worthy, the vessel and its 35,000-tonne cargo set off on the journey of 2,700 sea miles (almost 5,000 kilometres) to Hammerfest. Upon arrival in northern Norway, tugs and two strong winches were used to manoeuvre the barge into a specially made dock on the island of Melkøya. It was then lowered onto concrete plinths, while the dock was emptied of water and filled with gravel.

Liquefaction involves cooling natural gas from +40°C to -163°C in a cold box (see glossary). The cold box at the heart of the Melkøya LNG facility is a 62-metre-high unit, which was preassembled and shipped by sea from Antwerp ahead of the barge.

Before the natural gas is cooled in the heat exchangers, it must be purified of water, condensates, glycol, mercury and CO₂ in several stages. To protect the environment, the captured CO₂ is compressed and piped back into separate reservoirs under the ocean floor.

Dramatic increase in demand for LNG

After a construction, assembly and test phase of around six years, the plant is now running at full capacity. It is scheduled to ramp up to full output in 2009, producing around six billion cubic metres of liquid natural gas each year for an expected 30 years to come.

Statoil and the entire Snøhvit consortium see huge growth potential for this market, making their initial EUR 7.5bn outlay on the island of Melkøya a worthwhile investment.

According to the International Energy Agency (IEA) in Paris, global demand for natural gas is expected to increase by 3.5 percent each year until 2020, when it will account for one quarter of energy consumption worldwide. LNG currently accounts for around one third of all natural gas traded. The International Group of Liquefied Natural Gas Importers (GIIGNL) predicts that this figure will increase to over 50 percent by 2030. Supplies from the Barents Sea will play a major role in this development. The first LNG tanker, the Arctic Princess, left Hammerfest on 20 October 2007 with 145,000 cubic metres of liquefied natural gas on board.

Boom in LNG tanker-building business

The construction of additional specialised LNG tanker ships is one knock-on effect of this dynamic rise in LNG demand. A fleet of around 280 tankers currently ships LNG across the globe, the majority of which originates from gas fields in Algeria, Indonesia, Malaysia, Iran and Qatar. The fleet will have risen to over 400 vessels by the year 2015.

Modern LNG tankers are around 300 metres long and 50 metres wide. An average natural gas freight ship can accommodate 150,000 cubic metres of liquefied natural gas – enough to supply approximately 34,000 homes for a whole year.

Until now, the familiar spherical tank systems known as the Kvaerner-Moss type or Moss-Rosenberg spherical tanks have dominated LNG transport. The ships are equipped with three to five spherical tanks, each with a diameter of at least 40 metres. The tanks' walls are usually insulated with a four-centimetre-thick layer of aluminium. The spherical form makes these systems very stable.

However, state-of-the-art membrane-type carriers are increasingly gaining a foothold in this market. The tanks on these vessels fill almost the entire ship's hull and are constructed of a thin, flexible membrane, usually a one-millimetre-thick iron-nickel alloy known as Invar. Invar is highly resistant to expansion, even under extreme temperatures. An insulating layer comprising various materials such as plywood or industrial foam acts as a barrier between the membrane and the ship's hull and protects the steel hull plating from the extremely low temperature in the tank. This layer also supports the insulating effect of the membrane and keeps the temperature of the gas sufficiently low to prevent large-scale evaporation, also known as boil-off, during transport.

01

SNØHVIT PROJECT

Recoverable reserves	→	193 billion cubic metres of natural gas 17.9 million cubic metres of condensate (light oil) 5.1 million tonnes of natural gas liquids (NGL)
Water depth	→	250 to 345 metres
Development solution	→	Remotely operated subsea system
Pipelines	→	143 kilometres for feeding gas to the coast 153 kilometres for reinjecting carbon dioxide below the seabed
Land plant	→	Melkøya, just outside the shipping channel to Hammerfest
Annual export	→	5.67 billion cubic metres of LNG 500,000 to 900,000 cubic metres of condensate 150,000 to 250,000 tonnes of liquid petroleum gas (LPG)
Shipments	→	Around 70 shipments a year
On-stream period	→	2007 to 2035

Only 0.15 to 0.2 percent of the liquid methane evaporates during transport each day. This boil-off gas is vented from the tank to prevent pressure from building up and is commonly used as fuel to drive the vessel.

Although boil-off can never be entirely prevented, modern technology can be used to collect and reliquefy the resulting gas. Linde's French subsidiary Cryostar has developed just such a procedure. Combined with slow-running diesel engines, this process cuts costs in large ships on long-haul trips and – thanks to reduced CO₂ emissions – is also a significantly greener alternative to standard steam turbine propulsion. Shipbuilders Samsung Heavy Industries has been deploying this energy-saving reliquefaction process in its LNG carriers since 2008. These modern membrane tankers have maximum load volumes of 265,000 cubic metres and transport liquefied natural gas from Qatar to the USA.

Fit for the future

Our leading expertise in handling gases, engineering innovative plants and driving pioneering methods for processing natural gas puts us in an ideal position to make a valuable contribution to a diverse, environmentally friendly energy mix. And by building on this know-how, we intend to continue to play a major role in securing tomorrow's sustainable energy supplies.

Europe's largest natural gas reliquefaction plant in Hammerfest is testament to our ability to complete major projects of this scale under difficult environmental conditions.

Gas turbines and generators for producing electricity, pumps, heat exchangers and compressors – the list of individual components in the Hammerfest plant is long. This undertaking is a flagship project for Linde in a market that is continually growing. Its ongoing success is our gateway to further major LNG contracts across the globe.



01



04



02



05



03

01 Thanks to the gulf stream, the Hammerfest climate is comparatively mild despite the latitude. Winter temperatures average around -5°C , with snowy and icy roads, but the sea remains ice-free.

02 The LNG tankers load their valuable cargo at special filling plants before shipping it to its destination.

03 The sun does not rise in Hammerfest between 22 November and 21 January. In 1891, the city became one of the first in Europe to install electric street lights due to this long winter darkness.

04 The sea still plays a decisive role in the local economy around Hammerfest, with fishing the primary source of employment. The LNG plant also created around 350 permanent positions in the region.

05 View of the plant's core from the top deck.

Rudolf Stockmann (standing) is focused but content as he looks over a colleague's shoulder at the control centre of the LNG plant. Over the last year, the team has gradually increased LNG production to full capacity here. Linde's innovative method of separating CO₂ from the natural gas stream, liquefying it and storing it in formations beneath the seabed is regularly applied at the plant.



Interview with: Rudolf Stockmann, Lead Process Engineer, Hammerfest, Norway

“Good teamwork”

Mr Stockmann, what personal survival strategies have you developed for the long, dark winters north of the Arctic Circle?

↳ (Laughs): Shoes with spikes on the soles are a definite must. You can buy them everywhere here. During the six months of winter, the air is cold and damp, and the constant fluctuation between freezing and thawing means that the roads and footpaths are often covered in ice. But I’m used to it by now. After all, I’ve been involved in the project since October 2000 – right from the word go. And I’ve been based in Hammerfest since February 2006. I’ll also be one of the last to go when we finish our work in winter 2009.

Where have you lived all this time?

↳ I have an apartment on the outskirts of Hammerfest. It’s magnificent in summer when the sun’s in the sky 24 hours a day. But you have to be disciplined during midsummer and make sure you get some sleep at some point. Otherwise you spend the whole summer in a state of permanent fatigue.

What was the greatest challenge in constructing the plant?

↳ Time was definitely the biggest factor. The second critical issue was achieving the quality standards in the face of this enormous time pressure. This project was a first for us. During the initial phase, we accumulated hours and hours of overtime and continually had to postpone holidays as well as work extended shifts well into the night. But we got there, one step at a time. Which was a great feeling and very satisfying.

What will you miss most when you are back in Germany?

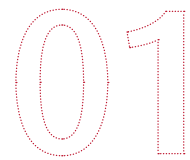
↳ The great teamwork with our colleagues at Statoil. Working on a project of this scale really pulls you together. We joined forces to find the right solutions – and even when things got really tough we still managed to have fun.

How is Linde ensuring that the knowledge gained in this project is kept and can be used in future projects?

↳ We have documented everything down to the very last detail. But especially when it comes to something like going on stream, a lot of it is down to personal experience – even with all the cutting-edge technology.

Is Linde capable of planning and constructing even larger LNG plants?

↳ With the experience we’ve gathered here – yes. Nevertheless, this 150-megawatts LNG reliquefaction plant is still one very large fridge.



ENERGY MEGATREND

Expertise in natural gas liquefaction is just one example of how Linde is helping to provide sustainable answers to the global challenge of rising energy demands. We also offer numerous applications that help make renewable sources of energy commercially viable and

increase the efficiency of fossil fuel production. One thing is certain: fossil fuels will remain a scarce resource, with prices set to rise further in the wake of the current economic crisis.

→ Coal

Coal has re-entered the picture as a promising alternative to oil and gas. Coal-to-liquids (CTL) technology enables the use of coal as a direct alternative to crude oil, even as fuel. Gas purification plants are an important building block for CTL projects, and Linde is currently constructing one such plant in China for Shell.

→ Crude oil recovery

Linde also plays an active role in developing new methods for crude oil recovery. As an oil field becomes depleted, the flow pressure declines and the feed rate drops. However, it is possible to exert some influence over this process using enhanced oil recovery (EOR – see glossary) technology. This delays or reduces the drop in feed rates by injecting gas, for instance. In carbon dioxide (CO₂) or nitrogen (N₂) flooding, water and CO₂ or N₂ are pumped alternately into the reservoir. Injected under high pressure, the gas is easy to separate from the oil produced and can then be pumped back into the system. Linde supports this procedure by constructing air separation plants to generate the necessary quantities of nitrogen. An outstanding example of our activities in this field is the world's largest air separation plant, which we constructed in the Gulf of Mexico. We launched operations there in 2000, going on to expand it in 2006. Our customer is the state-owned Petroleos Mexicanos Coportivo (Pemex) oil company, which develops the Cantarell oil field.

→ Biogas plants

Biogas plants are becoming an increasingly important way of generating electricity and heat from renewable energy resources. As part of a joint venture with US company Waste Management Inc., Linde is currently building the world's largest facility for converting landfill

gas into ecologically sound biogas in Livermore (California). In addition, we provide technologies for processing, purifying, transporting and storing biogas all over the world. In partnership with Süd-Chemie AG (Munich), we develop and market plants for second-generation (2G) biofuel production. These employ biotechnology to obtain ethanol from cellulosic plant matter.

→ Solar energy

Solar energy represents a key growth area for Linde. We supply specialty gases to photovoltaic cell manufacturers, rendering their production processes more energy-efficient and environmentally friendly (see p. 24 onwards). We also expanded our portfolio to include solar power technologies with the acquisition of Swiss plant construction firm Bertrams Heatec AG in 2007. Bertrams is a leading specialist in constructing systems for the safe transport of process heat, for instance in thermal solar power plants. Unlike photovoltaics, these plants use mirrors to concentrate sunlight. The resulting heat (hence the term "thermal") is used downstream to generate steam, which is harnessed to provide electricity by generators. Heat storage is a particularly important feature of this type of power plant, allowing solar heat captured during the day to be used at night for an uninterrupted electricity supply.

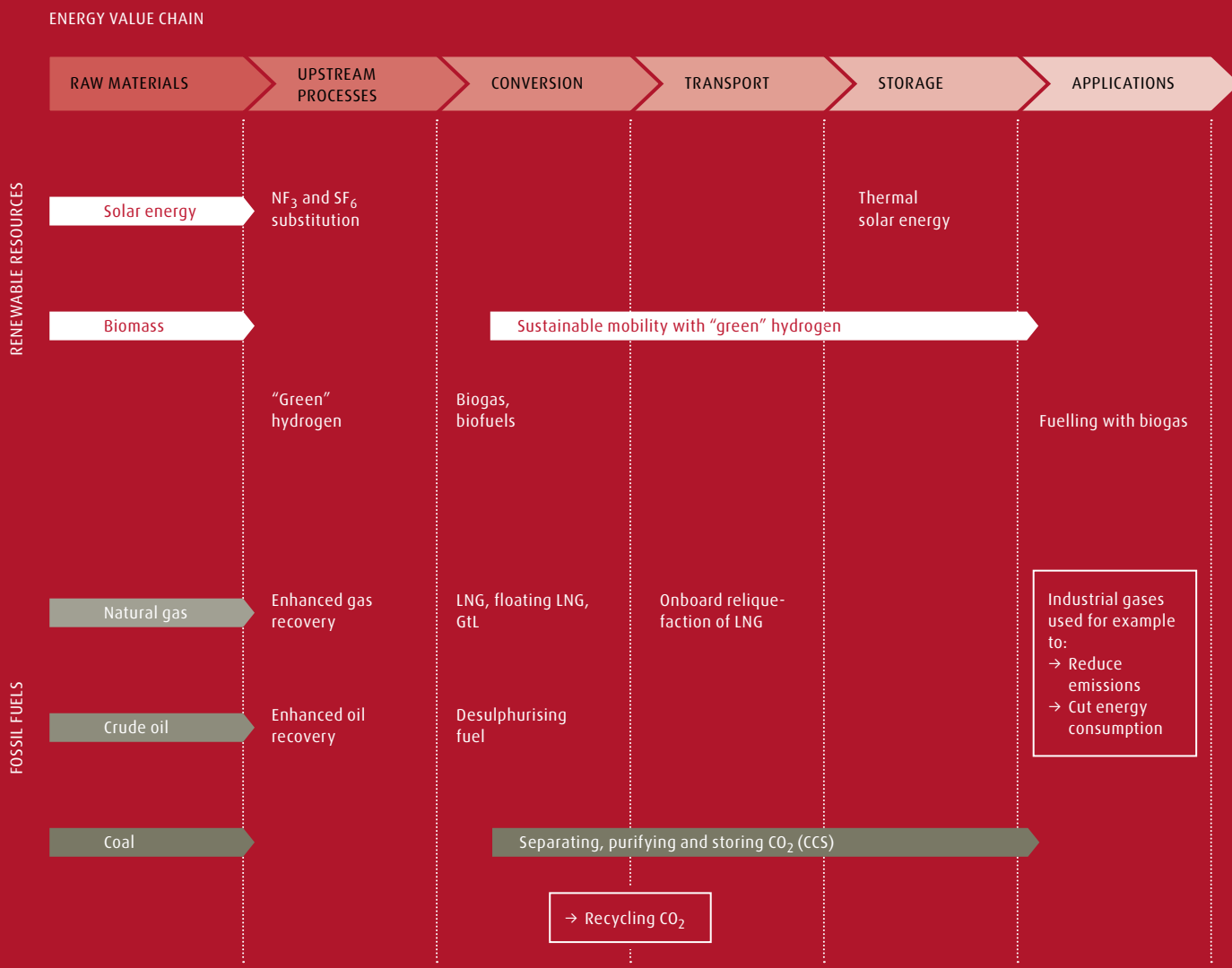
→ Hydrogen

Linde is systematically developing hydrogen as an environmentally friendly energy carrier – yet another example of our contribution to shaping a future powered by sustainable energy (see Innovations, pp. 36, 37).

