Holland Gateway
Hub for international business in The Netherlands

Report for

Ministry of Industry and Trade, Vietnam

Dutch Chemical Industry

Version : 1
Date : Friday, December, 18th, 2009

Chemical Industry in the Netherlands

Section 1: Facts and figures about the Dutch chemical industry 2008

The Netherlands provide a favorable climate to establish a chemical business. Important raw materials are available or can be easily supplied, while an extensive transportation network provides access to the European markets. Furthermore, chemical research and education in the Netherlands rank among the world top.

After the food industry, the chemical industry is the largest industrial sector in our country, contributing significantly to the Gross Domestic Product (2.9% in terms of added value). A total of around 66,000 people are employed in the chemical industry. The sector has more than 395 companies (with more than ten employees) and represents approximately 10% of industrial employment, 15% of production and 17% of exports. With a turnover of € 50 billion in 2008, the chemical industry plays a major role in the Dutch economy. Its positive contribution to the trade surplus in 2008 was € 17.3 billion.

The chemical industry accepts its responsibilities. It wishes to make an economic, yet safe and sustainable contribution to society in particular. Hence the chemical industry applies strict safety and environmental requirements and operates in accordance with the Responsible Care Global Charter program.

Turnover

The turnover in the chemical industry continued to rise during the past few years. The € 50 billion turnover of 2008 constitutes a 2% rise in turnover compared to 2007. With a (gross) added value of € 14 billion in 2008, the sector contributed to the Dutch Gross Domestic Product with 2.9%.

Production volume

In 2008, the production volume of the chemical industry fell to 135 index points (year 2000= 100 index points). This constitutes a 4.7% decrease compared to 2007.

Trade

Nearly three-quarters of chemical products produced in the Netherlands are exported, of which 75% goes to countries in Europe, while 25% is exported to countries elsewhere. Compared to 2007, export - including the transit of chemical products- rose by nearly 5% in 2008. In 2008, export amounted € 62 million.

This accounts for 17% of the overall export of the Netherlands. Import rose by nearly 8% to € 45 billion in 2008. This means that the chemical industry made a positive contribution to the trade surplus in 2008 of € 17 billion.

Destination of chemical products

The chemical industry supplies products to many other industries.

More than three-quarters of sales by the chemical industry involve basic chemicals.

Employment

Around 66,000 people were employed in the chemical industry in 2008. About one-third of personnel in this sector completed a study program of a university of professional education or higher. More than two-thirds followed an upper secondary education study program.

Research and development

Innovation is vital to the Dutch chemical industry. This is evidenced by, for instance, the sector's investments in research and development. The Dutch chemical industry spends about 2.5% of its turnover on in-house research and development (approx. 900 million). In addition, another 200 million Euros worth of research and development is outsourced.

Together with the costs for innovation, research activities account for approximately 25% of the total industrial expenditure.

Health, Safety and the Environment

Health, safety and the environment are of paramount importance in the chemical industry. The sector is on a continuous quest to further improve safety and environmental performances. This includes measures to further reduce greenhouse gas emissions, accreditation of contractors and obligatory safety training courses. The most recent figures on safety and the environment apply to 2007.

Safe working environment

An LTI (Lost Time Injury) stands for a direct physical ailment as a result of which an employee is physically or mentally (as diagnosed by a competent medical authority) unable to carry out his planned activities for a period of at least one day. The LTIR (Lost Time Injury Rate) is the number of LTIs per million hours worked.

During the last years, the Netherlands have shown a slight downward trend in the LTIR. In 2007, the LITR for own employees fell from 1.93 to 1.81. At such a low level, it is difficult to reduce this figure even further. The downward trend can also be seen at a European level.

Energy policy

The chemical industry is energy intensive. The industry has been pursuing an active energy policy since the seventies. This enabled the industry's strong growth to go hand in hand with a limited increase in energy consumption and a more or less steady emission of CO2 from the generation of energy.

Emissions

The chemical industry wishes to minimize emissions into the water, air and soil and generate as little waste as possible. Chemical businesses and the authorities together successfully reduced their emissions. Out of the 74 substances listed in the covenant, the objectives for 2010 for 61 of them (83%) were achieved as early as 2007. The emission of many of the earmarked acidifying and/or environmentally harmful substances into the air and water has been further reduced.

All the information in this section is provided by *The Netherlands Chemical Industry Association (VNCI).*

Section 2: Important factors for the chemical industry in the Netherlands

2.1 Operational environment for the chemical industry in the Netherlands

For the operational activities of a chemical facility, important factors include:

- Labor force
- Environmental policies and permits
- Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
- Research and development
- Investments
- Logistics

Labor force

The most important long-term asset of any business is the quality of its personnel. This counts particularly in a high-tech, knowledge-intensive industry like the chemical industry, where the development of new products, applications and process technologies is of the highest importance. The Netherlands is well known for its well-educated, highly skilled, multilingual work force. Further, the Dutch are known for their excellent working attitudes and efficient work organization, resulting in a higher productivity than in other European countries.

Unlike most other EU countries, the Netherlands offers employers labor flexibility. With about 10 percent of its work force having a flexible working relationship with the employer and 36 percent of workers employed part time, labor market flexibility is the highest in the EU. The availability of temporary employees, as well as flexible labor laws, allows companies to easily adapt their capacity and payroll to fluctuating product demand. It also gives employers the opportunity to screen potential long-term employees while they are on a flexible contract.

In Europe, labor costs in the chemical industry account for about 20 percent of production costs. Thus productivity is very important. The Dutch chemical industry has the highest productivity of all EU countries for both basic and specialty chemicals. The output in 2008 amounted to around EUR 757,000 per full-time employee. The Dutch government has taken an active role in ensuring that labor requirements are met by the output of the Dutch educational system. In addition VNCI, the Association of the Dutch Chemical Industry, is actively involved in making the chemical discipline appealing for high school students as well as for students at technical schools and at the university level. One of the initiatives is the

recruitment of students for an academic education in chemistry while they are working. This program will enable graduates with a technical degree from a college of higher vocational education to obtain an academic degree in chemistry within three years, while continuing to work. Another initiative is the opportunity for people with a technical master's degree to obtain a doctorate title in industrial chemistry by following a post-master chemistry study.

Environmental policies

Ever mindful of safeguarding the competitiveness of the Dutch industry within the global economy, the government's emphasis is on reducing and simplifying environmental rules and regulations within the framework of EU directives. The execution of environmental policy is by means of covenants: voluntary agreements between the government, environmental groups and the industry. Covenants use contracts and long-term agreements with target groups of industry sector organizations for self-regulation and target-setting concerning subjects such as VOC-emissions (volatile organic compounds), energy efficiency, conservation and environmental care. Formulating targets instead of regulating allows for flexibility, accountability and tailor-made solutions.

Environmental policies in the Netherlands are determined 20- to 30-years in advance. They are outlined in integral environmental plans described in the national environmental policy plans. This approach minimizes the chance for unexpected changes in environmental policy that might necessitate unanticipated and costly plant refurbishments.

The Dutch waste policy is based on the "polluter pays" principle. This is achieved by the use of market-oriented instruments, such as levies, and the introduction of tradable emission rights. In this way the cost of developing less polluting products and processes will be recouped in the form of lower levies or fewer required emission rights.

As a result of the Energy-Efficiency Improvement Multi-annual Agreement, the Dutch chemical industry now belongs in the top 10 percent worldwide concerning energy used per unit of product. This is particularly important for bulk chemicals where energy costs amount to about 30 percent of total costs. One creative approach the chemical industry is using to meet its targeted energy efficiency is the formation of networks between companies to share best practices with process technologies such as heat exchangers and separation technologies. The energy efficiency of the chemical industry in the Netherlands is around 0.17 ton oil equivalents per ton of product.

The total energy efficiency improved by 25 percent over the period from 1989 to 2000. This exceeds the goal of the first energy-efficiency covenant, which was to achieve a 20 percent reduction over that period. Between 1998 en 2007, the Dutch chemical industry achieved another total energy efficiency improvement of 25.2 percent. (Source: Association of the Dutch Chemical Industry (VNCI)). In order to stimulate companies to make energy-saving investments, they can deduct 44 percent of these investments from their profit. This rule was implemented by the Dutch government in 1997.

Sustainable development is the central theme of the government's present plans for the environment, the people and the economy. The government and the industry sector organizations encourage chemical industries in the Netherlands to participate in activities for sustainable development, i.e. through the Responsible Care Program, Product Stewardship Program and Corporate Social Responsibility. Responsible Care aims at improving performance regarding safety, health and the environment. The Product Stewardship Program focuses on reduction of products' impact on the environment throughout their life cycle. Corporate Social Responsibility shows the accountability of companies and their senior management to society ('license-to-operate'); and this initiatives becoming more and more important in the current environment. Companies engage in regional activities, integrate more and more into municipalities, and into society as a whole. At the same time, clusters of industrial companies and cutting-edge R&D institutes, supported by industry sector organizations and the government, are being formed to boost sustainable innovation that could bring significant competitive advantages through fundamental research, technological development and more efficient logistics

On June 1, 2007, new European Union legislation on registration, evaluation, authorisation and restriction of chemicals, known as REACH, went into effect. The objectives of REACH are to ensure a high level of protection for human health and the environment while maintaining incentives for innovation and market competitiveness. Importers, manufacturers and all other companies dealing with chemicals are affected by this European regulation. All relevant chemicals needed to be pre-registered with the European Chemical Agency (ECHA) between June 1, 2008 and December 1, 2008. During that period about 143,000 substances were registered. A list of exemptions exists, which includes polymers, pharmaceuticals and biocides. In order to help the Dutch chemical industry to comply with REACH, the Dutch government, together with the industry, has started a REACH-helpdesk.

As of January 2005, a package on emission trading has been introduced in the European Union. The idea behind the emission trading package is that by the end of the second time period (2008-2012), CO2 emissions in the EU will be 6 percent below the level it was in 1990. In early 2007, the EU states agreed on a CO2 emissions level by 2020 that is 20 percent below the level it was in 1990.

The trading system has given carbon dioxide (CO2) emissions a market value across the EU while limits have been set on the emissions from energy intensive sectors, including the chemical industry. So far companies receive emission rights free-of-charge from the government up to their allocated emission limit. Companies reducing emissions to a level below their allocated amount can sell the surplus to other companies, or bank it for future use. In December 2008, the European Parliament agreed to continue to provide emission rights free of charge to energy-intensive industries which are exposed to international competition, such as the chemical industry, after the present second emission trading system expires in 2012.

In order to reduce CO2 emissions, experiments are under way in the Netherlands and other countries to collect and store CO2 through a program called CCS (carbon capture & storage). The largest challenge, both from a technological and economic point of view, is the capture of the CO2. Also, companies are working on using CO2 by producing clean CO2 that can be sold as a commodity. An example is the sales by the Shell refinery in Rotterdam of clean CO2 to farmers for assimilation by plants in greenhouses.

With respect to waste disposal in the Netherlands, the first option is to prevent the creation of waste. The second option is recycling, followed by incineration and as a last resort landfill. There are several incinerators in the country. Large waste disposal companies in the country that specialize in the disposal of chemical waste include AVR-Van Gansewinkel, BFI /SITA, Ecotechniek Chemie, and Watco Ecoservice.

Permits

In the Netherlands, an environmental permit is obligatory for all new plants, in addition to the required building permit. Except for water pollution, which is regulated through the Surface Water Pollution Act, all polluting activities are dealt with by the Environmental Management Act (EMA). This Act stipulates that initiators of industrial projects in the Netherlands first be granted an environmental permit, before being given permission to start the construction process. Environmental law is nationally enforced, but permit conditions

may vary depending on the local situation and policy. Adequate preliminary consultation with the appropriate - local and/or national - authority on permit conditions is therefore advisable. By law, the procedure for obtaining an environmental permit has to be completed within six months.

An environmental permit needs to be requested from the municipality where the company will be located. The officials who issue the permits are well-trained in the challenges confronting the chemical industry in following environmental guidelines, to ensure that all companies are treated in the same manner. Generally, environmental protective provisions and measures are based on the "ALARA" principle (as low as reasonably achievable).

As a rule, environmental permits are linked to the establishment, rather than to an individual permit holder. Permits are usually granted for an indefinite period of time. However, the authority that issued the permit is obliged to determine on a regular basis if the restrictions and regulations attached to an environmental permit are still adequate with respect to technological developments, as well as developments related to the quality of the environment.

This situation with multiple permits will be greatly simplified once the General Regulations on Spatial Law Act (or 'Wet algemene bepalingen omgevingsrecht (Wabo)') comes into force, on January 1, 2010. With this Act, the Spatial Permit ('Omgevingsvergunning'), which integrates various permits into one, will be introduced. Due to this integration, the application procedure for permits will undergo major simplifications.

Spatial permit

The Dutch Council of Ministers wanted to further improve the business climate in the Netherlands through fewer, better and more effective regulations. Therefore the Ministry of Housing, Spatial Planning and the Environment has launched the Spatial Permit ("Omgevingsvergunning"), combining various permits, dispensations and exemptions with regard to housing, construction, spatial planning, nature and the environment. In short, the Spatial Permit is a broad, integrated permit creating a "one-stop shop" for companies with the exception of direct emissions to water. The implementation of the Spatial Permit is planned for January, 2010. Until this date, the existing legislation remains in place. In addition to simplifying the permitting process, also activities are taking place to limit the number of inspections. For example, as of April 2009 twelve inspection agencies in the

Rotterdam area are combined in Front Office Chemie Rijnmond. This approach serves as an example for the rest of the country.

Research and Development

In 2003, the Dutch government firmed an Innovation Platform to stimulate innovation in the economy. The Innovation Platform obtained EUR 800 million to sponsor R&D projects in six key areas, including the chemical industry. In addition, the chemical industry dedicated EUR 100 million to the founding of business centers for innovative starters. Due to its success, the first Innovation Platform was followed by a second platform in 2007.

The Innovation Platform initiative is only the latest in a series of measures by the government to encourage an innovative, competitive and enterprising economy. Other initiatives include fiscal measures such as reduced taxes on income from patents (from the corporate income tax rate of 25.5 percent to a special rate of 10 percent) and the Research and Development Promotion Act, which reduces the wage costs of R&D employees by reducing payroll taxes and social security contributions.

In 1997, the Dutch government together with various industries, universities, and institutes established four Top Technology Institutes. These centers of excellence are joint public/-private partnerships conducting joint programs between academia and industry. One of the original top institutes is connected to the chemical industry: the Dutch Polymer Institute (DPI). In addition to its exploratory research, this institute created in 2007 the DPI Value Centre to assist smaller companies and start-ups with among others the "Cradle-to-Cradle" concept. Other centers of excellence are in the areas of metals, food, and telematics. These institutes perform fundamental research, which is of interest to their industrial partners. Due to the success of the first four centers, another top technology institute, the Dutch Separation Technology Institute (DSTI), was founded in 2006. The research program covers all aspects from (fundamental) knowledge generation to technology implementation. This institute is obviously very relevant for many chemical companies. So far, 45 companies from the chemical, food, pharmaceutical, oil and gas, and process water industries have become partners of DSTI, including chemical companies such as AkzoNobel, Albemarle, DSM, Sabic, Huntsman, LyondellBasell, Norit, Organon Biosciences (Schering-Plough), Purac, and Shell. The industrial partners, the universities and other scientific institutes contribute 50 percent of the budget and government the other 50 percent. The intended budget is approximately EUR 65 million for the next five years.

Presently, the Chemical Industry Steering Group, consisting of some top managers from the chemical industry and knowledge institutes, investigates together with SenterNovem, a department of the Ministry of Economic Affairs, whether the process activities of DSTI and the Roadmap Process Intensification (PI) activities can be combined in a new institute for Sustainable Process Development (ISPT) in order to make an even better use of the available knowledge to realize breakthrough innovations.

According to The Times 2008 World University Rankings, Dutch universities rank high among the world's universities. Eleven of the country's universities were listed among the world's 200 top universities, with four among the top 100. This provides the country with a high level of knowledge, which is conducive for the development of specialty products. In addition, there is TNO, a Dutch institute for applied scientific research. It is by far the largest of its kind in Europe. Small and midsize companies mainly make up its contracts. The government subsidizes 40 percent of TNO's budget.

Investments

For investment projects, the chemical industry in the Netherlands can draw from an extensive pool of engineering firms. The availability of engineering firms and environmental consultants familiar with local circumstances as well as rules and regulations is of the utmost importance. Virtually all large international engineering companies have significant presence in the Netherlands. Companies include ABB Lummus Global, Arcadis, DHV, Fluor, Grontmij, Kvaerner, Royal Haskoning and Tebodin Consultants & Engineers. In response to early environmental legislation, engineering firms in the Netherlands have established a lead in environmental technology over many competitors in other countries.

Logistics

When operating in a foreign region - with differing regulations, languages and cultures, - it is not easy to tailor logistics operations to the specific needs of each customer and market. In the Netherlands, there is an ample number of logistic service providers specializing in chemicals. All general aspects of the logistics chain, such as custom procedures and storage of bonded products, can be outsourced to these providers, in addition to such chemical-industry-related aspects as special warehousing, packaging or re-packing of chemicals, and distribution of solid and liquid chemicals, including hazardous ones. The use of Electronic Data Interchange (EDI) systems by the Dutch logistics industry is advanced, and is in fact one of the most efficient in the EU. In the global Logistics Performance Index (LPI) survey of

the World Bank, the Netherlands ranks second for the overall LPI and first for such factors as customs efficiency, logistics infrastructure, international shipments, and logistics competence.

Dutch logistic providers founded the Holland International Distribution Council (HIDC). This non-profit association provides free advice and services to companies involved in setting up or restructuring their European supply chains. Within HIDC, several logistics companies specializing in European logistics for the chemical industry formed ELCHEMS (European Logistics Chemical Specialists) to help chemical companies with setting up or restructuring their European supply chains.

Much of the transportation of bulk chemicals is by pipeline, ship and train, whereas for specialty chemicals road transportation is the major mode of transportation. The Netherlands has the highest density of international highways of all countries in the EU with over 70 meters per square kilometer and the one but highest overall road density with 4 kilometers of high quality road per square kilometer. In the Netherlands, road transportation of chemical products accounts for over 6 percent of all professional road transportation.