GLOBAL ENERGY MEGATREND – OUR CONTRIBUTION TO SECURING FUTURE SUPPLIES

Through our innovative technologies, we are helping to secure future energy supplies. At the same time, we are capitalising on the global energy megatrend. Our process technologies are applied across the entire value chain of renewable resources and fossil fuels. We are stepping up our activities on the renewable front in particular, but are also involved in pilot projects based on coal-fired power plants to sequester, purify and store carbon

dioxide. These projects have since won the financial support of the German government. There is no doubt that we will continue to rely on coal for quite some time, which means that coal-fired plants must minimise their environmental footprint in the meantime. (Refer to the Linde Corporate Responsibility Report 2008 with its focus on Clean Technologies for more information – available for download from www.linde.com.)



02



Innovations

At Linde, we continue to open up new application opportunities for our products and services through ongoing research and further development of tried-and-tested methods and processes. We deliver solutions to sectors ranging from healthcare to the burgeoning photovoltaic industry. Here our new specialty gases and gas supply systems contribute to climate protection and ensure operating safety in solar cell facilities.

Parque de Solar Arnedo in Spain – solar modules as far as the eye can see. Power production with solar cells is particularly effective in sunny regions. Linde is the world's largest gas supplier for the photovoltaic industry, and our gases were also used in manufacturing the cells in this solar park in southern Iberia. Spain is the second-largest market for solar modules, after Germany.



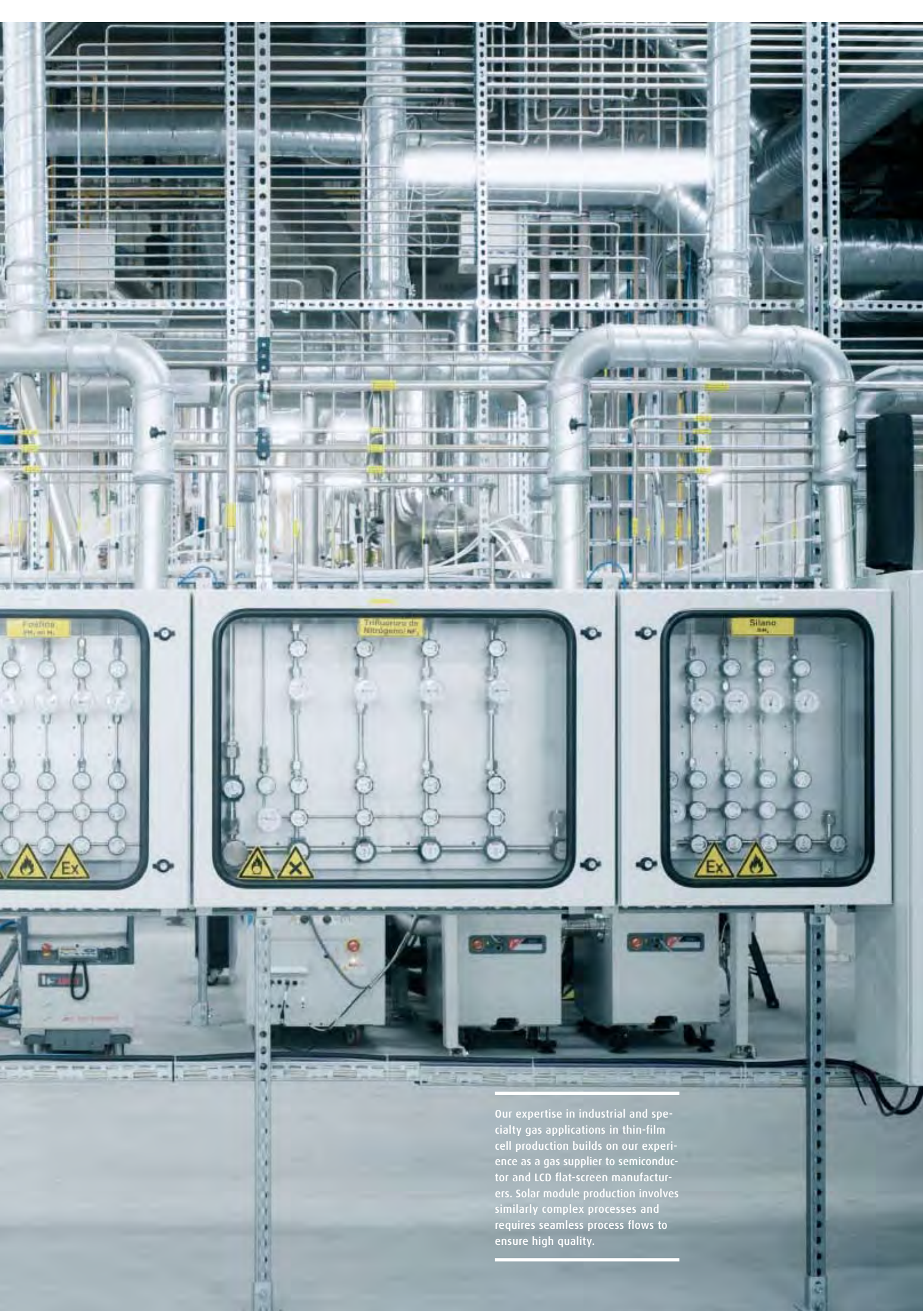
Industrial and electronic gases are essential to produce solar cells. Linde gases are used both to apply the ultra-thin silicon layers and to clean the process chambers – for instance at T-Solar in Ourense, Spain.

Gas temperature is a crucial consideration – cooling units ensure the right temperature for thin-film solar module production, even under the Spanish sun. *(right)*









Our expertise in industrial and specialty gas applications in thin-film cell production builds on our experience as a gas supplier to semiconductor and LCD flat-screen manufacturers. Solar module production involves similarly complex processes and requires seamless process flows to ensure high quality.

Innovations. A place in the sun.

02

Electricity generation from solar power using large thin-film modules has taken a quantum leap over the last few years. Particularly in Europe and Asia, state-of-the-art manufacturing plants have sprung up for these solar cells, requiring industrial and electronic gases. These are necessary both to apply the ultra-thin silicon layers to the modules – up to 5.7 square metres in size – and to clean the process chambers. As the world’s largest supplier of gases, Linde is working closely with customers, plant engineers and scientists to further improve the efficiency of solar modules.

In times of economic struggle, optimistic forecasts are few and far between, especially on the scale of this one: our experts anticipate that revenue from gases for solar power generation will increase by at least 30 percent year on year – or possibly even more. This prediction is based on the dynamic growth of the photovoltaic industry, and particularly thin-film photovoltaics. Our expectation is that from 2012, producers of photovoltaic modules will already be spending more on gases than flat-screen manufacturers, for instance. And from 2017, the photovoltaic sector even looks set to overtake microchip manufacturing – previously by far the largest consumer of electronic and specialty gases. These forecasts stem from the likelihood that solar energy will continue to gain in importance worldwide – both to reduce carbon dioxide emissions, and as a replacement for dwindling fossil fuel resources. The management consulting firm Frost & Sullivan anticipates that revenue from solar cell and module manufacturers will more than double by 2012, increasing from the current level of around USD 7 bn to USD 16.4 bn. The deciding factor here will be further technical innovations in solar module production.

The emergence of thin-film technology as a viable bulk production method for large-scale solar modules unleashed a veritable global race to set up the necessary facilities. Germany is a hotspot here, but solar plants have also been constructed in Southern Europe, Japan, China and India. And with the US energy policy set to change course under the new administration, North America may also become a major market for solar power. Our subsidiary Linde Nippon Sanso and other Linde Group companies present in Asia are all set to participate in this dynamic growth. Linde is already market leader in the silicon-based thin-film solar cell (see glossary) segment and a partner to almost all the solar cell manufacturers in the world.

Our cooperation here spans several areas. First, we deliver gases for photovoltaic module production and system cleaning. Second, we advise our customers on planning and building infrastructures to supply gases. And third, we also operate and maintain on-site supply systems. Here we work closely both with the solar module pro-

ducers and with manufacturers of the relevant facilities, tailoring our supply concept to the specific requirements at each individual plant. But our aim is always the same – to develop the technology in collaboration with our customers to the point where solar power can compete with non-renewable sources of energy.

Climate-neutral production

In providing industrial and specialty gases for thin-film cell production, Linde draws on its experience as a gas supplier to the semiconductor and LCD flat-screen sectors. Here, too, silicon (see glossary) is applied to a substrate such as glass, metal or ceramic by chemical vapour deposition using the specialty gas silane. Since this also coats the process chambers with silicon, they have to be cleaned after every production run. Traditionally, this is accomplished using nitrogen trifluoride (NF₃). However, since this gas is harmful to the environment, we are gradually replacing it with climate-neutral fluorine (F₂) generated on-site. Linde is the only gas supplier in the world to master this technology. In addition to these gases, nitrogen and hydrogen are also used in thin-film cell production.

Reference plant in Spain

Linde has collaborated on more than 20 thin-film cell production projects across the globe to date, from initial engineering to plant expansion. The facility in Ourense (Spain) is a notable example. This is where the T-Solar company constructed the first Spanish thin-film solar cell plant. It opened for operation in mid-2008 and produces solar modules with dimensions up to 2.2 by 2.6 metres (5.72 square metres) – five times the size of conventional silicon wafer-based modules (see glossary). Following a start-up phase, T-Solar will manufacture modules with a total power capacity of 40 megawatts (MW) per year here, employing a staff of around 190 and generating revenue in excess of EUR 100 m.

Linde’s contribution to this facility extended from designing the gas supply concept through engineering and project management to turnkey delivery. The supply equipment includes gas tanks and air compressors, a kilometre-long pipeline system, numerous valves and dependable safety installations. Among the latter are 150 gas detectors, for instance, to prevent unchecked leakages.

We are currently obtaining the silane for this new Spanish plant from American and Asian subcontractors. However, in future, we will be supplying T-Solar and other European customers from our new Schwarze Pumpe facility in Germany.



As a partner to the solar sector, Linde participates in a close collaborative network with leading manufacturers of production facilities and relevant research bodies. Our aim is to increase module performance and plant throughput to make solar power more competitive.

In a second expansion phase, Linde will also be generating nitrogen, hydrogen and potentially fluorine on-site in Ourense. The latter will enable the module manufacturer to start cleaning the chambers with climate-neutral F_2 instead of ozone-depleting NF_3 .

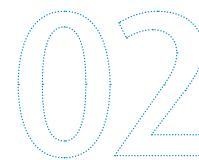
At full capacity, 20 modules will leave the facility every hour, initially bound for the 16 solar power plants T-Solar is now building in Southern Spain. On completion of the second construction phase in Ourense, with new production systems operational, module manufacture will switch to the tandem layer process. Here, amorphous and microcrystalline silicon (see glossary) are stacked in one cell. This method can increase efficiency by up to 50 percent in comparison with modules using purely amorphous cells. Tandem layer production also cuts costs per watt and saves energy.

This new production method will therefore increase the cost-efficiency of electricity generation from solar power and bring it another step closer to grid parity (see glossary). This particularly applies to the South of Spain – along with other Southern European regions – where high insulation makes for better plant efficiency and keeps solar power production costs especially low.

Partnerships for progress

To make solar power more competitive, Linde places great importance on close collaboration with all players in the solar sector, including key manufacturers of production facilities and the relevant research bodies. “Our joint aim, working closely with our customers, is to halve the costs per watt. As a gas supplier, we can contribute to this by increasing module performance and plant throughput”, explains Andreas Weisheit, Head of Business Development – Photovoltaics for Europe.

Weisheit goes on to specify that thin-film technology, in particular, still has significant potential to improve productivity further. One of the world’s main solar plant manufacturers anticipates that the latest generation of large-scale modules will cut the costs of solar power production by up to 25 percent in comparison with the smaller variants.



Major reference projects

Industry players, research bodies and investors are forming alliances to increase efficiency and cost-effectiveness – and Linde is involved in almost every project. Germany's E.ON energy group (Düsseldorf) and manufacturer of façade and roof-systems Schüco (Bielefeld) founded the Malibu joint venture to produce photovoltaic modules especially for office exteriors, for instance. Production began at its plant in Magdeburg (Sachsen-Anhalt) in autumn 2008, with an annual capacity of 40 MW. Malibu also supports several research bodies in Germany and across Europe with the aim of increasing plant efficiency. An endowed professorship at Bielefeld University has been set up to further this development work, and Linde is also contributing its expertise.

In Berlin, Inventux Technologies AG launched production of large-scale, micromorphous thin-film solar modules at the start of December 2008. In this first stage, the company invested around EUR 49 m in a facility with an annual capacity of 33 MW. This corresponds to 275,000 modules, or a surface area of around 60 football fields. Linde delivered the complete gas infrastructure and supply system for this plant. Inventux initially plans to distribute the thin-film modules in Germany and Spain, subsequently extending its reach to Italy, France, Greece and the US.

Linde is also working with Swiss plant manufacturer Oerlikon Solar on the construction of a photovoltaic production line for the Italian Pramac Group. The plant will be located in the Swiss canton of Tessin, opening for operation in 2009. In the initial phase, the facility is intended to manufacture 250,000 modules per year, with a power capacity of 30 MW. By 2011, this should reach 120 MW. The modules can be installed as windows or attached to the exterior of buildings.