2.2 technical infrastructure

The technical infrastructure for the chemical industry in the Netherlands can be characterized by:

- Advanced cluster forming
- Multimodal transportation capabilities
- Ample merchant storage capabilities

Advanced cluster forming

Although the Netherlands is one of the most densely populated countries in the world, there is enough space available in specially designated zones to accommodate chemical businesses. The basic chemical industry in the Netherlands is concentrated in several clusters. For producers of basic chemicals, being part of a cluster offers advantages such as receiving raw materials by pipeline from nearby suppliers and delivering finished products to nearby customers, as well as sharing support functions such as security and fire brigades. These factors are also the reason that a relatively high number of investment projects in the chemical industry are expansion projects at existing sites.

Port areas are favored locations in particular for chemical plants. The largest chemical cluster in the Netherlands is the port of Rotterdam. It starts at the North Sea, extends 40 kilometers (25 miles) inland, and is one of the world's top three ports by size and capacity. The harbor started in 2008 a further expansion with 2,000 hectares (nearly 5,000 acres), by reclaiming land from the North Sea. In addition to harboring many of the best-known global chemical and petrochemical players, Rotterdam is also home to an interesting cross-section of fine and specialty chemicals operations. The chemical cluster around the Zeeland seaports of Vlissingen (Flushing) and Terneuzen is located at the entrance of the river Scheldt, in between Rotterdam and Antwerp. The largest chemical complex belongs to Dow and occupies a 440-hectare (nearly 1,100 acres) site. A tunnel underneath the river Scheldt links the port areas of Terneuzen and Vlissingen.

The chemical cluster of Delfzijl is also located adjacent to a harbor. The local availability of rock salt and natural gas were the major factors that led to the development of this cluster. Akzo Nobel has a strong presence there, with such products as salt, chlorine, and caustic soda. The company finished building another modern chlorine plant, which opened by the end of 2006. In the southeast, there is a chemical cluster in the Heerlen/Geleen area. This cluster formed around the DSM specialty chemicals plants, and the petrochemical plants of SABIC (Saudi Basic Industries Corporation). SABIC currently has two naphtha crackers in Geleen that produce ethylene and propylene.

The Amsterdam port area is home to several specialty chemical companies. A new harbor basin has recently been built, which offers "green field" opportunities for chemical companies interested in good ship, barge, road, rail, airport and IT connections.

Multimodal transportation capabilities

The Netherlands has a very well-developed transportation system for chemicals. The main means of transportation of chemicals are by ship, truck, rail, and pipeline. However, even airfreight can be of importance, particularly for the specialty chemicals industry. Europe's far-reaching inland waterway system means that chemicals can be easily and economically shipped to other European destinations from the Netherlands, which is located on the delta of three major European rivers, the Rhine, the Meuse, and the Scheldt, and other European countries. In addition, there is an extensive system of feeder lines with coasters. Several pipeline systems have been put in place in the Netherlands for the transportation of various types of bulk chemicals, natural gas, industrial gases, crude oil, and oil products. These

pipelines are typically linked to systems in neighboring countries. For example, the ethylene pipeline network links about 40% of the ethylene capacity of the European Union.

Ample merchant storage capabilities

About one-third of the merchant tank capacity for chemicals in the European Union is located in the Netherlands. Tanks are available ranging in sizes from 300 to 40,000 cubic meters (10,600 to 1,400,000 cubic feet). Heated and insulated units are available. In addition, tank storage companies typically provide such added-value services as drumming, blending, bagging, sieving and palletizing.

The Netherlands is home to Vopak, the world-leading company in logistics and storage of chemicals, oil and gas.. It is the major provider of merchant storage capacity for chemicals in the Netherlands. In the Rotterdam/Antwerp area the company has a storage capacity for chemicals of 2.5 million cubic meters (88million cubic feet). Virtually all of this capacity is located near deep water.

2.3 Energy infrastructure in the Netherlands

A superior energy infrastructure in the Netherlands provides a competitive advantage to the chemicals industry, with:

- the lowest cumulative downtime of electricity supply in the EU (stable at around half an hour per year)
- over half of the country's energy consumption supplied by domestic natural gas
- privatization of electricity and natural gas production
- break-up of natural gas production and the supply network; the same is under consideration for electricity

The Netherlands is the only country in Europe with a ring system in its electrical grid. This makes it easier to isolate a power outage, since the ring can be switched off. Moreover, with the ring system the electricity can be transported from two sides, which allows for easy compensation of a downed power station. More than 50% of the country's electricity is generated by cogeneration of electricity and steam.

A comparison between several EU countries of prices for natural gas and electricity for the industrial sector is as follows:

Table 1: Natural gas prices in selected EU countries, EURO per Gigajoule (excl. VAT)

Country	2007 Rate
Germany	12.15
France	7.63
Belgium	6.89
The Netherlands	8.40
UK	10.55

Source: Eurostat, March 2007

Table 2: Electricity prices in selected EU countries, EURO per kWh (excl. VAT)

Country	2007 Rate
Belgium	0.0880
Ireland	0.1125
Germany	0.0646
The Netherlands	0.0920
UK	0.0950
France	0.0541

Source: Eurostat, March 2007

Since 1998, natural gas is available from competing suppliers. The production of electricity has been privatized in 1999. Related legislation guarantees electricity networks with sufficient quality and capacity.

Natural gas production was 73 billion m3 in 2005, making the Netherlands the fifth largest natural gas supplier in the world. The gas reserves in 2006 were estimated at 1,510 billion m3. Continuously, new fields are being developed and the prognosis is that for at least 25 years a stable supply of natural gas will be available from Dutch fields. The chemical

industry in the country accounts for about 65% of domestic natural gas consumption. Of this consumption by the chemical industry 60% is used for energy and 40% as raw material. To secure the reliability of the natural gas supply, the very dense Dutch pipeline network has many parallel pipelines and grids.

In addition to the availability of natural gas, the country has also ample supplies of sodium chloride and magnesium chloride salt of unique purity. Also oil is available from on-land wells as well as from the Dutch sector of the North Sea. In addition, annually more than 100 million metric tons of crude oil passes through the port of Rotterdam.

Wind energy is an increasingly popular source of electricity generation. Now both traditional windmills and modern wind turbines are a common sight in the Dutch landscape. By early 2007, the installed wind power capacity amounted to 3% of the country's electricity need. During 2006 a windmill park was built in the North Sea, another one is under construction, and more offshore parks are in the planning stage. This is an important development, since reportedly wind energy generated at sea has an output, which is nearly twice as high as wind energy generated on land. The intent is that by 2020 16% of the electricity is generated by windmills with 50% coming from offshore windmill parks.

Section 3: Base chemicals and specialty chemicals in the Netherlands

3.1 Base chemicals

More than 75% of the sales of the Dutch chemical industry concerns base chemicals. This is an important fact, since basic chemicals are the shoulders on which the specialty chemicals industry stands. The basic chemical industry employs around 40% of all employees in the chemical industry and with about 250 companies, the number amounts to one-third of all chemical companies in the country.

The table below provides the volume of thirty-four basic chemicals produced in the Netherlands. The total Dutch share of West-European capacity for the listed base chemicals is nearly 16%. This is very high for a country that accounts for only 4% of the population of Western Europe. For some base chemicals such as methyl tertiary-butyl ether, para-xylene, and styrene, the Netherlands has the highest production volume of all West-European countries.

In addition to the listed base chemicals, there are also major plants in the Netherlands producing such other basic chemicals as acrylamide, benzoic acid, elemental phosphorous, ethoxylate, ethyl-tertiary-butyl-ether (ETBE), melamine, methylisobutylketone, monochloroacetic acid, nitric acid, propylene, propylene oxide, sodium bicarbonate, urea, and industrial gases. There are, on the other hand, also base chemicals that are not or no longer produced in the Netherlands, but which are produced in other West-European countries. Examples include acetone, acetic acid, acrylic acid, adipic acid, aniline, butyl acetate, ethyl acetate, linear alkyl benzene, maleic anhydride, methyl methacrylate, phenol, sodium chlorate, and vinyl acetate monomer.

Increasingly, plants for bio-based bulk chemicals are being built in the Netherlands, including plants for the production of bio-methanol, bio-ethanol, bio-ETBE (from bio-ethanol and iso-butene), and bio-diesel.

Table 3: Selected base chemicals produced in the Netherlands

Base chemical	Capacity in thousand metric tons	Share of West-European capacity (%)
Acrylonitrile	235*	24
Ammonium phosphate	165	9
Ammonia	2,541	21
Benzene	2,895	30
Bisphenol A	315	29
Butadiene	415	18
Butanediol	125	31
Caprolactam	235	22
Carbon black	155	12
Chlor-alkali	787	7
Cumene	700	20
Ethylene	3,660	17
Ethylene dichloride	1,100	9
Ethylene glycol	290	18
Ethylene oxide	468	14
Formaldehyde	637	8
Hydrofluoric acid	11	3
Hydrogen peroxide	95	8
Isopropyl alcohol	300	40
MDI (methylene-di-para-	430	26

phenylene isocyanate)		
Methanol	100*	4
Methyl ethyl ketone	85	25
Methyl tertiary-butyl ether	1,030	33
Mixed xylenes	485	13
Ortho-xylene	130	20
Para-xylene	560**	23
Phthalic anhydride	75	11
PTA (purified terephthalic acid)	290	14
Soda ash	300	5
Sodium silicate	90	8
Styrene	2,667	38
Titanium dioxide	90	6
Toluene	245	12
Vinyl chloride monomer	620	9

*The Methanor plant, which produced methanol from natural gas, has been closed and has been rebuilt by Biomethanol Chemie to produce biomethanol. The plant came on stream in 2007. Its original capacity is 100 kiloton, which will later be scaled up to 500 to 1,000 kiloton.