Foundations for the future: Masdar City

The Masdar PV solar project aims to break into a whole new dimension – the wholly owned subsidiary of Abu Dhabi Future Energy Company (ADFEC) is currently building a EUR 150 m plant for thin-film solar cells in the German city of Erfurt (Thuringia). This is scheduled to open in the third quarter of 2009, with an initial annual production capacity of 50 MW, set to increase further by 2010. The company's ambitious aim is to become one of the three largest producers of thin-film photovoltaic cells in the world by 2013. Our subsidiary Linde Nippon Sanso is responsible for supplying all the industrial and specialty gases required here, designing and installing the gas supply and distribution systems, as well as operating and maintaining the on-site systems under the umbrella of a Total Gas Management service.

Masdar PV is part of Abu Dhabi's Masdar Initiative, under which the emirate plans to invest a total of USD 15 bn in developing Masdar City. This will be the world's first CO₂-free, car-free and waste-free industrial city, powered by solar energy and housing up to 50,000 people. The foundation stone was laid in February 2008. Since then, the Persian Gulf has also been hit by worsening economic conditions, with the inevitable impact on investments in ambitious projects. However, the Gulf States remain undeterred – their objective is to shape a future beyond crude oil and natural gas, and Linde is playing an active role in making this vision a reality.



01



04



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- 01 Spain's first facility for thin-film solar cell production opened for operation in Ourense in mid-2008. Here, T-Solar manufactures modules up to five times the size of their conventional silicon wafer-based predecessors. This process uses nitrogen, hydrogen and climate-neutral F_2 .
- 02 High-tech machinery for solar panel production – gases from Linde are pumped into the plant from the cellar area below for this highly complex procedure.

- 03 Plenty to do – T-Solar plans to build 16 solar power plants in southern Spain alone. The next-generation modules will increase efficiency even further.
- 04 The T-Solar power plant in Parque de Solar Arnedo, Spain.
- 05 Harnessing the power of the sun – solar modules produced in Ourense are 2.2 by 2.6 metres in dimension.



As one of Europe's first facilities for thin-film module production, the Ourense plant is arousing great interest. Alexandre Lemée, Sales Manager at Linde Nippon Sanso, points out Linde's strengths as a gas supplier – reliability and long-term price guarantees are crucial for a technology where gas costs amount to around 15 percent of total manufacturing expenditure.

Interview with: Alexandre Lemée, Sales Manager at Linde Nippon Sanso SL in Spain

“Major opportunities in Spain”

Mr Lemée, what does your role as Sales Manager involve?

↳ I'm responsible for the smooth running of projects with our most important customers. At the moment, I am mainly working with T-Solar. I liaise with our team on the ground to make sure that we deliver all agreed services on time and to the highest quality. Of course I also try to drum up new business for the company.

The installation in Ourense is seen as a reference project that should attract further orders for Linde from solar energy customers. What kind of feedback have you received from the market?

↳ We have had a steady stream of interested parties visiting the plant since it went on stream in June 2008. At production start-up, there was almost no other opportunity to visit a facility of this kind manufacturing thin-film modules in Europe.

Were there any potential customers among the visitors?

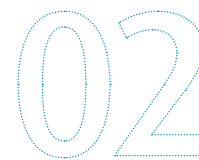
↳ There is a huge amount of interest in thin-film technology. We hope to land a contract similar in scope to the T-Solar agreement soon.

How do you rate growth prospects in the Spanish market?

↳ Spain is the second-largest market for solar modules after Germany. Last year, we received a significant number of requests, also from investors inquiring about the returns on these kinds of plants. But the market has calmed down – the financial crisis has also had a healthy corrective effect. Serious prospects now are investors who know their way around the industry and have a solid financial background. We estimate the potential for thin-film plants in Spain at around 500 megawatts (editor's note: current installed capacity is 45 megawatts).

What strengths does Linde bring to the table as a gas supplier to capitalise on this market growth?

↳ A wealth of experience backed up by secure and reliable delivery and long-term price guarantees. This is an extremely important point, as gas accounts for 10 to 15 percent of total production costs in the thin-film segment.



INNOVATIONS

The vast potential of industrial gases is still waiting to be unlocked. Many of our new developments target the growing market for environmental and energy technologies. Our efforts here include close collaboration with industry partners to develop solutions for

environmentally friendly production of electricity and fuels. We are also involved in developing enabling processes for zero-emissions power plants.

→ **Partnership to investigate oxyfuel combustion**

In September 2008, Linde and Vattenfall Europe Technology Research GmbH, a subsidiary of the energy group Vattenfall, entered into an extensive technology partnership aimed at carbon dioxide sequestration in coal-fired power stations. The two companies have joined forces to investigate the benefits of oxyfuel combustion for lignite and pit coal, and develop this technology for subsequent deployment in large-scale power plants. The tests are being carried out at a research facility with a pilot coal-fired power plant equipped with CO₂ sequestration technology. The plant was recently put into operation by Vattenfall in the German town of Schwarze Pumpe. Linde built an air separation and carbon dioxide liquefaction plant for this pilot power station. In its role as technology partner, Linde is providing Vattenfall with extensive scientific and technical expertise during the first trial phase, which is set to run until the end of 2011.

→ **Opening of Belgium's first hydrogen fuelling station in Brussels**

As one of the world's largest manufacturers of hydrogen production systems, Linde covers the full range of technologies required for a successful hydrogen value chain, ranging from production to fuelling. Last year, for example, Belgium's first hydrogen fuelling station was officially opened in Brussels by Linde, the petroleum company Total and the Flemish Ministry for Economy, Enterprise, Science, Innovation and Foreign Trade. Linde developed the technology for storing the cryogenic liquid hydrogen as well as the fuelling system. The Total fuelling station is located on the motorway to Paris and was constructed as part of a partnership between BMW and Total. Almost all liquid hydrogen fuelling stations around the world are equipped with fuelling technology developed by Linde.

→ **First zero-emissions ship on Alster and Elbe rivers**

Linde has opened the world's first hydrogen fuelling station for fuel-cell passenger ships in Hamburg under the umbrella of the Zemships initiative. Zemships is an EU-supported project promoting hydrogen as a source of fuel for ships. The Zemships fuelling station supplies a zero-emissions ship with gaseous hydrogen. This hydrogen-powered fuel-cell vessel can carry up to 100 passengers on the Alster and Elbe rivers. To refuel, liquefied hydrogen stored at a temperature of -253 °C is converted to gas in a vaporiser and compressed up to 450 bar in a two-stage system. The entire fuelling station was planned and constructed by Linde.

→ **Helium cooling system for CERN**

Linde was also involved in a high-profile global scientific project last year. In 2008, the Large Hadron Collider (LHC) at CERN (see glossary) near Geneva (Switzerland) accelerated protons to almost the speed of light in its underground circuit for the first time. Our subsidiary, Linde Kryotechnik AG, headquartered in Pfungen, Switzerland, designed, built and installed the requisite helium cooling system. Back in 2003, CERN's management already presented Linde Kryotechnik AG with the Golden Hadron Award in recognition of the company's outstanding achievements. The Swiss cryogenic experts and two other companies in the consortium are responsible for operating and maintaining the systems.

A TEAM OF INVENTORS

Dedicated research and development is crucial in ensuring global success for a technology player such as The Linde Group. In fiscal 2008, we invested over EUR 100 m in research and development to further strengthen our innovative drive. The Linde Group Inventors' Club is just one example of how we are increasingly promoting an

innovative spirit within the Group. Since 2005, this forum has been fostering creativity and new ideas throughout our global organisation. It does so by awarding prizes in the categories "technological innovation" and "innovation with the highest monetary value" to the ten best patents registered each calendar year.



↳ An employee in front of a CO₂ storage tank at the Schwarze Pumpe coal-fired power plant – Linde delivers a wide range of components for this pilot facility, which is investigating ways of reducing CO₂ emissions.



↳ Fuelling with hydrogen – almost all H₂ fuelling stations around the world are equipped with innovative technologies developed by Linde.



↳ Turning straw into energy – we develop procedures for generating environmentally friendly biogas from regenerative sources.



↳ Keeping cool for the big bang – cryogenic technology developed by Linde cools the world's most powerful particle accelerator at CERN, near Geneva in Switzerland.



↳ Medical gases – we develop new treatments for respiratory diseases, making life easier for a great many people.



↳ Blast furnace in a rolling mill – our REBOX® technology saves energy and reduces harmful emissions.

03



Growth markets

We are committed to sustainable, profitable growth. And a strong presence in emerging markets is essential to achieve this aim. Linde has carved out a particularly firm foothold in burgeoning markets such as China, India and the oil and gas-producing nations of the Middle East, as well as in Latin America, Eastern Europe and Russia – thus ensuring a solid foundation for sales and profit growth. These are all regions experiencing rising demand for industrial gases and the enabling production facilities across the petrochemical, steel, electronics, solar power and environmental protection industries.

Boom town – The Linde Group is building one of the world's largest industrial gases clusters in Ningbo, China's second-largest seaport. New plants and industrial parks are springing up at several sites across the city on the Yangtze estuary, all benefiting from the extensive pipeline network and sophisticated infrastructure in the emerging metropolis. All of which creates jobs. Linde currently employs a workforce of around 2,500 in the Greater China region, and this figure is set to rise.





We offer a tailor-made service to customers from the most diverse sectors in Ningbo. These include Formosa Heavy Industries, a plastics manufacturer in the Beilun district. By partnering with Formosa, Linde ensures a reliable supply of pipeline and cylinder industrial gases.





Since 2007, Linde has been supplying Ningbo Iron & Steel Co., Ltd. – the largest iron and steel manufacturer in the Ningbo region – with oxygen and nitrogen from two of its air separation plants. In 2007 and 2008, we closed three new tonnage deals with Ningbo Iron & Steel, Ningbo Wanhua Polyurethane and Hanwha Chemical Corporation (HCC). Linde will thus be investing around EUR 110m in three other air separators in this up-and-coming industrial zone in the Yangtze Delta.



Growth markets. Prime position in emerging regions.

03

In the city of Ningbo, in Eastern China – an economic hotspot less well known than Shanghai – Linde is establishing one of the world's largest industrial gas clusters. We already supply major customers from the petrochemical, steel and metal processing industries from on-site facilities and via pipeline here. Soon, we will have set up an integrated gas infrastructure, consisting of no fewer than five high-performance air separators and a widely ramified pipeline network and benefitting numerous companies in Ningbo's three thriving industrial parks.

The Linde Group could hardly have picked a better location for one of its biggest industrial gas centres. Ningbo is China's second-largest seaport and lies just a few hours south of Shanghai by car. Its three extensive industrial parks not only house numerous flourishing companies across a wide variety of sectors, but also offer a sophisticated infrastructure.

Investment magnet

With growth rates regularly above ten percent since the foundation of the first special economic area in 1984, by 2007 Ningbo's gross domestic product (GDP) had risen to more than EUR 34 bn. According to the regional government's Eleventh Five-Year Guideline, this should reach around EUR 45 bn in 2010. By mid-2008, 1,400 foreign-financed companies were registered for business there.

Small wonder, then, that Ningbo is one of Linde's most important growth markets – and not only within the Greater China region. This is exemplified by our total outlay of over EUR 180 m to date, making Linde one of Ningbo's biggest foreign investors.

Linde is currently represented across the Greater China region as a whole by around 50 subsidiaries and joint ventures, over 100 plants in key industrial hubs, and a headcount of around 2,500. This makes Linde the largest gases and engineering company in the region.

Dynamic growth regions

Within just two decades, the Greater China region has evolved into one of the world's key markets for Linde and will certainly remain a focal point for investment and growth. But other global regions also make a substantial contribution to our company's expansion. Alongside China, other defiantly dynamic markets in the face of the financial crisis include the oil and gas-producing nations of the Middle East, the emerging economies of Eastern Europe, Russia, Turkey, and South-East Asian countries such as India, Singapore, Malaysia and Vietnam.

Our strong presence in these markets is partly a consequence of our merger with BOC. That company traditionally enjoyed an outstanding position on the gas markets of Asia and Africa; Linde in South America and Eastern Europe. Bundling these strengths in The Linde Group propelled the newly restructured company to the position of leading gas supplier in Greater China, South and South-East Asia, South Africa, the Middle East and Eastern Europe, and to second place in South America. In short, we are now positioned right at the forefront of all key emerging markets.

Thanks to highly sophisticated gas-production technologies and a reliable supply of industrial, medical and specialty gases, Linde is also helping emerging economies in Latin America to close the gap with established industrial nations. The Linde Group's footprint now extends to almost 100 countries and across a wide portfolio of products and services. We supply industrial and healthcare companies from our own gas plants, provide engineering and process technologies, and offer services spanning the most diverse gas applications. Together, these 100 countries account for around 90 percent of global GDP. Linde is market leader in 46 of the 70 key countries in this group, and number two in a further ten.

The reach of our Engineering Division also extends around the globe; our experts having designed and constructed over 4,000 plants in around 100 countries to date. The spectrum here spans air separation, olefin, synthesis gas, hydrogen, adsorption and natural gas facilities. And this success story is set to continue, even if raw materials prices linger at rock bottom for several years in the wake of the economic crisis. Securing a reliable energy supply remains a long-term global megatrend, and as soon as emerging economies see stronger growth rates again – if not sooner – their energy demand will be back on the rise.

Greater China and the Ningbo gas cluster

Linde has constructed over 150 facilities in China since the mid-1960s. While the majority of these have been for hydrogen production and air separation, we have also supplied plants for gas processing (see glossary), petrochemicals, water treatment and desulphurising crude oil. Linde's total investments in China significantly exceed EUR 553 m to date.

Our strategic decision to play a central role in supplying gases to the rapidly expanding companies in the industrial parks of Ningbo takes our involvement in China to a whole new level. Linde's activities on China's highly industrialised east coast will make this area to the north and south of the Yangtze estuary home to one of the world's largest gas clusters. We are building up a seamless infrastructure of on-site facilities, pipelines, tanks and cylinder gases, which will enable us to meet the needs of local companies.