**ExxonMobil is expanding its capacity to 750 thousand ton.

Source: Chemical Week (2007/2008/January-May 2009)

In addition to base chemicals also many types of bulk polymers are produced in the country, including polyvinyl chloride (PVC) with 675 thousand tons, or around 17% of West-European production volume, polystyrene (PS) with 175 thousand tons, or 7% of West European production, polypropylene (PP) with 1,920 thousand tons, or 11% of West-European production volume, polyethylene (PE) with high density PE at 280 thousand tons, or 7% and linear low density PE at 760 thousand tones, or 37% of West-European production volume, and acrylonitrile-butadiene-styrene (ABS) with 155 thousand tons, or 22% of West-European production volume. Several engineering plastics are also produced in the country, including polyethylene terephthalate (PET) with 220 thousand tones, or 5% of West-European production volume, polybutylene terephthalate (PBT), polycarbonate (PC) with 120 thousand tons, or 11% of West- European production volume, and various types of polyamides.

3.2 Specialty chemicals in the Netherlands

The Netherlands has long been a center of the basic chemical industry in the European Union. However, it should be noted that 40% of the value of chemical production in the country is specialty and fine chemicals. Two-thirds, or more than 500 companies, are active in the specialty chemicals sector, and employ close to 60% of the total work force in the chemical industry. The vast majority of these companies are small to mid-size companies. Leading sectors include coatings, printing inks, flavors and fragrances, catalysts, adhesives, pharmaceuticals and their intermediates.

The specialty chemicals industry is one of the most innovative industries in the small and mid-size company sector. International competition and pressure from new domestic and European rules and regulations are conducive to the improvement of products and processes. Many of the small and midsize companies in the specialty chemicals sector make use of subsidies and favorable fiscal rules to reduce their expenses for research and development. One type of subsidy, especially created by the Dutch government for small and mid-size companies, is research vouchers with a value of either EUR 2,500 or EUR 7,500. With these vouchers companies can buy advice from universities or institutions. Three thousand vouchers of each type are available per year. When a company is rewarded a voucher it also needs to contribute some of its own money to the project. For example, if a company receives a voucher of EUR 7,500, it needs to spend in addition EUR 2,500 of its own money. Most of the vouchers are used to improve production processes.

Recently, the Netherlands Foreign Investment Agency conducted a survey in the United States to determine what the most important location factors are for specialty chemical plants. The survey revealed the following as the most important factors:

- Transparent environmental policies which are consistent over the long term
- A quick and transparent permit process
- Availability and flexibility of experienced labor
- High productivity
- Flexibility of labor
- Proximity to international highways and transportation systems
- Favorable financial policies

The Netherlands is well qualified to meet these requirements. Some examples of the many companies producing specialty chemicals are provided in the following table.

Table 4: Selection of specialty chemical manufacturers in The Netherlands

Company	Location	Products
Akzo Nobel	Sassenheim	Coatings
Albemarle	Amersfoort	Catalysts
BASF Catalysts (previously Engelhard)	De Meern	Catalysts
Biesterfeld	Alphen a/d Rijn	Water treatment chemicals
Bison International	Goes	Adhesives
Cabot	Botlek	Colorants
Ciba Specialty Chemicals	Maastricht	Colorants
DSM Coating Resins	Zwolle	Coatings
DSM Fine Chemicals	Sittard	Fine chemicals
Ferro	Rotterdam	Coatings
Flint Ink	Winschoten	Inks

Givaudan (previously Quest)	Naarden	Flavors and fragrances
Henkel	Nieuwegein	Adhesives
Holland Colours	Apeldoorn	Colorants
ICI (Acheson Colloiden)	Scheemda	Inks
ICI (National Starch & Chemicals)	Zutphen	Adhesives
IFF	Tilburg	Flavors and fragrances
Johnson Matthey	Maastricht	Coatings
Nalco	Tilburg	Water treatment chemicals
Organon BioSciences (Diosynth)	Oss	Fine chemicals
Paramelt	Heerhugowaard	Adhesives
PPG Chemicals	Delfzijl	Silicas
PPG Coatings	Tiel	Coatings
PPG Industries (previously Ameron)	Geldermalsen	Coatings
Rohm and Haas	Amersfoort	Colorants
Saba International	Dinxperlo	Adhesives
Sakura (Talens)	Apeldoorn	Inks
Sigma Coatings	Uithoorn	Coatings
Sonneborn (previously Witco)	Koog a/d Zaan	White oils
Soudal	Breda	Adhesives
Tronox (previously Kerr-McGee Pigments)	Botlek	Colorants

Source: Netherlands Foreign Investment Agency

Section 4: Chemical clusters in different regions

4.1 Chemical Cluster Rotterdam/Moerdijk

The largest chemical cluster in the Netherlands is the Port of Rotterdam. Starting at the North Sea and extending 40 kilometers (25 miles) inland. It is Europe's largest port, and one of the world's top three ports. This cluster resulted from the long-time presence of oil refineries. Today, there are six refineries, of which four world-scale:

- Agip Benelux
- Esso Nederland (ExxonMobil)
- Koch H.C. Partnership (condensate splitter)
- Kuwait Petroleum Europoort
- Nerefco Europoort (BP, Chevron)(Europe's largest refinery
- Shell Nederland Raffinaderij (Shell, Statoil)

The chemical industry has made one of the largest contributions to the growth of industrial activities in Rotterdam and, not surprisingly, one of the sector's primary strategic goals is to stimulate further growth and diversity in its chemical cluster. The Port of Rotterdam has singled out the specialty and fine chemicals sector for particular attention in the coming years, and one of its main priorities is to establish a dedicated industrial park for these types of operations. Other plans are to extend the port area by reclaiming more land from the sea (Second Maasvlakte). This will provide an additional 1,000 hectares (2,500 acres) of industrial sites with direct access to deep waters. The schedule is for the actual construction of Maasvlakte 2 to begin in 2008 so that the first ship can dock at the quayside in 2013.

In addition to chemical production in the port area, a growing number of third-party logistics providers are specializing in the storage and distribution of chemicals, including packed chemicals. Altogether, 380,000 m2 of chemicals storage sheds exist in this cluster. In addition, for the storage of liquid chemicals, there is an independent tank storage capacity of 2.1 million m3.

In close proximity to the refineries, a large and growing number of well-known international chemical companies are manufacturing many different types of bulk, semi-finished and specialty chemical products. There is a high degree of synergy between companies in the cluster. Many of them supply feedstocks and intermediate products to their neighbors. Often, the waste streams of one company serve as raw materials for another company. The many possibilities for creating synergy have resulted in a highly efficient, low-cost operating climate for all of the chemical companies active in the Rotterdam cluster. Many specialized service and utility providers have operations close to the production plants. This makes it easy for chemical companies to outsource these activities.

"Huntsman's polyurethane chemicals production site is one of the most developed co-siting arrangements in the Port of Rotterdam. It is interesting to see how companies, previously used to looking inwardly, are now asking what they can do together." Max van der Meer, European Operations Director Huntsman

The chemical companies in the Rotterdam/Moerdijk cluster are listed in the following table, along with their major products.

Table 6: Chemical Manufacturers in Rotterdam/Moerdijk

Company	Head office	Product
Air Products	United States	Industrial gases
Air Liquide	France	Industrial gases
Akzo Nobel Base Chemicals	The Netherlands	Chlorine, soda
Alcan-Aluchemie	Canada	Carbon anodes
Almatis	United States	Tabular aluminium
Arkema	France	Mercaptans, agrochemicals
Basell*	United States	Polyolefins; polybutene-1
BioPetrol Industries**	Switzerland	Bio-diesel

Cabot	United States	Carbon black
Caldic***	The Netherlands	Formaldehyde; paraformaldehyde; hexamine
Cerexagri (United Phosphorous Ltd.)	India	Agrichemicals (mainly fungicides)
Climax Molybdenum (Phelps Dodge)	United States	Molybdates
Cytec Industries	United States	Acrylamide
Carbon Black Nederland (Degussa)	Germany	Carbon Black
Domo Polypropylene	Belgium	Polypropylene
DSM Resins	The Netherlands	Synthetic resins
DSM Special Products	The Netherlands	Benzoates, benzaldehyde
DuPont de Nemours	United States	Resins, elastomers, glycols
Eastman Chemical	United States	PTA, PET
ExxonMobil Chemical	United States	Benzene, xylenes, oxo-alcohols, plasticizers
Ferro	United States	Pigment, dyes
Givaudan (previously Quest)	Switzerland	3-propanal