HAPPY CITY

Situated on the Yangtze estuary, with a population of around 5.5 million, Ningbo is one of the ten happiest cities in China. This was the outcome of a nationwide survey of over three million people in 2008, focusing particularly on employment, income, housing, environment and education. A subtropical climate, attractive coastal and mountainous scenery and a rich cultural heritage make the city on the eastern edge of the Zhejiang province (approximately 47 million inhabitants) even more enticing. The tourist attractions include the 36-kilometre bridge over Hangzhou Bay, linking the economic centres of Ningbo, Hangzhou and Shanghai as the crow flies, as well as cultural sites such as the thousand-year-old Baoguo temple around 13 kilometres from central Ningbo, and the historic fortifications on each side of the mouth of the Yongjiang river.

Broad customer base

Ningbo's three industrial parks house a wide spectrum of sectors – each with a different focal point. Beilun, Ningbo's eldest park by 20 years, is the hub for metal processing, the electronics industry and electronics supplier firms. Daxie taps the benefits of the deep-sea port with its focus on petrochemicals, fine chemicals and storage

facilities, while SINOPEC (China Petroleum & Chemical Corporation) operates China's largest crude-oil refinery and ethylene complex in Zhenhai, alongside other chemical companies now established there.

Other major investors in the Ningbo cluster include China's third-largest petroleum company CNOOC (China National Offshore Oil Corporation), Ningbo Steel – the Zhejiang province's largest steel manufacturer – Formosa Plastics Group, Ningbo Wanhua Polyurethane, Hanwha Chemical Corporation and Mitsubishi Chemicals.

"All these sectors require large volumes of industrial gases. This represents huge potential for Linde, which we are now systematically tapping," explains Josef Weber, Project Manager at Linde Engineering. "We are playing our part to ensure Linde achieves its aim of turning the Ningbo region into China's biggest industrial gases centre by 2012."

Strides to success

Thanks to close collaboration between the Gases and Engineering Divisions, Linde has already achieved several important milestones towards this aim in the space of the last few years. Founded in 2004, our wholly owned subsidiary Linde Gas Ningbo agreed its first contract with Ningbo Steel that same year. This covered construction of two on-site air separation facilities with a total oxygen capacity of 42,000 standard cubic metres per hour (scm/h) and 40,000 scm/h nitrogen, assuring a long-term supply for the company's steel plant. A supply agreement with Formosa Plastics Group followed in 2005, for its production facilities in Beilun. In 2006, Linde began construction work on a pipeline connecting Zhenhai and Beilun to exclusively supply Zhenhai's chemical park with industrial gases.

In October 2007, we concluded a supply contract with Ningbo Wanhua Polyurethane. This covers provision of oxygen and nitrogen to the chemical company's major Ningbo plants for methylene diphenyl diisocyanate (MDI – see glossary) production. It involves construction of two air separation plants by our Engineering Division, each with a capacity of 40,000 scm/h, as well as a 30-kilometre pipeline between the Beilun and Daxie industrial parks. Wanhua is the only Chinese chemical company possessing the technical expertise to produce MDI – an intermediate product used to manufacture polyurethane (see glossary).

The collaboration between Linde and Wanhua entails an outlay of around EUR 92 m – Linde's largest single investment in China to date.

03

In addition to Wanhua, the new air separation plants will also supply gases to Ningbo Steel and produce 16,000 scm/h liquid nitrogen and oxygen plus noble gases krypton and xenon for the open market.

Integrated network

Linde was awarded its latest Ningbo contract in October 2008, again by Ningbo Steel, for construction of a third on-site air separation facility. This will supply the expanded steel plant in Beilun's industrial park, delivering an additional 21,000 scm per hour from end-2009.

We also concluded a supply agreement with Korean Hanwha Chemical Corporation (HCC) this reporting year. This petrochemical company is constructing a new world-scale PVC production plant on Daxie Island, scheduled to start in 2010. In the initial phase, Linde will then supply the plant with up to 8,250 scm of oxygen and 2,000 scm of nitrogen per hour. We will pipe these gases from the two air separation facilities we are currently building on the Daxie site of our customer Ningbo Wanhua Polyurethane.

From 2010 onwards, Linde will therefore be operating five air separation plants in Ningbo. In addition, we plan to construct a facility for purifying noble gases krypton and xenon by the same year – the first of its kind for Linde Gas in China.

These new projects will build up a wide-ranging network between industrial companies in Ningbo by 2010. HCC will obtain its raw material for PVC production from Wanhua, for instance, which manufactures MDI there. And Linde Gas Ningbo will supply both companies with the necessary gases from the air separation plants for Ningbo Steel and Wanhua.

An extended pipeline network will also play a role in fostering close collaboration between gas supplier and customers. Alongside the 30-kilometre pipeline between Beilun and Daxie, we are planning to connect Beilun and the Zhenhai chemical park. This new oxygen pipeline will be around 42 kilometres in length and is scheduled for completion by 2010, ready to supply further new customers.

With these strategic investments throughout the Ningbo cluster, The Linde Group is securing its position as leading gas supplier in a booming market.

01 The Linde Group has invested over EUR 180m in the Ningbo region alone.

02 In 2008, Linde closed two new on-site contracts to supply Ningbo Iron & Steel and Hanwha Chemical Corporation.

03 Our industrial gases are transported to points of use in the Ningbo region via an extensive pipeline network.

04 The old and the new go hand in hand in Ningbo City. Prosperous economic centres attract huge numbers of the rural population from poorer provinces.

05 View of the Linde site located in the Beilun district.

06 In 2010, each day Linde will produce 800 tons of nitrogen, oxygen and argon for industrial customers plus noble gases krypton and xenon for the open market.



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Major projects such as the gradual networking of the three industrial parks in the greater Ningbo area call for highly professional project management skills. Julie Zhu and Jimmy Zhou from Linde Gas discuss project progress with colleagues from Linde Engineering on Daxie Island.

Interview with: Julie Zhu, Commercialisation and Integration Manager, and Jimmy Zhou, Market Development Manager, Linde Gases Division, Greater China

“One of the most promising locations in China”

Ms Zhu, Mr Zhou, how long have you been working for The Linde Group in Ningbo?

↳ **Julie Zhu:** For around four years now. I used to work for the BOC Group and joined the company through an Asian management trainee programme.

↳ **Jimmy Zhou:** I started working for BOC in 2002.

Ms. Zhu, you are responsible for commercialisation in the Greater China region. What exactly does this involve?

↳ **Julie Zhu:** As the commercialisation manager, I’m involved in projects right from the word go. It’s my job to ensure they are successfully completed in line with the underlying business plan.

You are also responsible for another area ...

↳ **Julie Zhu:** Yes. I have also been part of the integration management team since the merger of Linde and BOC. Here, I help to anchor the Linde management system at subsidiary and joint venture level. Our task is to make sure that all of the company’s goals are met and that we are generating value for our stakeholders.

Mr Zhou, you are responsible for market development in Ningbo. What are your primary areas of focus at the moment?

↳ **Jimmy Zhou:** Linde operates air separation plants in three large industrial parks in Ningbo. We have more or less completed our development work in two of these zones. Now, together with our partners, we are currently focusing on developing new activities in the Zhenhai park. As these three zones continue to merge, the Ningbo cluster is shaping up to be a major hub in the Greater China region.

How many employees are now based at Linde in Ningbo?

↳ **Jimmy Zhou:** We are currently a team of 80, headed by our Managing Director Mr. Lin Funian.

What impact is the economic crisis having on Linde’s business in Ningbo?

↳ **Jimmy Zhou:** These are difficult times for the economy worldwide. It’s not a regional issue. However, we maintain close ties to our customers, so we do know that the chemical industry in particular is expecting 2009 to be a difficult year. Nevertheless, no major customer has yet reassessed their plans for Ningbo and no major customer has delayed or halted planned investments. On the contrary, many see this as a particularly good time to invest in new plants in Ningbo.

So you are not worried about the future?

↳ **Jimmy Zhou:** Ningbo is definitely one of the most promising locations in China, which is what makes it such a high-priority focus for Linde.



GROWTH MARKETS

Linde has achieved an excellent footing both in the Greater China region (People's Republic of China, Hong Kong and Taiwan) and in other emerging economies. We consistently strive to cement this

leading position through a combination of organic growth, acquisitions and joint ventures.

→ **New air separation plant for ArcelorMittal**

During the reporting year, Linde concluded a long-term contract to supply the world's largest steel manufacturer, ArcelorMittal, with industrial gases. This covers construction of a new air separation plant at the company's Galati site in Romania as well as modernisation of the existing plants there, at an investment value in excess of EUR 100 m.

→ **Further contract with BorsodChem**

We also agreed a further long-term supply contract with the Hungarian chemical company BorsodChem for the on-site supply of industrial gases. This will involve Linde constructing a new air separation plant at the company's location in Kazincbarcika, North-East Hungary, investing around EUR 26 m. The plant is scheduled to open in November 2010 and will then supply BorsodChem with up to 7,000 cubic metres of gaseous oxygen and nitrogen per hour via pipeline. It will also produce liquid oxygen, nitrogen and argon for the regional gas market. With this new investment, Linde will be responsible for operating two air separation plants to generate air gases and three steam reformers to supply gaseous hydrogen and carbon monoxide at BorsodChem's Kazincbarcika site. Linde's total investment here thus amounts to more than EUR 200 m.

→ **Linde acquires 51 percent of shares in SIGAS**

Linde also entered a strategic partnership in the Middle East in 2008, acquiring 51 percent of shares in Saudi Industrial Gas Co. Ltd. (SIGAS). With strong family roots, SIGAS is Saudi Arabia's second-largest industrial gases company. In fiscal 2007, it generated revenue approaching EUR 28 m, at a headcount of around 400. Annual growth for the industrial gases market is estimated at over 10 percent in Saudi Arabia.

→ **Two new air separation plants for Abu Dhabi**

In May 2008, Linde and the Abu Dhabi National Oil Company (ADNOC) agreed to construct two large air separation plants in Abu Dhabi (United Arab Emirates). The project will be implemented under the companies' joint venture, Elixier, at a total investment volume of around USD 800 m. The new plants will be connected to the local supply and pipeline network from the end of 2010 and provide nitrogen for natural gas extraction. The nitrogen will be injected into the on-shore condensate fields at Habshan (Abu Dhabi). Together, the two plants will have a capacity of 670,000 scm/h of nitrogen. The state-owned oil company ADNOC holds 51 percent and Linde 49 percent of shares in the Elixier joint venture, established in December 2007. ADNOC manages the oil, gas and petrochemical business in the United Arab Emirates, both on and off shore (see also Synergies chapter, p. 66 onwards).

INDUSTRIAL GASES – BIG OPPORTUNITIES IN EMERGING MARKETS

US Americans spend an average of USD 49 per capita on industrial gases each year, making them global leaders in this field, ahead of Australians (USD 42) and western Europeans (USD 38). In China, this figure currently amounts to just USD 2 per year and is hardly higher in the majority of South and East Asian states. There is also

still a significant gap between spending in Western and Eastern Europe. However, rising living standards in emerging economies will see demand for industrial gases increase in these regions. Industry experts from Spiritus Consulting put growth rates for Eastern Europe at 12 percent, and 11 percent for South and East Asia.

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- Annual per capita expenditure on industrial gases in USD.

Source: Spiritus Consulting, Ifo Institute.



04



Broad customer base

As a leading supplier of industrial gases, we have a vast portfolio of pioneering products and gas applications. Our leading role makes us the partner of choice for customers across a wide variety of industries. This broad customer base gives us a steady foundation – even in economically turbulent times. The glass and water treatment industries, for example, are amongst the sectors considered least susceptible to economic downswings. The food and beverages industry is also considered a stable economic anchor, showing relatively minor fluctuations in turnover.

View of company headquarters from the Adelholzener Alpenquellen GmbH factory site. Adelholzener has grown into one of the leading producers of mineral waters, fruit juices and juice spritzers in Germany. The Linde Group delivers around 2,000 tonnes of carbon dioxide each year to Adelholzener, which is owned by the Sisters of Charity of Saint Vincent de Paul.







Around 400 million bottles are filled per year in nine modern plants. Adelhöfener was one of the first drinks manufacturers to introduce 100 percent reusable PET bottles.

Sauerstoff O₂

Druckluft

Druckluft ölfrei

Kohlensäure CO₂

Mittleres CO₂ • EN 12068-2 • EN 12068-3 • EN 12068-4 • EN 12068-5 • EN 12068-6 • EN 12068-7 • EN 12068-8 • EN 12068-9 • EN 12068-10 • EN 12068-11 • EN 12068-12 • EN 12068-13 • EN 12068-14 • EN 12068-15 • EN 12068-16 • EN 12068-17 • EN 12068-18 • EN 12068-19 • EN 12068-20 • EN 12068-21 • EN 12068-22 • EN 12068-23 • EN 12068-24 • EN 12068-25 • EN 12068-26 • EN 12068-27 • EN 12068-28 • EN 12068-29 • EN 12068-30 • EN 12068-31 • EN 12068-32 • EN 12068-33 • EN 12068-34 • EN 12068-35 • EN 12068-36 • EN 12068-37 • EN 12068-38 • EN 12068-39 • EN 12068-40 • EN 12068-41 • EN 12068-42 • EN 12068-43 • EN 12068-44 • EN 12068-45 • EN 12068-46 • EN 12068-47 • EN 12068-48 • EN 12068-49 • EN 12068-50 • EN 12068-51 • EN 12068-52 • EN 12068-53 • EN 12068-54 • EN 12068-55 • EN 12068-56 • EN 12068-57 • EN 12068-58 • EN 12068-59 • EN 12068-60 • EN 12068-61 • EN 12068-62 • EN 12068-63 • EN 12068-64 • EN 12068-65 • EN 12068-66 • EN 12068-67 • EN 12068-68 • EN 12068-69 • EN 12068-70 • EN 12068-71 • EN 12068-72 • EN 12068-73 • EN 12068-74 • EN 12068-75 • EN 12068-76 • EN 12068-77 • EN 12068-78 • EN 12068-79 • EN 12068-80 • EN 12068-81 • EN 12068-82 • EN 12068-83 • EN 12068-84 • EN 12068-85 • EN 12068-86 • EN 12068-87 • EN 12068-88 • EN 12068-89 • EN 12068-90 • EN 12068-91 • EN 12068-92 • EN 12068-93 • EN 12068-94 • EN 12068-95 • EN 12068-96 • EN 12068-97 • EN 12068-98 • EN 12068-99 • EN 12068-100



In the drinks industry, gases not only have an important impact on taste. Carbon dioxide, nitrogen and oxygen are also required for cooling, mixing and preserving beverages. (left)

Modern production facilities in perfect harmony with a traditional religious order. The Sisters of Charity are as much a part of Bad Adelholzen life as the trucks that regularly deliver Linde gases to the idyllic Alpine town at the foot of the Hochfölln mountain.

Broad customer base. Gases for healthy drinks.

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The beverages market has been relatively stable for more than ten years in most industrial nations, Germany included. Even in times of economic hardship, drinks manufacturers have succeeded in maintaining revenue levels. Several of our customers

from this segment have been on a steady growth path for many years now. Adelholzener Alpenquellen GmbH is a prime example.

This mid-sized company has outperformed the market thanks to a steady stream of new products, packaging innovations and production processes. Its Active O2 line of oxygen-enriched drinks is now firmly established in around 20 foreign markets, with the company exporting to countries such as the United Arab Emirates and Japan.

The flavoured drinks and healing waters from Bad Adelholzen have a simple success formula – high-quality mineral water from the depths of the Chiemgau hills at the foot of the Bavarian Alps. Bavaria's largest mineral source is owned by the Sisters of Charity of Saint Vincent de Paul, a congregation with its motherhouse in Munich. Each year, our Gases Division promptly and reliably delivers between 1,700 and 2,000 tonnes of carbon dioxide from natural sources along with oxygen and other gases to Bad Adelholzen to keep the drinks sparkling.

As Adelholzener's gases partner, Linde also supplies the beverages company with liquid nitrogen (N₂). This inert gas (see glossary) is injected into the head space of filled bottles to create a protective atmosphere and prevent oxidation. This process significantly reduces the chemical reactivity of the drinks.

Stable market

This close, long-standing collaboration with mineral-water specialist Adelholzener is just one of many examples of the strong ties we enjoy with customers in the food and beverages industry and the importance of this segment in our customer base. Gaseous and liquid gases from Linde play a key role in maintaining the quality of food and drink. They are used for a variety of applications including shock-freezing and cooling, protecting against germs and keeping packaged food fresh. They are also used to carbonate drinks.

Although the food and beverages industry does not typically experience dynamic growth, it is a relatively stable economic driver, even in times of financial turbulence. This is of course a major advantage compared, for example, with the semiconductor industry, which is often subject to extreme fluctuations. In fact, fluctuations in the bev-

erages market tend to be restricted to shifting preferences as consumers switch from beer to wine or from water to juice spritzers. Quantitative fluctuations tend to be seasonal. The annual per capita beverage consumption in Germany is relatively consistent at 750 litres, which translates into a total volume of around 61.5 billion litres. Approximately 90 percent of this is produced and bottled in Germany. Alcohol-free drinks account for around 40 percent of the entire German market, while 50 percent of all beverages consumed in Germany are carbonated. Almost 10 billion litres of this is beer and around 11 billion litres is carbonated water. Other carbonated drinks account for approximately 9.5 billion litres. Each year, Linde supplies drinks manufacturers with around 166,000 tonnes of highest quality food-grade liquid carbon dioxide.

SUCCESS STORY: ACTIVE O2

The close collaboration between Linde and Adelholzener was partly inspired by an idea that occurred to both companies back in 2001 – namely, the possibility of adding extra oxygen to mineral water. Once initial scientific studies verified the positive effects of the additional oxygen, both companies focused on mastering the technical challenges. After all, the oxygen had to remain in the drink even after the seal had been broken – so the mixture of gases had to be just right. "We spent many days and nights working with Linde to get the perfect mix of oxygen and CO₂, allowing the oxygen to remain stable in the water," recalls Peter Flechsenhar, from Adelholzener Alpenquellen's product development department. Further tests were then carried out on the end product. The results were positive – the oxygen is absorbed directly by deoxygenated blood in the veins, providing extra reserves for the liver and kidneys.

Today, Active O2 has evolved into a broad product line and is one of the key drivers of Adelholzener's success at home and abroad. Each year, around 100 million bottles leave the plant, generating more than one quarter of the company's annual turnover, which industry experts estimate at around EUR 130 m.

Promising prospects for drinking water treatment

The water business is a strategic pillar for Linde in a much wider context, too, especially in economically challenging times. Access to clean drinking water is a basic human need, but water is becoming an increasingly scarce resource. Accelerated by climate change, water



New delivery for the drinks industry. The gases are stored in special tanks before being deployed in various production processes.

scarcity is becoming a global megatrend that is impervious to economic ups and downs. Not only does this apply to arid land in Australia, India, China, Saudi Arabia, North Africa, California and Spain, it is also affecting southern England, for example, and various islands of the Netherlands.

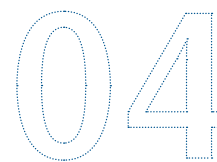
Against this background, investments in water technology are now intensifying. Water treatment systems, for instance to obtain drinking water from seawater desalination plants, are experiencing a particular increase in demand. CO₂ is used in many of these facilities to deliver the required quality of drinking water.

The increasing shortage of water also places mounting pressure on industry to conserve resources. This is no longer an environmental trend, but an economic necessity – the only way to keep water supply costs at an acceptable level. As a provider of water treatment technologies, this development is of benefit to Linde. And that effect even extends to countries such as China, where water treatment activities were previously on a small scale only.

The responsible use of water as a valuable resource goes hand in hand with renewed efforts to keep process water circulating in a closed loop wherever possible. Efficient wastewater treatment technologies are an effective way of combating water shortages. The new US President, Barack Obama, for example, backs implementation of the relevant US water laws and will tighten them if need be. Recycling treated wastewater often only becomes possible and economically viable with the use of oxygen or ozone, so in this sector, too, new markets are opening up for Linde.

COMMITTED TO THE ENVIRONMENT

Environmental protection also plays an important role in the ethics-driven corporate policy of Adelholzener Alpenquellen GmbH. Back in 1997, it was one of the first companies in this industry segment to present an environmental statement in line with the European Union's Eco-Management and Audit Scheme (EMAS – see glossary). This initial statement was certified in 2004 for the third time. The company produces energy from solar panels installed on its factories – which are also planted with rooftop vegetation. The two farms owned by the congregation are also certified. The company's PET bottles (see glossary) can be reused up to 25 times, and are made of 100-percent recyclable material. A special committee monitors and advises company management to ensure that it continues to maintain the perfect balance between sustainability, quality and innovation, both now and in the future.



CHANNELLING PROFIT INTO GOOD CAUSES – A LOOK AT THE HISTORY OF ADELHOLZENER ALPENQUELLEN GMBH

Back in 1907 when the Sisters of Charity of Saint Vincent de Paul acquired the spring, no one could have foreseen that the company, driven by charitable motives, would go on to be such a leading manufacturer of beverages. The company's portfolio now ranges from healing and mineral waters to fruit juice spritzers and mixed fruit juices. But the Sisters originally purchased the site with its spa buildings and the mineral water source (discovered by St. Primus) as a place of convalescence for nuns looking after the sick, old and poor, and to make the healing water available to as many people from the region as possible.

The source thus found its way back to its original roots. The spring's history goes back as far as the year 286 AD when it was discovered by St. Primus, a Roman legionary. According to local lore, St. Primus worked as a missionary for the Christian faith and healed the sick using the power of prayer and the spring's water. The spring's importance grew under the management of the Sisters of Charity. In 1939, the Primus source, as it was generally known, was made an officially licensed healing spring. The town of Adelholzen was permitted to use the prefix "Bad" in 1946, making it an official spa town.

From 1970 to 1992 alone, annual production of bottled water rose from 16 million to over 300 million bottles. By the middle of the 1990s, however, the company had to make some drastic decisions. The market for traditional mineral waters was stagnating, while ice teas, fruit-juice spritzers and flavoured waters were increasing in popularity. The company made a bold decision and became the second company in Germany to start using reusable PET bottles – still a strategic pillar today. The company has channelled around EUR 160m into modernising its product lines and manufacturing processes since 1998. Today, nine state-of-the-art filling plants process up to 380 million reusable PET and glass bottles each year. With 420 employees, Adelholzener is one of the biggest mineral water companies in Germany.

With the exception of funds required for investments, all proceeds from the sale of mineral waters and flavoured drinks are channelled back into the order's community projects. The order runs several healthcare facilities, retirement and nursing homes, and shelters for the homeless.

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- 01 Adelholzener Alpenquellen GmbH is located in Siegsdorf in Bavaria. The community was granted the right to use the prefix "Bad" (spa) in 1946.
 - 02 With its wide portfolio, Adelholzener has something for every taste – with fruit drinks, diet carbonated drinks and the Active O2 brand complementing the range of traditional mineral waters.
 - 03 Profits from beverage production are not only used for business investments such as new bottling plants, but are also channelled into the order's community projects.
 - 04 The congregation house of the Sisters of Charity of Saint Vincent de Paul is a stone's throw away from the production facilities.
 - 05 Spring water from Adelholzen is a pure product of nature. Nestled in the idyllic heart of the Bavarian Alps, the company has developed a close partnership with Linde Gas over the years.



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Taking samples - Dieter Högl tests a bottle of Active O2, a range of drinks developed in close cooperation with Linde.

Interview with Dieter Högl, Linde Gas, Sales – Foodstuffs, South Germany

“Our customers rate quality”

Mr Högl, the food and beverages industry is generally regarded as a stable sector even in times of economic turmoil. Does this tie in with your experience?

↳ Absolutely. The beverages industry serves one of society’s most basic needs and pleasures. Food and drink are a fundamental part of life, so they are not greatly affected by economic highs and lows. In fact, it is more a question of seasonal fluctuations. In summer, people tend to opt for alcohol-free thirst quenchers and generally drink more than in winter.

What is it that your customers particularly value about Linde? What do they get from us that they can’t get from our competitors?

↳ Our customers rate the all-round quality they’ve come to expect from Linde – from the purity of our gases to predictable, on-time deliveries. Our dedication to quality also extends to professional consultation services, ensuring optimum, cost-efficient deployment of gases, especially when it comes to rolling out new applications. Our customers trust us and regard us as a strong, reliable partner.

How many customers are you responsible for in your area?

↳ My region covers southern and eastern Bavaria and includes around 300 customers, all from the foodstuffs and beverages industry.

And how many kilometres do you notch up each year visiting your customers?

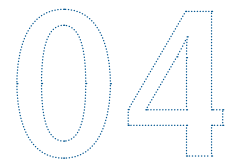
↳ I generally travel around 60,000 kilometres by car.

So do you do anything to keep in shape after spending all this time behind the wheel?

↳ I go hiking in the mountains at weekends, which helps strengthen my back following long periods on the road. I also enjoy Nordic walking and, in winter, cross-country skiing.

Your job involves marketing industrial gases to the drinks industry. Admittedly, this doesn’t sound too exciting on the surface. What is it that makes your job so interesting?

↳ Gases can be used for a huge range of applications in the food and drinks sector. So we are constantly confronted with new challenges. To maintain our position as a technology leader in the industrial gases segment, we have to anticipate evolving customer needs and deliver workable solutions – fast. Every day is a new challenge and we never stop learning. But that is exactly what makes this job so much fun!



DIVERSIFIED MARKET STRATEGY

Even a company such as ours is not totally immune to the effects of the current economic crisis. However, our highly diverse customer base gives us a relatively stable footing. We supply our products

to a wide variety of industries, with the result that no single sector accounts for more than 15 percent of total turnover.

→ Glass industry

The construction industry is one of the main buyers of glass. This sector benefits from public contracts, with spending set to increase over the coming months to bolster the economy. For glass manufacturers, this will more than compensate for the decline in orders from the automotive industry.

The market for plate glass – as used in skyscrapers – remains stable. The same holds true for fibreglass, whose applications include damping and insulation. Industrial glassware, such as glass phials for the pharmaceutical industry, is also experiencing robust demand.

Around 65 percent of all glass manufactured is for packaging purposes, consumed by economically resilient sectors such as the food and beverages industry.

Another expanding market is specialty glass. This is used in solar-panel manufacturing and thin-film technology (glass modules for photovoltaic cells), for instance. Innovative glass-melting techniques also represent a promising growth area for the industrial gases sector. Linde is actively involved in developing suitable process technologies here, thus tapping new customer segments for our gases.

→ Mining and raw materials

In times of economic slowdown and financial crisis, the price of gold usually climbs, in turn making gold mining more financially attractive. So gaseous and liquid oxygen therefore remain in demand for

gold mines. Around 30 customers from Australia and 20 from Africa are currently deploying our GOLDOX technology for efficient gold recovery and this is on the rise.

Although global market prices for nickel, zinc and copper have fallen as a result of declining demand, this encourages companies to refine their mining processes and increase the efficiency of metal recovery. Once again, Linde stands to benefit from this trend thanks to rising demand for applications using industrial gases such as oxygen and nitrogen.