Hercules	United States	Cellulose derivatives
Hexion Specialty Chemicals[a]	United States	Formaldehyde; bisphenol A, epichlorhydrine, epoxy resins
Huntsman Polyurethanes	United States	MDI; polyether polyols, polyurethane foams
Ineos Acrylics	United Kingdom	Polymethyl methacrylate and acryl resins
Invista (Koch Industries)	United States	Nylon 6.6, polyurethane fibers, fluoropolymers
Kemira Chemicals	Finland	Hydrogen peroxide, water treatment chemicals
Dr. W. Kolb	Switserland	Surfactants
Kraton Polymers	United States	Elastomers
Linde-Hoek Loos	The Netherlands	Industrial gases
Lucite International	United Kingdom	Methylmethacrylate
Lyondell	United States	Propylene oxide, glycol, bio-ETBE (ethyl-tertiary butyl ether), MTBE (methyl-tertiary butyl ether), butanediol
Lyondell / Bayer	United States / Germany	Propylene oxide, styrene monomer
Microchemie	The Netherlands	Urea, melamine (under construction)
Nu3	The Netherlands	Fertilizers
Nufarm	Australia	Crop protection chemicals
Omega Pharma	The	Over-the-counter pharmaceuticals

(ex Chefaro)	Netherlands	
Organik Kemya	Turkey	Water-based acrylic polymers
Shell Chemical	The Netherlands	Propylene, MTBE, solvents, ethylene, butadiene, ethylene oxide / glycol, ethylbenzen, propylne oxide, styrene monomer, isopropanol, polymer polyols
Shin-Etsu	The Netherlands	Vinyl chloride monomer, polyvinylchloride
Tessenderlo Chemical	Belgium	Feed phosphates
Tikkurila Coatings	Finland	Paints
Tronox (previously Kerr-McGee)	United States	Titanium dioxide
Unilever	The Netherlands	Detergents
Wetro	The Netherlands	Liquid logistics; production of products such as calcium nitrate, magnesium nitrate, magnesium sulphate, and potassium phosphite
WHEB Biofuels****	United Kingdom	Biofuel

* Basell has two plants in the Rotterdam/Moerdijk cluster: A plant in Pernis, which is scheduled for closure in 2007, and a plant in Moerdijk.

** Construction of the plant with an annual capacity of 400,000 tonnes biodiesel and 60,000 tonnes of pharmaceutical glycerine started in March 2007.

A total investment of €80 million. The plant is co-siting with Vopak.

*** Caldic is building an ethanol plant and ethanol storage capacity, which will be operational in 2008.

****Construction of the plant will begin in 2007 and is scheduled to be operational in 2008. The investment is over €70 million.

Source: Netherlands Foreign Investment Agency

4.2 Chemical Cluster Terneuzen/Vlissingen

The chemical cluster around the Zeeland seaports of Terneuzen and Vlissingen (Flushing) is located between Rotterdam and Antwerp, at the estuary of the river Scheldt. The largest chemical complex belongs to Dow and occupies a 440-hectare (1,085-acre) site. With 33 separate plants including three naphtha crackers, it is Dow's largest investment outside the United States and the second largest Dow plant in the world. Dow and the other chemical companies in the Terneuzen/Vlissingen cluster are listed in the following table, along with their major products.

Table 7: Chemical manufacturers in Terneuzen/Vlissingen cluster

Company	Head office	Product
Air Liquide	France	Industrial gases
Air Products and Chemicals	United States	Industrial gases
Arkema	France	Tin compounds for additives in pesticides, paint and other products
BOC	United Kingdom	Industrial gases
Broomchemie	Israel	Organic and inorganic bromides

Cerestar (Cargill)	United States	Starch and starch derivatives
Dow	United States	Ethylene, benzene, styrene, cumene, ethylene oxide, latex, ethylene glycol, polymers, polyglycols, etc.
Eastman Chemical	United States	Resins, colofonium esters, etc.*
KoSa Group (Koch and Saba)	United States	Dimethyl terephthalate (DMT), polyester polyols
Sea Way Chemical Processing	The Netherlands	Waste recycling based on chemical technology
Thermphos	Kazachstan	Elemental phosphorus and phosphorus derivatives
Yara	Norway	Nitrogen fertilizers and ammonia
Zuid Chemie (Grande Paroisse, a subsidiary of Total)	France	Fertilizers

* Mid 2007, Eastman Chemical received a permit to build a hydrogen plant. **Nedalco is investing €150 million in a plant with a capacity of 200 million liter bio-ethanol made from ligno-cellulose (second generation bio-fuels). The plant will be operational by the end of 2008.

Source: Netherlands Foreign Investment Agency

In addition to the chemical plants listed above, there is a refinery in Vlissingen, which processes about 7.5 million tons of crude oil each year. The refinery is jointly owned by Total (55%) and Dow (45%). There is also storage of LPG (liquefied petroleum gas), provided by Chemgas, part of Royal Vopak. Chemgas is specialized in the storage and distribution of LPG and chemical gases. The LPG is discharged from seagoing tankers and stored at the Chemgas terminal. From there, it is distributed to customers in the Netherlands and other parts of Europe by pipeline, road, rail or barge. Chemgas has a total storage capacity of about 130,000 cubic meters. Merchant storage capacity in the cluster is provided by Petroplus Tankstorage. The company has a storage capacity of 155,000 cubic meters for

mineral oils, chemicals and edible oils, with loading and discharging facilities for road, rail and waterway transport.

A new tunnel, the Western Scheldt Tunnel, links the port areas of Terneuzen and Vlissingen since its completion in March 2003. Within the Terneuzen/Vlissingen cluster, 800 hectares (1,975 acres) are available for development. The following sites are currently available for specialty chemical companies:

- Value Park Terneuzen
- Axel Plain
- Industrial Park Vlissingen

Value Park Terneuzen is a joint venture between Dow Benelux and Zeeland Seaports, with the goal of attracting new chemical companies to invest in this site. The site itself covers a total area of about 110 hectares (270 acres) and is situated next to the Dow site in Terneuzen, one of the most advanced chemical plant sites in the world, with its range of raw materials, utilities, transport connections and waste treatment facilities. Integration with Dow Benelux's state-of-the-art infrastructure could provide potential investors with an outstanding base of operations in Europe.

Oiltanking (Germany) built a tank terminal with a capacity of 350,000 m3 at the Value Park location. The terminal, which is able to handle a wide range of petrochemical and chemical products, opened in 2005. In early 2007, it was announced that Biofueling, a Dutch company established by a Spanish investment group, will invest €45 million to build a bio-diesel plant with a capacity of 200,000 ton per year, The plant is scheduled to become operational in 2008. The plant is a good example of the synergies Value Park has to offer: For its storage and shipping Biofueling will use the capacity of Oiltanking and its by-product, glycerine, will be delivered to Dow for use in its production process.

Next to the Value Park is a 30-hectare (75-acre) Logistics Park designed for chemical distribution and value-added logistics. Zeeland Seaports has invested in a short-sea and barge container terminal on this site. Logistic services are offered by Katoen Natie and Vos Logistics.

The Axel Plain is a new, 400-hectare (990-acre) port-related industrial site on the Ghent-Terneuzen canal. The Industrial Park Vlissingen already includes three established

companies - ThermPhos, KoSa and Sea Way Chemical Processing - and has about 20 hectares (50 acres) available for specialty chemical companies. The site also offers co-siting opportunities.

Zeeland Seaports started with several companies and knowledge institutes the initiative for a BioPark Terneuzen. The objective of this initiative is to link activities between existing and new bio-based companies in order to create synergies resulting in cost reductions for the participating companies as well as less stress on the environment. An example is the new Nedalco bio-ethanol plant, which will use biomass waste from Cargill's Cerestar plant.

4.3 Chemical Cluster Delfzijl

The local availability of rock salt and natural gas are the major factors in the development of this chemical cluster, which is the second largest chemical cluster in the country. Salt exploitation started in the fifties. The exploitation of natural gas began in the sixties.

The core of this chemical cluster is the Chemical Park Delfzijl, located adjacent to a harbor. Akzo Nobel has a strong presence at this site, with such products as salt, chlorine, caustic soda. Akzo Nobel built two new plants at the site, one for the production of chlorine, and one for the production of monochloro acetic acid (MCA). The chlorine plant has an initial capacity of 100,000 ton, and the MCA plant of about 70,000 ton. The plants came on-stream in 2006. The construction of this plant offers the opportunity to companies who need chlorine in their process to locate in this cluster.

The chemical park comprises pipeline grids for steam, chlorine and other products. It is also the location of a cogeneration plant with a capacity of 500 MW. Recent investors are two U.S. companies: FMC and Noveon Resin (owned by Lubrizol) with plants for, respectively, hydrogen peroxide and chlorinated PVC. Other companies at the Chemical Park Delfzijl

include Brunner Mond, Delamine, Kemax, BioMethanol Chemie and Tejin Aramid (previously Teijin Twaron). During 2005 and 2006, a total of €400 million was invested by the companies located at the park in new plants, expansions and maintenance. In addition to the above-referenced Akzo Nobel plants also Brunner Mond built, next to its present caustic soda plant, the first plant in the Netherlands for the production of sodium bicarbonate. Furthermore, Teijin Aramid continues to expand its production of aramid precursors.