→ Healthcare

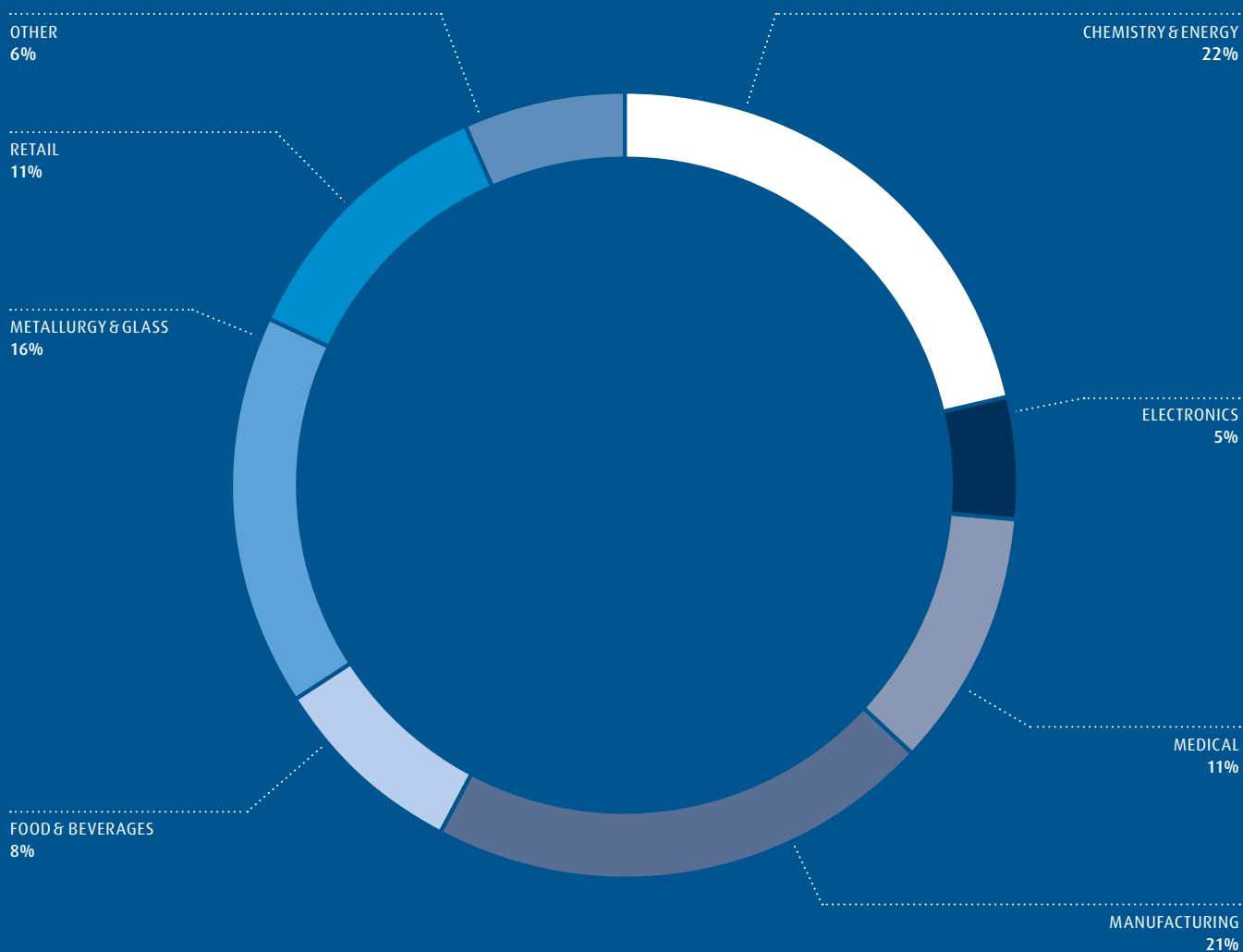
The ageing population has become a global megatrend. This is set to fuel long-term growth of the healthcare market as more and more people live longer and require medical assistance in their old age. More generally, diagnosis and treatment methods are constantly being improved, which also opens up new markets. And patients with respiratory diseases who rely on innovative medical applications with oxygen from Linde Gas Therapeutics naturally continue to do so regardless of any economic crisis. Thus our Homecare business recorded average annual sales growth of 12 percent between 2000 and 2007, securing a leading position in Europe and Latin America, in particular. And our Hospital Care business places us firmly at the forefront of the global market.

STRONG, STABLE CUSTOMER BASE

A simple break-down showing the distribution of our gases across industries shows just how diversified our customer base is. Some sectors here, such as the chemical and steel industries, are affected by the economic crisis. Yet others benefit from structural growth

trends and will continue their expansion when the crisis is over. These not only include the energy and healthcare sectors, but also the electronics industry, which we supply with gases for use in the production of solar power plant modules.

Gases Division 2008, Distribution across industries



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Synergies

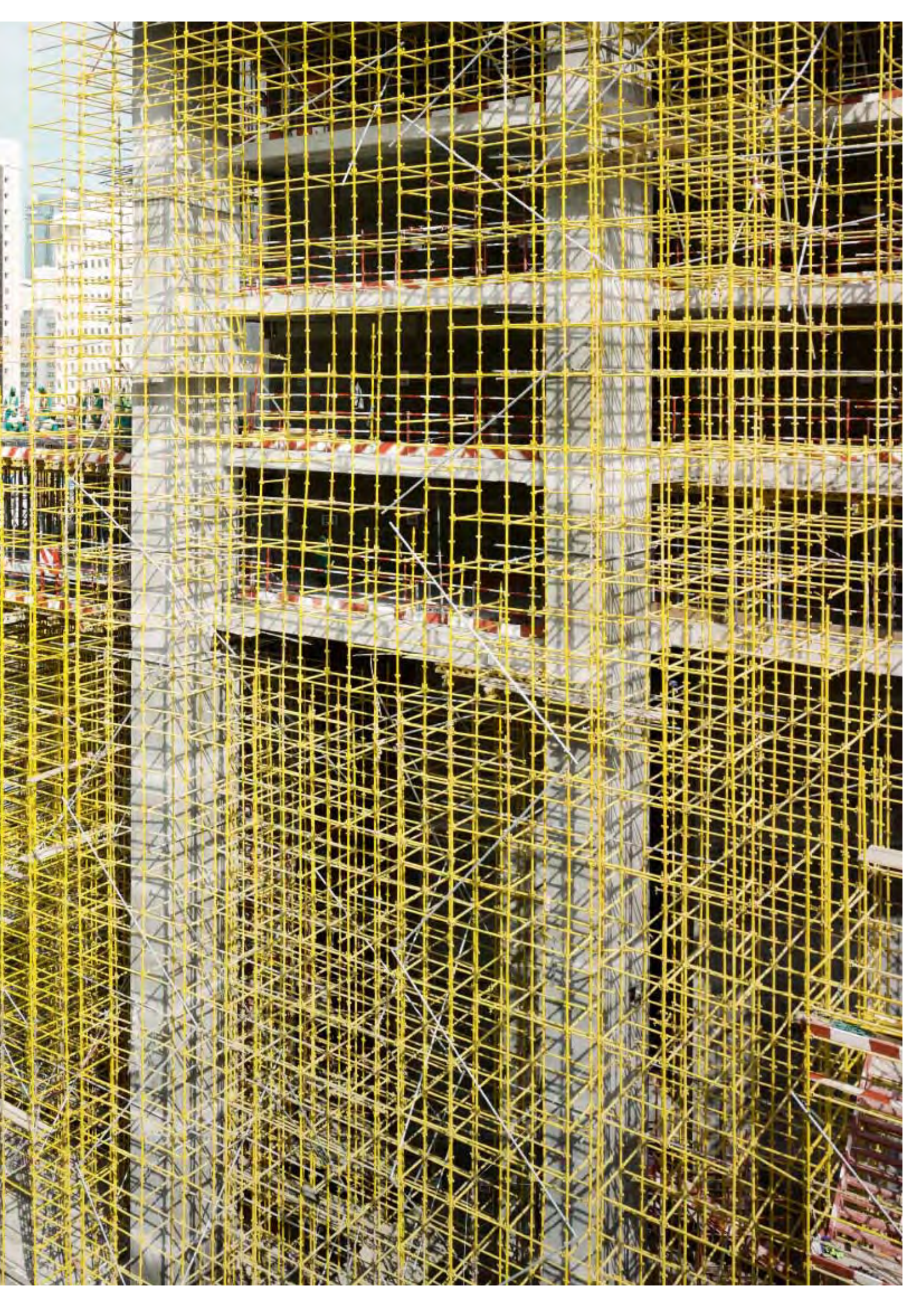
We continuously capitalise on the synergies that arise between our Engineering and Gases Divisions. Our position as a technology leader in the field of international plant engineering gives us a decisive advantage over other gas companies. Especially in emerging markets, the long-standing customer relationships established through our Engineering Division help drive further expansion of our gases business in numerous different countries. And this symbiosis works in both directions: our Gases Division is the Engineering Division's biggest customer.

Elixier II construction site in Abu Dhabi. The modern air separation plants Linde is building in the middle of the desert, between Abu Dhabi City and Ruwais on the coast of the Persian Gulf, play an important role in ensuring the efficient recovery of crude oil and natural gas from the Habshan on-shore field. The new plants will be connected to the local supply and pipeline network from 2010 onwards and provide nitrogen for injection into oil and gas reserves.





The population of Greater Abu Dhabi is set to rise from today's level of 900,000 to around 3.1 million by 2030. Impressive architectural projects such as the Abu Dhabi Central Market are creating living space, shopping oases and office complexes in record time. The region also offers opportunities for Linde. The work we are doing within the framework of our joint venture with Abu Dhabi National Oil Company (ADNOC) consolidates our position as a market leader in the lucrative gases and engineering sectors.







Named after the founder of the United Arab Emirates, the Sheikh Zayed Bin Sultan Al Nahyan Mosque is the third-largest mosque in the world. Together with the Jumeirah Mosque in Dubai, it is one of only two Muslim places of worship in the UAE to permit entry to non-Muslims at certain times. The 400-million-euro edifice has been open for prayer since its completion at the end of 2007.

Synergies. Standing strong – together.

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In September 2006, the British BOC Group was acquired by The Linde Group. Since then, the Gases Division, with its highly diverse international business base, has gone on to become the Engineering Division's largest customer, with orders for air separation plants more than doubling during this period. Our gases business also increasingly benefits from the long-standing customer contacts established by our engineering experts. Linde's successful track record in the United Arab Emirates (UAE) is perhaps the most high-profile example here.

Over the past ten years, Linde has succeeded in positioning itself as a trusted partner of crude oil and natural gas producer Abu Dhabi National Oil Company (ADNOC). This successful relationship, which has since spawned a joint venture with ADNOC, is largely built on the close collaboration between our Gases and Engineering Divisions. This partnership is behind several major deals to develop natural resources – projects that benefit both our Engineering and Gases Divisions. ADNOC controls around 90 percent of the extensive crude oil and natural gas deposits in the UAE.

Ethylene plant opens doors

Located in the Persian Gulf, the emirate of Abu Dhabi accounts for 85 percent of the total area of the UAE, making it the largest region in the emirates. Linde has operated a subsidiary in Abu Dhabi since 1995. In 1999, our Engineering Division was commissioned to construct an ethylene cracker (see glossary) in Ruwais by Borouge, a joint venture between ADNOC and Austrian plastics manufacturer Borealis. The plant went on stream in 2001 with an annual production capacity of 600,000 tonnes. Just two years later, a second plant constructed by Linde went online.

Rising demand for thermoplastics such as polyethylene (PE – see glossary) and polypropylene (PP – see glossary) led Borouge to expand the complex in Ruwais (Borouge II). To this end, the company commissioned one of the world's largest ethane crackers from Linde, a deal worth USD 1.3 bn. With an annual production capacity totalling 1.5 million tonnes, the new ethylene plant is scheduled to start operations at the end of 2009 and should more than treble production capacity for petrochemical products in Ruwais.

A joint venture by the name of Elixier

Linde and ADNOC's successful working relationship in the petrochemical industry paved the way for even closer collaboration. In November 2007, the two companies agreed to set up a joint venture for the production and long-term supply of industrial gases to customers in Abu Dhabi. ADNOC Linde Industrial Gases Company Ltd. trades under the name Elixier. Both ADNOC (51 percent of the shares) and Linde (49 percent of the shares) are shareholders in the company.

At the time the company was founded, both partners had already set their sights on a joint project. Under contract from Elixier, Linde's Engineering Division is currently working on the first air separation plant in Ruwais' industrial zone. It will pipe nitrogen to the Borouge II complex and supply liquefied nitrogen and oxygen to other customers, such as Linde and ADNOC. This Elixier I project also includes plans to supply Linde's Gases Division with liquefied gases for sale.

Impressive reference for Elixier II

And the Linde/ADNOC collaboration keeps going from strength to strength. Just a few months after the joint venture was founded, Elixier commissioned our Engineering Division to construct two air separation plants at Mirfa on the coast of the Persian Gulf, between Abu Dhabi City and Ruwais. With a total capacity of 670,000 standard cubic metres per hour, these plants will be two of the largest of their kind in the world. The capital outlay for this major project is around USD 800 m.

The dimensions of the project are matched only by the five major nitrogen production plants built by Linde over the past years for the Cantarell complex in Mexico. "To save time and money, we've been using the blueprints of these tried-and-tested air separation plants in Mexico for the new plants on the Persian Gulf," explains Dr Gerhard Beysel, Business Development Manager for air separation plants in the Engineering Division. The nitrogen produced in the plants in Mexico is pumped into the Cantarell oil field. The resulting pressure enables the crude oil to be extracted more efficiently from below the seabed in the Gulf of Mexico (enhanced oil recovery, EOR).

The nitrogen from the new plants in Mirfa (Elixier II) will – in simple terms – be used for a similar purpose. The gas is to be transported 50 kilometres by pipeline from the coast to the Habshan field. Here it will be injected into gas and oil reservoirs to create a constant pressure level, enabling the gas and condensate to be pumped to the surface more evenly. Previously, natural gas was



Apartments for around 280,000 people are currently being constructed on the natural island of Al Reem alone, off the north-eastern coast of the city. The project also includes hotels and a golf course. And as the skyscrapers grow, so does the need for energy.

used to generate the necessary pressure. This, however, meant that large amounts of this precious energy source were lost.

The decision to inject nitrogen into the oil and gas field was taken following extensive investigations by experts at Schlumberger Oilfield Services and Exxon Mobil Corp. Choosing the correct medium to inject into the reservoirs depends on the composition of the bedrock that contains the reserves. The conditions in Habshan certainly indicated that nitrogen would be a good choice. But it was the positive results from our reference plants in Mexico that really tipped the scales in favour of nitrogen and, consequently, construction of the two air separators. The existing infrastructure at Mirfa also made it the perfect site for the new plants, as utilities such as electricity and water plus a desalination plant, port and pipeline network were already in place.