These and other companies in the surrounding area are listed in the following table, with their major products. There are about 400 hectares (nearly 1,000 acres) of land available for new companies in the area. Thanks to subsidies and other factors, such as lower labor costs, this area is less expensive than the western part of the Netherlands.

Table 8: Chemical manufacturers in Delfzijl and surrounding area

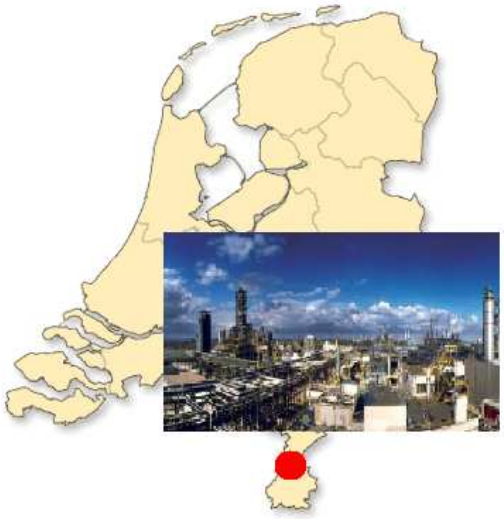
Company	Head office	Product
Acheson Colloids (ICI)	United States (England)	Graphite dispersions
Akzo Nobel	The Netherlands	Salt, chlorine, caustic soda, methylamine, etc.
Avebe	The Netherlands	Potato flour
BioMethanol Chemie	The Netherlands	Bio-methanol
Brunner Mond (Tata Chemicals)*	United Kingdom (India)	Caustic soda, sodium bicarbonate**
Delamine	Japan/The Netherlands	Ethylene amines
Dow	United States	Raw materials for polyurethanes
Dynea	Finland	Resins, formaldehyde
FMC	United States	Hydrogen peroxide
Kemax	Finland/The Netherlands	Calcium chloride
Kisuma (Kyowa Chemical)	Japan	Magnesium hydroxide, hydrotalcite

Kollo silicon carbide	The Netherlands	Silicon carbide
NedMag	The Netherlands/Belgium	Magnesium oxide, calcium chloride
Noveon (Lubrizol)	United States	Chlorinated polyvinylchloride
PPG Chemicals	United States	Silicas
Purac	The Netherlands	Gluconates
Rohm and Haas	United States	Sodium boron hydride
Teijin Aramid	Japan	Precursors for aramide fiber
Zeolyst***	United States	Y-zeolites

*Tata Chemicals of India acquired the British BrunnerMond in 2006
**The plant, with a capacity of 50,000 ton of sodium bicarbonate, will be operational in 2007.
***A 50/50 joint venture between PQ Corporation and CRI Catalyst, a Shell company.

Source: Netherlands Foreign Investment Agency

4.4 Chemical Cluster Sittard-Geleen



The chemical cluster in the southern part of the province of Limburg is known as Chemelot, the chemical innovation community (www.chemelot.com) Chemelot allows companies to operate more efficiently, because they share utilities, infrastructure and energy, share knowledge about environmental issues and profit from each other's innovation power. All generating accelerated business growth.

Big players on Chemelot are DSM, Sekisui and Sabic (Saudi Basic Industries Corporation). The

DSM specialty chemicals plants and the petrochemical plants that Sabic acquired from DSM in 2002 cover a large part of the area. Sabic currently operates two naphta crackers in Geleen that produce ethylene and propylene. The cracker producing ethylene has a capacity of 1,200,000 million tons of ethylene per year, one of the largest in Europe. DSM and SABIC operate a total of fifty production facilities on a site of 800 hectares (2,000 acres). A substantial portion of the products is subsequently used at this very same site as raw materials for a large number of downstream plants.

Core competences at Chemelot are polymers and networks, advanced (bio)organic synthesis and process development, chemical engineering and analytical expertise. The Chemelot Research & Business Campus houses 1,000 researchers and scientists. The site offers a complete chemical infrastructure including third party research & development and presents other chemical companies the opportunity for co-siting. This approach substantially lowers initial investment costs as well as operating costs. There is plenty of room for business expansion, with 50 hectares available for chemical activities and another 50 for service providers.

Table 9: Chemical companies in Limburg

Company	Head office	Product
Akzo Nobel Functional Chemicals	The Netherlands	Chelates, micronutrients, etc.
Akzo Nobel Ink & Adhesives Resins	The Netherlands	Adhesives
Basic Pharma Manufacturing	The Netherlands	preparation and packaging of ointments, creams, liquids and trial products for clinical investigation
Carbolim	Belgium	Liquid carbon dioxide
CeDo Recycling	The Netherlands	Production of LDPE and PET regranulate from waste plastic
Celanese Emulsions	USA	Vinyl polymer dispersions
Ciba Specialty	Switzerland	Anorganic pigments and pigment dispersions

Chemicals		
Colortrend (Degussa)	Germany	Colorants
CPS Color	Finland	Pigments
Dalli Dicom	Germany	Detergents
Dex-Plastomers	USA/the Netherlands	50/50 joint venture between ExxonMobil Chemical and DSM. High performance ethylene octene copolymers.
DSM	The Netherlands	Biomedical materials, elastomers, engineering plastics, fiber intermediates, melamine, pharmaceutical products, caprolactam, aspartame, acrylonitrile, ethylene propylene diene monomer (EPDM), fertilizers, pigments
DuPont Filaments	USA	Filaments
ExxonMobil Chemical Films	USA	Oriented polypropylene packaging films
Frencken Fabrieken	The Netherlands	Adhesives, coatings
GBC Films Europe	USA	Thermal and pressure-sensitive laminating films
Helichem	The Netherlands	Private label producer of cleansing agents, synthetic resins
Hexion Specialty Chemicals	USA	Resins, adhesives
Honeywell Fluorine Products	USA	Fluorides
INEOS Silicas	United Kingdom	Silicas, zeolites
Intertek Caleb Brett	United Kingdom	Chemical, plastics and polymer analysis laboratory
Invista Nederland	USA	Polyester resins

Johnson Matthey	United Kingdom	Black obscuration and silver conductive enamels
Kriya Materials	The Netherlands	Coatings of metal oxide dispersions, optical coatings and transparent scratch-proof coatings with antistatic functionality
LVM - Tessenderlo Group	Belgium	PVC powder
Nano Specials	The Netherlands	Nano-powders and nano-dispersions (additives) with an anti-static action
Oxford Performance Materials	USA	Ultrahigh performance thermoplastic polymers (biomaterials)
Penn Color	USA	Pigment dispersions, water-based color concentrates, printing inks
Plalloy Mtd	Japan	Thermoplastics compounding and coloring services
Polyscope Polymers	The Netherlands	Styrene maleic anhydride (SMA)
PQ Europe	USA	Silicates
Romar-Voss	Germany	Polyester, epoxy en polyurethaan composites and coatings
Sabic	Saudi-Arabia	EHQ in Sittard, naphtacracking, polyethylene, polypropylene, bio-ethyl-tertiary-butylether (ETBE)
Scotts International	USA	Speciality fertilizers and turf products
Sekisui Alveo	Japan	Crosslinked polylefin foams
Sekisui Jushi	Japan	Plastics
Sekisui S-Lec	Japan	Polyvinyl butyral resin for PVB interlayer film
Solvay	Belgium	Quinones, peracetic acid

Teijin Kasei Europe	Japan	Polycarbonate resin
Terreco	The Netherlands	Soil decontamination services with PuriSoil, a decontamination technology developed by DSM
Tessenderlo Chemie	Belgium	Benzyl alcohol, benzyl acetate
Tredegar Film Products	USA	Elastomeric and nonwoven laminate films
Umicore	Belgium	Zinc oxide
Water4Life	The Netherlands	Water purifiers on basis of membrane technology

Source: Netherlands Foreign Investment Agency

Section 5: Policies / innovation/ Subsidies

5.1 REACH (Registration, Evaluation, Authorization and Restriction of Chemicals)

Introduction

The EU chemicals policy has been reformed based on the following reasons:

- increased knowledge about the hazards of chemicals;
- improved manageability of legislation in regards to chemical substances;
- the need for sustainable development.

With the new EU legislation on chemicals in place (abbreviated as REACH), the chemical industry recognizes its responsibilities to ensure the protection of human health and the environment, while delivering good economic performance and meeting the expectations of the market. The Netherlands government understands the position of the chemical industry, and all other companies dealing with chemicals, and provides guidance through a help desk, tools and close cooperation with organizations in the industrial sector.

REACH

REACH is the EU Regulation for Registration, Evaluation, Authorization and Restriction of Chemicals. It came into effect on June 1, 2007, in order to streamline and improve the European Union's legislative framework on chemicals. REACH places greater responsibility on industry to manage and reduce the risks that chemicals may pose to health and environment. REACH also has an additional objective: to assure the free movement of chemicals within the EU market, and to enhance innovation and the competitiveness of the EU-based chemical industry.