Professional project management

A great deal of complex work will have to be completed during the 40-month planning and construction phase before Linde can hand over the turnkey plants to Elixier in 2011. Core components such as cryogenic equipment and heat exchangers have to be manufactured or – to be more exact – assembled as packaged units (PUs) at our Schalchen and Bremen sites in Germany and shipped from there to the construction site. Preassembling parts in this way reduces assem-

bly time on-site. Linde sources machines, compressors and other equipment from suppliers. At the same time, however, construction work in Mirfa has to be monitored and, from 2010 onwards, the plant components delivered by sea have to be assembled. We will be handing over turnkey facilities to our customer, so our engineering tasks also extend to management and monitoring of all subcontracted construction and assembly work. We have put together a dedicated project team, specially trained for this logistical challenge.

Newcomer Elixier

As work progresses on these large nitrogen plants in Mirfa, the recently established Elixier venture is set to develop and expand its headcount to up to 60 employees under the leadership of General Manager Harald Schütz. Both Linde and ADNOC are equally represented on Elixier's board, with Linde appointing Executive Board member Dr Aldo Belloni and Dr Hans-Hermann Kremer, responsible for our gases business in the Regional Business Unit Eastern Europe & Middle East. The Elixier board is headed by Mohammed A. Sahoo Al Suwaidi, a representative of ADNOC and General Manager of Abu Dhabi Gas Industries Ltd. (GASCO), the company that deals with the gases side of ADNOC's business activities. Abdulaziz Alhajri, CEO of Borouge, is also a member of Elixier's top management team.

05

Proximity is also a key factor in ensuring successful collaboration between the governing bodies of all participating companies and the experts from Linde's Engineering and Gases Divisions on-site in Abu Dhabi. So it certainly made sense for all three joint venture parties to take offices in close vicinity in the UAE capital. Elixier is located in the same office complex as GASCO, in a building owned by the ADNOC Group.

Linde also benefits from the customer contacts established by Uwe Rathmann during his many years as head of our Engineering offices in Abu Dhabi. Rathmann himself played a major role in the foundation of Elixier.

Growth opportunities

Elixier has a clear set of tasks and goals. The joint venture is responsible for operating these air separation plants and delivering industrial gases to oil and gas recovery companies and the petrochemical industry in Abu Dhabi and the remaining emirates, with priority of course given to companies and joint ventures under the umbrella of the ADNOC Group.

"Elixier currently has supply contracts with four customers in Ruwais and Mirfa: ADNOC, GASCO, plastics manufacturer Borouge and Linde's

Gases Division," states General Manager Harald Schütz. And this is just the tip of the iceberg. The ADNOC Group and its affiliates in the petrochemical industry are expanding. This growth attracts other companies looking to profit from the existing and emerging infrastructure supplying raw materials, gases, energy and water. The land earmarked for two additional air separation plants in Mirfa looks set to be a hive of activity in the near future.

SYNERGIES

The word synergy derives from the Greek "synergo" and describes mutually beneficial cooperation between living beings, materials or forces. Or, in the words of Aristotle, "the whole is more than the sum of its parts". This phenomenon also occurs in the business world when, for example, Linde Engineering is contracted by the Gases Division to construct air separation plants, which the Gases Division then uses to supply its customers. Each Division benefits from the know-how and commercial success of the other. And, of course, our customers also benefit from the complementary technical expertise of two equally strong partners.

- 01 View of the huge construction site on Al Reem Island off the coast of Abu Dhabi City – the lights from the towers can be clearly seen from the desert.
- 02 The development of Sowwah Island is a cornerstone of Plan Abu Dhabi 2030. The island is set to become the heart of the Abu Dhabi Central Business District and the commercial hub of the UAE's capital.
- 03 Only camels manage to keep their cool in temperatures of up to 50 °C. Per capita power consumption in the United Arab Emirates is around 30 percent higher than in the USA – and this includes energy for air conditioning.
- 04 "We build the country" is emblazoned on huge billboards in Abu Dhabi. The new Abu Dhabi Central Market in the heart of the city is a hive of activity.
- 05 Until the 1960s, the city landscape was defined by simple buildings, in many cases without electricity or running water systems. Due to its rapid expansion, however, Abu Dhabi has been regarded as one of the world's most modern cities since 1980.
- 06 View of the parking deck at Sheikh Khalifa Energy Complex. Oil remains the main source of income in the country and one of the main reasons for the high car density in the Emirates. Even today, however, the government is working hard to move towards an oil-free future. This obviously calls for new technologies.
- 07 A dense pipeline network connects the natural gas and crude oil fields of Abu Dhabi. Many of the lines can barely be seen after a sandstorm.



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The personal touch is always best. Harald Schütz (General Manager, Elixier, left), Mehmet Hamurcu (Construction Manager, Linde Engineering, centre) and Salem Alattas (GASCO Sr. Project Manager Major Projects Group) stop at a desert pipeline. Abu Dhabi is a multicultural melting pot, bringing together people with totally different outlooks. Over 80 percent of the people living here are of foreign origin.



Interview with: Harald Schütz, General Manager of Elixier, Abu Dhabi

“I was welcomed with open arms”

Mr Schütz, you were previously working in Hong Kong and are now based in Abu Dhabi – that must be a major culture change?

↳ *It certainly is. Business culture here is nothing like it is in China – and even less like what we’re used to in Germany. It’s like being part of a big family – from day one. Here, business matters are discussed quite freely and openly by the relevant committees and a close circle reaches the final consensus.*

So what would be your recipe for success in this region?

↳ *Here it’s all about mutual success. You really have to immerse yourself in the culture and extend the trust that has been shown to you to others. This opens the door for you to channel your own ideas into the decision-making process and jointly realise those ideas – especially when dealing with challenging situations or issues.*

How do you find the actual working environment?

↳ *As was my experience in Asian countries, they place great importance on hospitality in the Emirates. I receive a lot of support not just from all my colleagues at Linde, but also from staff at the ADNOC Group and especially GASCO (editor’s note: operates the gas business on behalf of ADNOC). I’ve really been welcomed with open arms here, even by members of the upper echelons, which is very gratifying.*

And how is Elixier progressing against this background?

↳ *Well, drawing on this wide-ranging support and my own contacts, I am endeavouring to model Elixier’s employee structure on the multicultural example we see in the UAE. Over 80 percent of the population here originates from overseas. And so far, each of our employees comes from a different country. When they start work, I will have the opportunity to give back what I have received in building up Elixier – openness, friendliness and trust.*

Do you still have time for leisure activities? What is there to do in Abu Dhabi?

↳ *You can practise almost all kinds of sport here, from riding to skating. Trips to the desert are a particular highlight, with barbeques under the fantastic star-lit sky. We’ve already done this several times with colleagues from Linde. Essentially, we have everything on our doorstep – even skiing is only a stone’s throw away in neighbouring Dubai!*



SYNERGIES

In other regions, too, we are increasingly generating new business for our Gases Division on the back of long-standing collaboration with customers and partners in the Engineering Division. And our

on-site capabilities offer the ideal one-stop solution – not only do we construct a plant on our customer's premises, we also go on to operate that plant on behalf of the customer.

→ Ethylene plant in Dahej, India

At the end of 2008, in consortium with South Korea-based Samsung Engineering, we received a contract for turnkey construction of an ethylene plant in Dahej, India. This was awarded by the Indian company OPAL, a subsidiary of the state-owned ONGC (Oil and Natural Gas Corporation Ltd.). In total, the contract is worth around EUR 1.03 bn, with Linde's stake amounting to EUR 350 m. The new plant will be the largest of its kind in India and one of the largest ethylene facilities worldwide. India is one of our most promising markets in terms of both plant engineering and our gases business, and we particularly benefit from the wide-ranging synergies between the two Divisions here. Linde has enjoyed a successful partnership with Samsung Engineering for almost 20 years now, significantly boosting our operations in China, Thailand, Malaysia and Saudi Arabia, and now in India too.

→ Joint projects involving our Gases and Engineering Divisions

Around 85 percent of the Linde on-site facilities that opened for operation in fiscal 2008 were joint projects between our Gases and Engineering Divisions. Examples of this efficient collaboration include a steam reformer at the Burghausen chemicals hub (Germany), a hydrogen facility for Voest Alpine in Linz (Austria), carbon monoxide supplies for our customer Lucite in Singapore, and a HyCO plant to produce hydrogen and synthesis gas for Bayer AG in Caojing (China).

→ Long-term supply contract for industrial gases

Our latest project for the world's largest steel manufacturer, ArcelorMittal, also builds on collaboration between our gases and plant

engineering business. In spring 2008, we signed a long-term agreement to supply industrial gases to the company's Galati location in Romania. The contract also includes construction of a new air separation plant and modernisation of existing facilities, at an investment volume in excess of EUR 100 m.

→ Second hydrogen plant in Lemont, Illinois

Our on-site business also continues to benefit from the high demand for hydrogen to purify and desulphurise crude oil. This process is growing in importance as government authorities tighten environmental regulations covering emissions. We are preparing to construct a second hydrogen plant at our Lemont site in Illinois (USA), for instance, and will then be supplying the neighbouring refinery, run by CITGO Petroleum Corporation, with around 1.3 million standard cubic metres (scm) per day. CITGO will use the hydrogen to treat high-sulphur (or sour) crude oil from Canadian oil sands.

→ SCALE kick-off

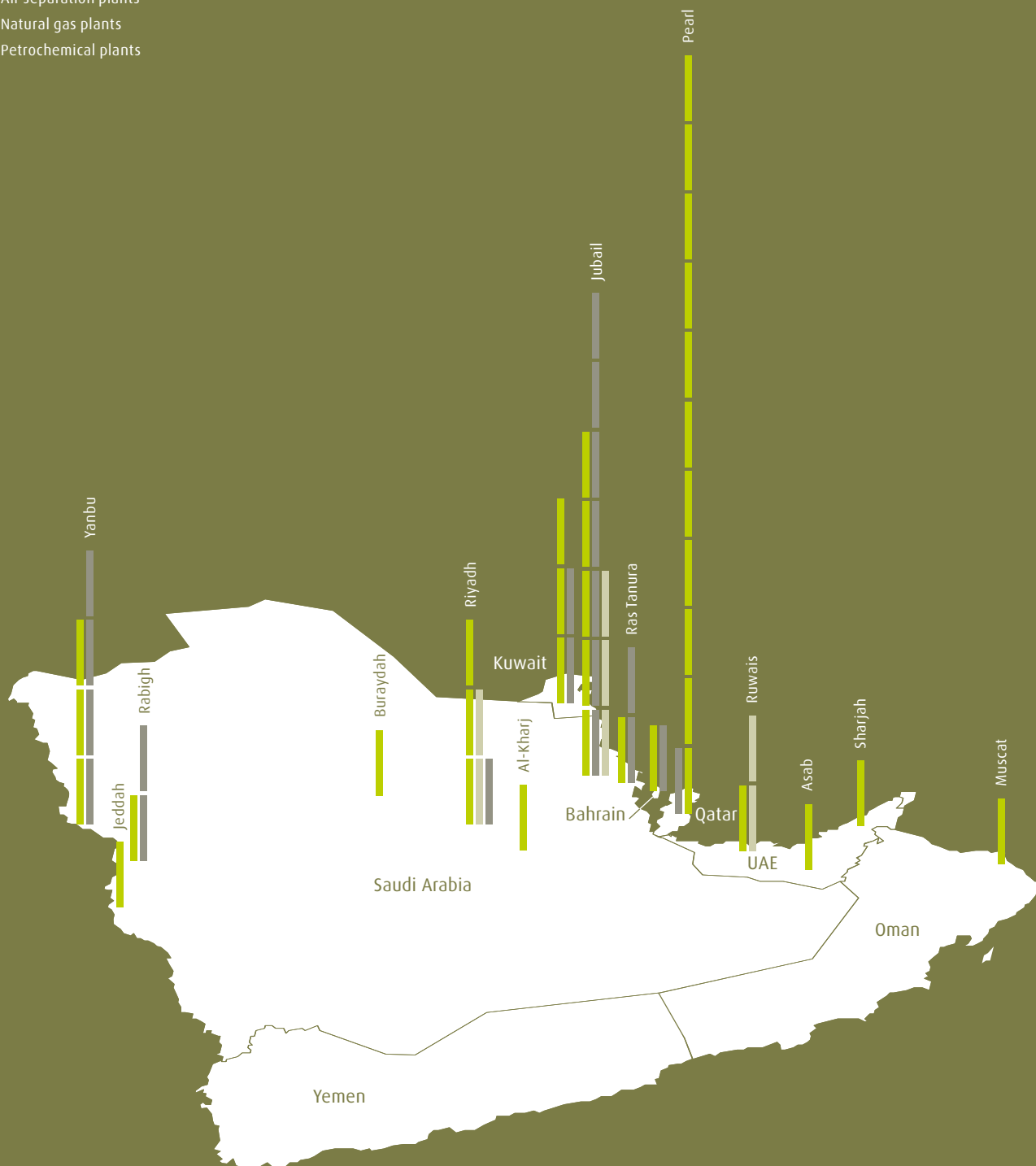
To harness the synergies between our two major Divisions even more effectively in future, Linde kicked off the SCALE project in spring 2008. This optimisation programme should enable the Engineering Division to supply the Gases Division with air separation plants across the globe at significantly lower cost and shorter delivery times (24 months maximum). We intend to achieve this objective by increasing standardisation, simplifying workflows and concentrating on suppliers and partners offering maximum cost efficiencies. This will allow us to make our on-site business even more competitive.

STRONG PRESENCE IN A KEY REGION

Over the past decades, Linde Engineering has engineered and built over 50 plants for the most varied of customers dotted around the Arabian Peninsula – from Saudi Arabia to Oman and from Kuwait to the United Arab Emirates. Our engagements here range from air separators through natural gas plants to petrochemical facilities.

At the same time, our Gases Division has invested over USD 1 bn in total in the Middle East, joint ventures included, to supply local customers with industrial gases. The close collaboration between these two Divisions not only gives Linde a competitive edge, it also gives our customers the benefit of our bundled, synergised expertise.

- Air separation plants
- Natural gas plants
- Petrochemical plants



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Our Annual Report, which includes the Linde Annual and the Financial Report of The Linde Group, is available in English and German. You can download either version from our website at www.linde.com. You will also find an interactive version of the Annual Report online.