Adoption of REACH and GHS

On June 1, 2007 REACH went into effect for new substances, and will be gradually implemented for existing substances. In addition, the Globally Harmonised System of Classification and Labelling of Chemicals (GHS)", initiated by the United Nations, went into effect in the EU on January 20, 2009. This new regulation on classification by types of hazards, labelling and packaging of substances and mixtures ("CLP Regulation") contributes to the GHS aim that the same hazards will be described and labelled in the same way all around the world. It aims to enhance the protection of human health and the environment during the handling, transport and use of chemicals, and is also an important factor for trade

facilitation. As of December 1, 2010 all chemicals must have been classified and labelled in accordance with the CLP Regulation. For mixtures there is a transition period until June 1, 2015. The CLP Regulation complements the REACH Regulation.

REACH is being implemented in phases as this is a time-consuming task with a lot of stakeholders involved. Until June 1, 2008, there was a transition period during which current complementary legislation and regulations remained in place. From June 1, 2008, most REACH requirements came into effect. On that date, the Chemical Substances Act (WMS) of the Netherlands was replaced in full by the REACH-requirements. The execution and enforcement will be arranged according to chapter nine of the Environmental Protection Law. This means that REACH is part of the environmental permit from June 1, 2008, onward. On June 1, 2009, the Substances Restrictions Act in the Netherlands will be abandoned.

Are you a manufacturer, importer, or downstream user of chemicals or distributor?

REACH applies to all manufacturers and downstream users of chemicals, as well as importers and distributors who have any dealings with chemical products. Under REACH, your company may play various roles depending on the types of substances you use, and your participation in the life cycle of those substances. You may be a manufacturer or importer of one chemical, while for another chemical you are a downstream user.

REACH comprises the following steps:

- Pre-registration and exchange of information
- Registration of substances
- Evaluation by the relevant authorities.
- Authorization by the relevant authorities

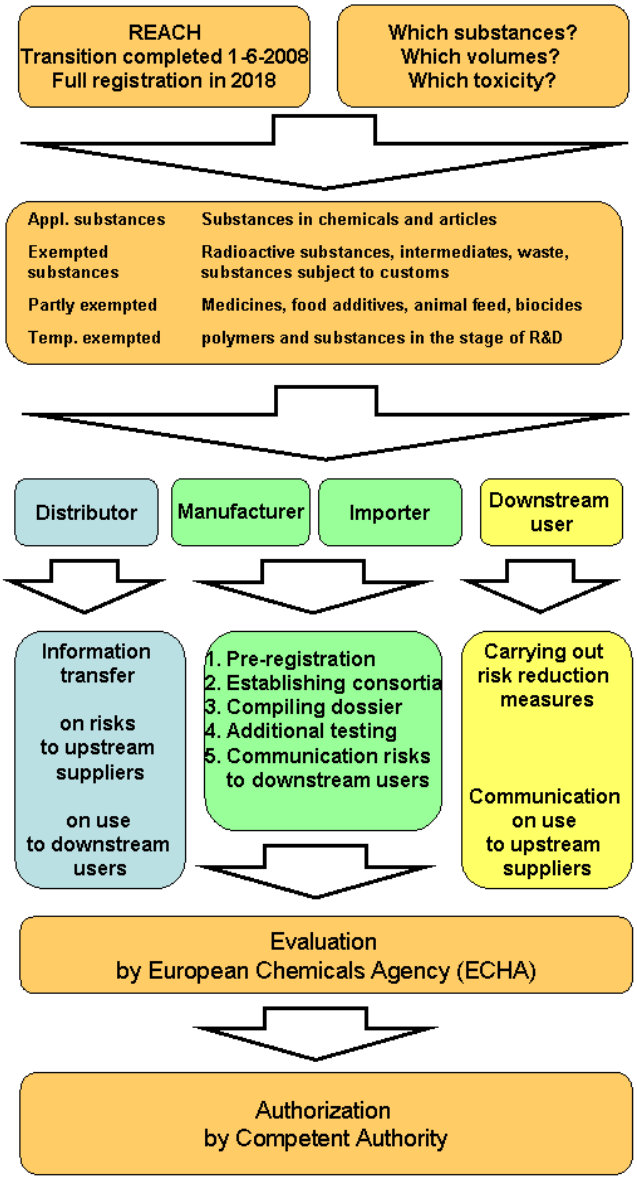
REACH requirements are stricter on manufacturers and importers than on downstream users and distributors:

- Manufacturers and importers intending to bring substances (or substances in preparation) into the EU-market are required to collect data on physical-chemical, toxicological and eco-toxicological properties, in order to participate in the required registration process. The amount of data will depend on the anticipated or actual annual production or import volume, the characteristics of the substance involved,

and the substances' intended use, as well as the extent to which, and in what way, people or the environment may be exposed to those substances.

- Downstream users and distributors are obliged to communicate information on use and exposure risks to producers/importers, and must pass information on risks to health and environment in the supply chain, and to take actions in implementing risk reduction measures.

The REACH process is shown in the following graph:



Existing and new substances

Existing chemicals are defined as chemical substances that are listed in the European Inventory of Existing Commercial Substances (EINECS). Existing Substances have been on the market since before September, 1981. The EINECS list contains over 100,000 substances, and can be found on the website of the European Chemicals Bureau (ECB). New substances are defined as chemical substances which do not appear in the EINECS-list.

The following division in substances is applicable to REACH:

Applicable substances	Pure substances, substances in chemicals and in articles.
Exempted substances	Radioactive substances, not isolated intermediates, substances subject to customs supervision and waste materials
Partly exempted	Medicines, food additives, flavors, animal feed, substances in biocides
Temporarily exempted	Polymers and substances in the R&D stage

Pre-registration

Manufacturers and importers are required to register their substances. For this purpose, manufacturers, importers and downstream users need to prepare an overview of substances, including volumes, supply chain and available physical-chemical and (eco-)toxicological data. Manufacturers and importers are encouraged by the EU, through a 'One Substance, One Registration' (OSOR) policy, to provide joint registration packages. The establishment of a registration consortium will substantially reduce the costs and the burden of administration for companies. In order to be eligible for the registration of existing substances, the manufacturer and importers were required to pre-register, within the period of June 1 to December 1, 2008, the substances that they intend to register. During this period around 143,000 substances were registered by some 65,000 companies, a total of about 2.1 million pre-registrations. For each preregistered substance Substance Information Exchange Forums (SIEF) with consortia partners and downstream users are being established to facilitate the registration-process. The pre-registration process encompassed only basic data on the substance involved, including its EINECS and CAS number, the name and address of the contact person of the company, the envisaged deadline for the registration and the tonnage band. Companies that did not pre-register their chemical

substances are no longer allowed to market these products in the EU. The only remedy to get the products back in the market is to register them.

Registration

The registration requirements depend on production and import volumes, and include data collection on physical-chemical properties and toxicological and eco-toxicological hazards. Companies or registration consortia are required to compile a registration dossier with the data packages. To perform animal testing for the compilation of test data requires prior approval of the European Chemical Agency (ECHA), which manages the REACH process. This is to avoid the duplication of animal testing. Use of alternative data sources comprising in-vitro techniques, predictive modeling (QSAR), and data sharing, will lead to more standardized and reliable material safety data sheets (MSDS). Human toxicity comprises amongst others carcinogenic, mutagenic and reproductive toxicity (CMR). Eco-toxicity is divided into Persistent, Bio-accumulating and Toxic substances (PBT), and very Persistent and strongly Bio-accumulating substances (vPvB). Information on existing substances, which are submitted by manufacturers and importers of existing substances are stored in the International Uniform Chemical Information Database (IUCLID), which is managed by the European Chemicals Bureau (ECB).

Evaluation and authorization

The time from registration to evaluation is about 60 days, when all data are available. The ECHA will share the evaluation results with the competent authorities in the EU member states. In the case of the inclusion of a number of high risk substances containing CMR and/or PBT or vPvB properties, the ECHA might decide to initiate an authorization procedure. This means that a decision will be taken to determine the conditions and applications of dangerous substances that are still safe to be applied. REACH also introduces the possibility of more general restrictions on the use of substances up to a full ban on its placement on the EU-market.

In October 2008, ECHA published a list of 15 substances of very high concern (SVHC) for authorization. Companies may have legal obligations resulting from the inclusion of substances on the Candidate List. These obligations are not linked only to the listed substances on their own or in preparations but also to their presence in articles.

Time schedule

The table below indicates the time schedule for companies engaged in the REACH process:

Activity manufacturers and importers	Planning*	Description
Start	June 1, 2007	REACH regulation in effect Transition phase legislation
	June 1, 2008	Most REACH-requirements in effect; start pre-registration
Pre-registration of substances	6 months	June 1 - December 1, 2008
Building registration consortia	0 - 11 years	Depending on volumes
Registration >1000 tons/annum produced/imported	3.5 years	Before December 1, 2010
Registration CMR substances, PBT and vPvB substances > 100 tons/annum	3.5 years	Irrespective of volumes Before December 1, 2010
Registration >100 tons/annum produced/imported	6 years	Before June 1, 2013
Registration >1 ton/annum produced/imported	11 years	Before June 1, 2018
Expected end of the registration process	June 1, 2018	Existing substances

*Transition period after REACH is in effect

Relevant authority and help desk

The Netherlands government assists the chemical industry, as well as all other companies dealing with chemicals, in fulfilling the obligations outlined in REACH, through the REACH help desk. The Netherlands Ministry of Housing, Spatial Planning and the Environment (VROM) is the relevant authority in performing all national tasks regarding to the European REACH Regulation (EC) 1907/2006. The REACH Bureau is the national legal organization that acts by the order of VROM.

The Netherlands REACH-help desk informs companies about REACH, and answers questions on their tasks, responsibilities and duties within the scope of the REACH legislation. With the help of the EU Navigator tool you can identify the obligations your company has to fulfill relating to REACH. More information on REACH is available on the website of the EU. Specific questions on how to fulfill specific REACH tasks and obligations can be directed to your sector group or industry organization such as the Netherlands Chemical Industry Association (VNCI)I.

Holland Gateway, as a national knowledge platform, is willing to assist international enterprises and organization with necessary procedures.

5.2 Innovation

In 2005, the Innovation chemicals identified as key areas. The steering group Chemistry was founded in 2006 and has written a business plan, indicating what the ambition of the chemical industry in the Netherlands and where the bottlenecks. In October 2007 the Chemistry Regiegroep submitted an innovation proposal to Ministry of Economic Affairs.

The Regiegroep Chemistry is created following the decision of the Innovation to chemistry to designate as a key area.

The steering group includes representatives of leading chemical companies (DSM, Dow Benelux, Akzo Nobel, Octoplus Technologies, Unilever Research & Development and Shell) and research institutions (University of Utrecht, Technical University Eindhoven and University of Groningen). Branch organizations, such as VNCI and NWO (Chemical Sciences) support the steering group.

In December 2006, the Regiegroep Chemie's business plan submitted to the Ministry of Economic Affairs (EZ) and the Strategic Advisory. This proposal was based on the business, and had a focus polymers. On the advice of the Strategic Advisory Committee, the Regiegroep Chemistry in October 2007 a new proposal for an innovation.

Innovation Intelligence has - as part of the business - an independent study on the chemicals sector performed. The aim of the study to the decision making of the program proposal to support. End sought is information relating to a some important criteria in the framework for innovation programs, namely international excellence, contribution to economy and society and consistency and (international) cooperation.

The business of chemistry Regiegroep has four lines of action consistent with the aim of the contribution of chemistry to enhance and create new businesses.

1. Strengthening Knowledge - basic research
2. Public-private partnerships
3. From R & D activities to
4. Open Centers for Chemical Innovation (COCI)

Besides these four action lines of the business plan also describes a number of necessary support measures:

1. Availability of sufficient, skilled staff and to link education and employment (Human Capital Roadmap Chemistry).

2. Strengthening the image of chemistry (Chemistry is Everywhere).

3. Unique and streamlined regulations and enforcement.

Central to the "Elaboration of the business' *innovation* are four *lines:*

- materials
- Biotechnology for specialties
- catalysis and sustainable processes
- process

Each line innovation can make a significant contribution to achieving the ambitions.

Every innovation is a coherent line of great expertise, competitiveness and innovativeness of the Dutch chemicals. Various activities, including public private partnerships (PPP), are therefore already in place innovative lines.

The four lines are common innovation underpinned by the "horizontal" action programs.

Full report (*Innovation Intelligence: Chemistry)* available upon request.

Section 6: Chemical Research & Development

As a result of the highly educated work force in the Netherlands, leading chemical companies such as Akzo Nobel (including Organon and Intervet), Dow, DSM, GE Plastics, Ondeo-Nalco, Shell, and Unilever have established large chemical R&D laboratories there. Several smaller research or contract-research-oriented companies have been established in recent years, often as spin-offs from major companies or universities. These aim at specific research areas or technologies. Examples are Avantium, which was specifically established as a High Throughput Screening company, and Syncom, which is an organic synthesis-oriented business.

The chemical industry in the Netherlands accounts for around 30% of industrial Research and Development (R&D) expenditures. In 2004, the annual in-house plus outsourced R&D expenditures of the Dutch chemical industry amounted to over 2.5% of sales, according to the Dutch Chemical Industry Association (VNCI). Over the last few years, in-house R& D activities have shifted more to application and product research. In order to compensate for this, there is more collaboration with the universities for fundamental research. As a result, the chemical industry has become one of the most important financiers of chemistry research at Dutch universities. The chemical industry's R& D expenditures have exhibited a shift from basic chemicals to fine chemicals.

Ten of the Netherlands' fourteen universities offer chemistry curricula. A recent review by the Royal Dutch Academy of Sciences (KNAW) has determined the following main research areas per university:

Source: Netherlands Foreign Investment Agency

In 1997 of four ' Centers of Excellence' were founded for telematics, food science, metal technology and polymers. These centers are jointly funded by the government and a consortium of companies. The centers are comprised of a network of specialists from universities and the industry, working on pre-competitive industrial research. The activities of interest for the chemical industry relate to polymers and catalysis:

Source: Netherlands Foreign Investment Agency

1. The research of the Dutch Polymer Institute (DPI) focuses on polyolefins, engineering plastics, coating technology, rubber technology and functional polymer systems such as electro-optical systems and solar cells. (see slide XXX)

2. The Dutch Institute for Catalysis Research (NIOK) gathers the knowledge of eight Dutch universities in the catalyst area. It is a nationwide graduate school, also acting as the platform and sparring partner for national and international experts on catalysis in academia, industry and government.

3. Within Dutch Graduate School on Process Technology (OSPT) six universities which are active in the area of Process Technology are collaborating; there are a total of 10 faculties, involving 35 research groups with 50 (full-time and part-time) professors and about 250 lecturers, post-docs, PhD students and research associates.

Dutch Polymer Institute – DPI

DPI, located in Eindhoven, is a foundation set up to perform exploratory research in the area of polymer materials and is funded by industry (ca 25%), knowledge institutes/ universities (ca 25%) and the Ministry of Economic Affairs (max. 50%).

Industry, universities and government, and DPI performs pre-competitive research projects to add value to the scientific community through scientific publications and to the industrial community through the creation of intellectual property.

DPI provides a unique platform for new technology awareness in which participating industrial companies, commercially competitors in the marketplace, communicate on a pre-competitive basis to trigger innovation. DPI integrates the scientific disciplines and know-how of universities into the chain of knowledge to optimise the conditions for making breakthrough inventions and triggering industrial innovation. DPI aims to combine scientific excellence with a real innovative impact in industry, thereby creating a new mindset in both industrial and academic research.

www.polymers.nl

Organization for Applied Scientific Research-TNO

Chemical R&D can also be outsourced to an organization such as TNO (Organization for Applied Scientific Research). TNO is a contract research organization that links the latest technological developments to practical applications. The daily work of some 5,000 employees is to develop and apply knowledge. TNO provides contract research and specialist consultancy, and it grants licenses for patents and specialist software. It tests and certifies products and services, and issues independent evaluations of quality.
TNO is versatile and works through partnerships. It is active in five core areas:

1. TNO Quality of Life
2. TNO Defense, Security and Safety
3. TNO Science and Industry
4. TNO Built Environment and Geosciences
5. TNO Information and Communication Technology

To service the chemical industry efficiently, the business centre TNO Chemistry has been set up, located in Zeist. TNO Chemistry's vast range of expertise can be applied from product idea, via application development, to industrial processes, including all aspects of safety and registration.

TNO is the only organisation that covers the entire spectrum of advice and research for customers and research partners, from safety and health promotion to registration and technology. In the process, TNO sometimes succeeds in finding the missing piece to a puzzle. In other cases, TNO is involved in the entire procedure, from strategy determination to execution.

www.tno.nl

Section 7:Associations and Websites

VNCI

The Netherlands Chemical Industry Association (VNCI) promotes the collective interests of the chemical industry in the Netherlands by means of consultations, information meetings and recommendations. The VNCI acts on behalf of the entire sector as a central contact point and undertakes activities that have a positive impact on the image of the chemical industry. www.vnci.nl

VVVF

The Association of Paint and Printing Ink Manufacturers (VVVF) is a nonprofit organisation that promotes the interests of the Dutch paint and printing ink industry. The VVVF works to achieve good conditions for manufacturing and trading in paint and printing ink in the Netherlands. www.vvvf.nl

NRK Federation

Several trade associations that are active in the rubber and plastics industry are members of the Dutch Rubber and Plastics Federation (NRK Federation). The Federation acts as an umbrella organisation in promoting the interests of the entire rubber and plastics industry. The trade associations that are members of the NRK Federation represent the more sector specific interests. www.nrk.nl

NWO

The Netherlands Organisation for Scientific Research (NWO) promotes and finances research in every conceivable scientific discipline, in the process generating innovation and aiming to cultivate enthusiasm for scientific research and disseminate the results to a broad audience. Furthermore, as time goes by, the NWO is increasingly directing activities in the Dutch scientific community. This pivotal role between industry, society and researchers facilitates cooperation as well as the dissemination and application of the results of fundamental research. www.nwo.nl

The information in this report is also provided by *Netherlands Foreign Investment Agency* (NFIA), SenterNovem (SenterNovem).

Holland Gateway, as a national information and service center, is able to introduce national- wide network to International enterprises and organizations.