If you require any additional information about The Linde Group, please contact our Investor Relations department. Our staff would be delighted to send you anything you need free of charge.



Glossary

→ Amorphous silicon (a-Si)

A material used to manufacture thin-film solar cells. Here, the photoactive semi-conductor is an amorphous (non-solid) silicon that is deposited in a thin layer on the substrate material (e.g. glass). This process offers significant potential savings in comparison to crystalline silicon technology thanks to lower material and energy requirements plus the highly automated production process.

→ Biogas

Biogas is generated when plant matter decays in biogas facilities. Its main elements are methane and carbon dioxide. Methane is the component harnessed to produce energy and also the primary component of natural gas.

→ CERN

The European Organisation for Nuclear Research (Conseil Européen pour la Recherche Nucléaire) is a major research facility located near the city of Geneva in Switzerland. The organisation is most commonly known for its particle accelerator. With 1,700 magnets and a circumference of 27 kilometres, CERN's Large Hadron Collider (LHC) is the world's largest particle accelerator.

→ Cold box

Completely encased and fully equipped, ready-to-use unit comprising heat exchangers to separate gases at low temperatures.

→ Eco-Management and Audit Scheme (EMAS)

The Eco-Management and Audit Scheme was established in mid-1995. It is a voluntary initiative that enables businesses to evaluate and continuously improve their environmental performance.

→ Enhanced oil recovery (EOR)

Also known as tertiary recovery of crude oil, this procedure involves the use of steam, chemicals or gas such as nitrogen to extract the maximum amount of remaining reserves from an oil field.

→ Ethylene cracker (steam cracker)

Steam cracking is a thermal process in petrochemistry where steam is used to convert longer-chain hydrocarbons (naphtha, propane, butane, ethane and gas oil) into short-chain hydrocarbons. These resulting compounds are then used as raw materials for plastics, varnishes, solvents and pesticides.

→ Gas processing

Natural gas not only contains methane but also heavy hydrocarbons such as ethane, propane and butane. These gases must be separated in a fractionator before natural gas can be used as a fuel.

→ Grid parity

This term from the energy industry refers to a situation whereby solar electricity or electricity from other renewable sources reaches parity with grid electricity prices (generated at a coal-fired power plant, for example).

→ Inerting

A process by which materials are converted or processed to less reactive or inert materials. Inert materials include noble gases, glass and porcelain.

→ Liquefied natural gas (LNG)

LNG is regarded as a promising fuel of the future because of its high energy density, constant heat rating and high purity.

→ Methylene diphenyl diisocyanate (MDI)

A chemical compound and aromatic isocyanate. MDI is a key raw material used in the manufacture of polyurethane and polyamide-imides as well as insulating foam and adhesives.

→ Microcrystalline silicon ($\mu\text{-Si}$)

In contrast to amorphous silicon, microcrystalline silicon has a crystalline structure with much smaller grains than conventional crystalline cells. A double layer structure comprising microcrystalline and amorphous layers is almost always used to produce micromorphous solar cells. These types of solar cells are created by depositing an amorphous and a microcrystalline silicon layer on top of each other on the substrate. Each layer is specially designed to exploit a specific light spectrum. The solar cells are known as tandem cells as a result of this double layer model.

→ PET reusable bottles

PET is an abbreviation of polyethylene terephthalate. PET bottles are light, stable, transparent and almost indestructible. Thanks to their light weight, PET bottles are a more environmentally friendly option than glass bottles, especially as part of a recycling system.

→ Polyethylene (PE)

Polyethylene is a thermoplastic created by polymerising ethane. It has a wax-like surface and is highly resistant to acids, lyes and other chemicals. PE is used in a variety of products including foils, containers, pipes and packaging.

→ Polypropylene (PP)

A polyolefine, semi-crystalline thermoplastic. It is used in a range of products including dashboards, battery housings, child safety seats, bicycle helmets, insulating material, cable sheaths, insulating foils, pipes, fibres and packaging materials.

→ Polyurethane (PU)

PU is a versatile plastic that is used in the most diverse areas, e.g. as foam for mattresses and sponges, as coating foam to insulate buildings, and in varnishes, adhesives etc.

→ Silicon

Silicon is a hard, brittle nonmetal with a dark grey sheen and a diamond-like lattice structure. Crystalline and amorphous silicon can be differentiated by the size of the crystals. Silicon is a typical semi-conductor element. Its ability to conduct electricity increases with temperature. Adding metal atoms (impurities) also increases silicon's conductivity.

→ Thin-film solar cells

In order to create thin-film cells, thin layers of photoactive semiconductors are applied to a substrate material. These layers are approximately 0.001 millimetres thick. The cells have a very homogenous structure and are auburn to black in colour.

→ Wafer

In the semiconductor, photovoltaic and micro-mechanics industries, a wafer is a circular or square slice, around one millimetre thick, on which electronic components or photoelectric layers are constructed. These slices are usually made of monocrystalline silicon with diameters of between 150 and 300 mm. The larger the wafer, the more integrated circuits (chips) it can hold.

Review of the year

JANUARY

↳ The Linde Group signs a long-term supply contract for industrial gases with the steel producer Corus, part of Tata Steel. The contract involves the construction of a new air separation plant (ASU) at Corus' Scunthorpe site in North Lincolnshire, England, for around EUR 80 m. The new ASU will come on stream in mid-2010, making it possible to increase steel production.

FEBRUARY

↳ Linde is awarded a contract by BASF to construct a large hydrogen plant for their facility in Ludwigshafen, Germany. Linde will handle the basic and detail engineering and materials procurement for this project, as well as the installation and commissioning of this turn-key hydrogen plant which is scheduled to come into operation in mid-September 2009. In the past, Linde has built oxygen and ethylene production plants at the Ludwigshafen facility, but this is the first hydrogen plant that Linde has supplied for BASF.

MARCH

↳ Linde Nippon Sanso (LNS), a company of The Linde Group, signs an exclusive contract with Malibu GmbH & Co. KG in Bielefeld, Germany, to supply all the gases required for the production of photovoltaic modules. The long-term contract comprises over-the-fence supply of nitrogen (N₂), hydrogen (H₂), silane (SiH₄), nitrogen trifluoride (NF₃), argon (Ar) and helium (He). In addition, Linde and Malibu are entering into a joint development programme for advanced gas technology which will contribute towards improving the effectiveness of the solar cells, and increasing production throughput and profitability. Malibu is a joint venture between energy service provider E.ON and Schüco, a major worldwide provider of building envelope systems.

APRIL

↳ The Linde Group enters into a long-term supply contract for industrial gases with the world's largest steel producer ArcelorMittal. The agreement involves the construction of a new air separation unit (ASU) at ArcelorMittal's site at Galati in Romania and the refurbishment of existing assets on the site. The total investment exceeds EUR 100 m.

↳ Linde and the American company Waste Management Inc. enter into a joint venture agreement in Livermore, California, to build the world's largest plant for the conversion of landfill gas into environmentally friendly biogas. The liquefied biogas will be used as fuel for Waste Management's 300 trash collection and recycling vehicles in California. The total investment in the project is USD 15 m. Linde is responsible for the engineering of the plant as well as the cleaning and subsequent liquefaction of the landfill gas.

MAY

↳ Linde sells its Colombian subsidiary Cryogas S.A. to the Chilean industrial gases and welding company Indura S.A. at an enterprise value of EUR 90 m. The divestiture was an antitrust condition imposed by the Colombian regulatory authorities arising from the acquisition of The BOC Group. Cryogas S.A. has around 400 employees and achieved sales of approximately EUR 49 m in the 2007 financial year.

↳ Linde also sells MAPAG Valves GmbH in Horgau near Augsburg in Germany to the technology group Metso in Finland at an enterprise value of EUR 36 m. With the divestiture of this non-core business, the Engineering Division is able to focus more closely on its core competences. The company employs around 100 staff and achieved sales of approximately EUR 31 m in the 2007 financial year.

↳ Süd-Chemie AG, a world-leading producer of catalysts and adsorbent materials, and Linde enter into an exclusive cooperation agreement to develop and market plants for the production of second-generation biofuels. Under this agreement, biotechnology will be used to extract fuels such as ethanol from the parts of plants that contain cellulose, such as wheat and maize straw, grasses and wood.

↳ Linde and Abu Dhabi National Oil Corporation (ADNOC) decide to construct two large air separation units through their joint venture Elixir in Abu Dhabi (United Arab Emirates). The total investment is around USD 800 m. From the end of 2010, the new plants will be connected to the utility and pipeline network and will supply nitrogen for the recovery of natural gas. State-owned oil company ADNOC owns 51 percent and Linde 49 percent of the shares in the Elixir joint venture, which was formed in December 2007.

↳ Linde acquires 51 percent of the shares in the family-owned Saudi Arabian industrial gases company SIGAS (Saudi Industrial Gas Co. Ltd). SIGAS, which employs about 400 people, is the second biggest industrial gases company in Saudi Arabia and achieved sales of around EUR 28 m in the 2007 financial year.

JUNE

↳ The first Belgian hydrogen filling station is inaugurated in Brussels by the oil company Total. Linde developed the technology which allows the low-temperature liquid hydrogen to be stored next to the station, as well as the refuelling system. Linde has been powering ahead with the development of hydrogen technology for years. Almost all the filling stations in the world which supply liquid hydrogen are equipped with Linde refuelling technology.

JULY

↳ The rating agency oekom research classifies Linde as a particularly sustainable company. In its corporate responsibility rating report, oekom research assesses the activities of around 1,000 listed companies worldwide for sustainability. With an overall rating of B-, Linde achieves prime investment status for the first time and is therefore among the top-ranking companies in its industry. Based on this rating, Linde's shares qualify as an environmentally and socially ethical investment.

AUGUST

↳ Linde officially opens the world's first hydrogen filling station for fuel cell passenger ships in Hamburg as part of the Zemships initiative. Zemships (zero emissions ships) is an EU-sponsored project for the development of fuel-cell powered ships. The Zemships filling station supplies the zero emissions ship with gaseous hydrogen. The first passenger ship in the world to be operated using hydrogen fuel cells will convey up to 100 passengers on the Alster and Elbe. The entire fuelling station was designed and built by Linde.

SEPTEMBER

↳ For the first time, protons are accelerated to almost the speed of light in the underground tunnel of the Large Hadron Collider (LHC) built by CERN (the European Organisation for Nuclear Research) in Geneva, Switzerland. This is also the debut of the Linde cooling systems installed here. The helium chilling system was designed, built and installed by the Linde subsidiary Linde Kryotechnik AG based in Pfungen, Switzerland.

↳ Linde enters into a joint venture with SINOPEC Fujian Petrochemical Company Limited (FPCL), a subsidiary of China Petroleum & Chemical Corporation (SINOPEC), for the long-term supply of industrial gases to customers in the province of Fujian in south-eastern China. This collaboration will result in a capital outlay of around EUR 100 m. Each of the partners, FPCL and Linde Gas (Hong Kong) Limited, a fully-owned Linde subsidiary, has a 50 percent share in the new joint venture.

↳ The Linde Group and Vattenfall Europe Technology Research GmbH, a subsidiary of the Vattenfall energy group, enter into a wide-ranging technology partnership for carbon dioxide separation in coal-fired power stations. The aim of the collaboration is to test the oxy-fuel combustion process for lignite and anthracite and to develop the technology for subsequent use in large power stations. The tests are being conducted at the research facility for a coal-fired power station with carbon dioxide capture technology in Schwarze Pumpe in Brandenburg, Germany, recently officially inaugurated by Vattenfall. Linde has built an air separation plant and a carbon dioxide liquefaction plant for this pilot power station. Linde is supporting Vattenfall via a technology partnership, providing extensive scientific and technical expertise during the first trial phase to the end of 2011.

OCTOBER

↳ Linde acquires the remaining 50 percent of the shares in the Australian LPG company Elgas, Sydney, at an equity value of around EUR 126 m. Elgas was formed in 1984 as a 50/50 joint venture between BOC Limited, a subsidiary of The Linde Group, and AGL Energy (AGL). Elgas is the largest marketer of LPG (Liquefied Petroleum Gas) in Australia and operates Australia's largest LPG storage facility at Port Botany in Sydney. The company achieved sales of around EUR 255 m in the 2007.

↳ Linde enters into two new contracts for the on-site supply of gases to the companies Ningbo Iron & Steel Co. Ltd and Hanwha Chemical Corporation (HCC) in Ningbo in eastern China. Under the agreements, Linde will build an additional air separation plant, an investment of around EUR 17 m. The new plant will supply oxygen to the steelworks of Ningbo Steel in Ningbo Beilun district from the middle of 2009.

↳ The Linde Group signs a further long-term on-site supply contract for industrial gases with the Hungarian chemical company BorsodChem. The agreement involves the construction by Linde of a new air separation unit (ASU) at BorsodChem's Kazincbarcika site in north-eastern Hungary, an investment of around EUR 26 m. The new ASU is due to come on stream in November 2010. With this new investment, Linde will now be operating two ASUs for BorsodChem for the supply of air gases and three steam reformers for the supply of gaseous hydrogen and carbon monoxide at Kazincbarcika. Linde's total investment at this site exceeds EUR 200 m.

NOVEMBER

↳ Linde wins three major contracts in China from customers in the photovoltaic industry. Linde covered more than 50 percent of the gases market for thin-layer photovoltaic cells in China in 2008, a market, which is growing at a particularly fast rate. This reinforces its position as the world's largest supplier of liquefied and specialty gases to this industry sector. Our subsidiary Linde LienHwa has entered into contracts with the companies Tianwei Baoding, Hangzhou Amplexum and ENN Solar.

DECEMBER

↳ Linde and its consortium partner Samsung Engineering, South Korea, are awarded the contract for the turnkey construction of an ethylene plant in Dahej, India. The plant was commissioned by the Indian company OPAL, a subsidiary of the state-owned ONGC (Oil and Natural Gas Corporation Ltd). The contract is worth around EUR 1.03 bn, of which Linde's share is EUR 350 m. The plant will be the largest of its kind in India and one of the largest ethylene plants in the world.



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